OSSTEM IMPLANT SYSTEM Documentations Vol. 3

OSSTEM IMPLANT SYSTEM

Documentations Vol. 3

Early & Esthetic

OSSTEM IMPLANT

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Early & Esthetic

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Effect of Microthread & Platform Switching on the Maintenance of Marginal Bone Level

Su-Jin Choi[1)], Young-Deok Chee[1)*], I-Su Jo[1)]

Introduction

The resorption of marginal bone following implant grafting has been reported. Resorption of 1.5 mm is generally detected for the first year after functional load and 0.2 mm for every year thereafter. Maintaining the height of marginal bone is important for functional and aesthetic reasons. For the methods of minimizing bone loss occurring after loading, discussions on bone-retention elements with microthread and rough surface, design (platform switching narrow neck) of the fixture?abutment junction area, and implant design including a stable seal for abutments are ongoing. This study sought to measure and evaluate for 12 months the marginal bone loss occurring after mastication with implants featuring microthread and platform switching.

Materials and Methods

A total of 20 patient visitors from May 2005 to January 2007 were considered. 75 implants (GS II, OSSTEM®, Korea) were grafted in the crestal bone level of the edentulous areas of the maxilla and mandible in accordance with the protocol of the manufacturer. After the functional load, the volume of marginal bone loss was measured through radiation and analyzed. After prosthetic mounting, X-rays were done at intervals of 3 months. Using a UTHSCSA (Univ.of Texas Health Science Center) Imaging Tool, the height of each bone was measured from the mesiodistal point of implant grafts. The measured mean value was regarded as the volume of bone loss.

Fig 1.

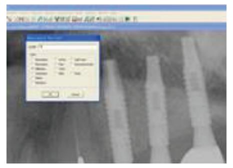


Fig 2.

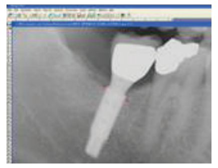
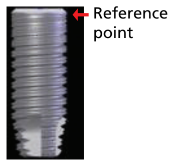


Fig 3.



Results

< Patient & implant characteristic >

Table 1.

Gender	N	%
Male	9	45
Female	11	55
Total	20	100

Fig 4.

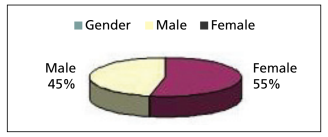
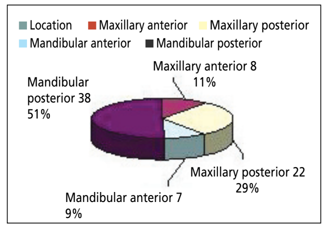


Table 2.

Location	N	%
Maxillary anterior	8	10.67
Maxillary posterior	22	29.33
Mandibular anterior	7	9.33
Mandibular posterior	38	50.67
Total	75	100.00

Fig 5.

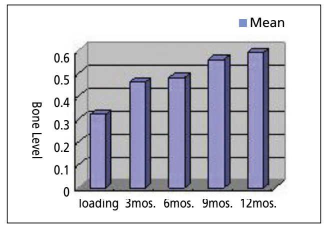


< Marginal bone level by follow-up visit >

Table 3.

Marginal Bone Level	Mean±SD
Baseline (loading)	0.32±0.38
3mos.	0.46±0.51
6mos.	0.48±0.42
9mos.	0.56±0.53
12mos.	0.59±0.52

Fig 6.



<Analysis of factors associated with the changes in bone levels>

Table 4.

Mean±SD

Stage	Baseline (loading)	3Mos.	6Mos.	9Mos.	12Mos.
1st stage	0.48±0.40	0.5±0.38	0.59±0.41	0.65±0.41	0.47±0.35
2nd stage	0.22±0.22	0.45±0.57	0.4±0.42	0.49±0.62	0.62±0.55

Table 5.

Location	Baseline (loading)	3Mos.	6Mos.	9Mos.	12Mos.
Mx. ant	0.06±0.16	0.0±0.20	0.25±0.22	0.02±0.05	0.36±0.38*
Mx. post	0.32±0.39	0.73±0.66	0.54±0.64	0.90±0.65	1.01±0.45*
Mn. ant	0.28±0.28	0.37±0.30	0.50±0.15		
Mn. post	0.39±0.40	0.41±0.40	0.49±0.40	0.53±0.44	0.29±0.35*

Table 6.

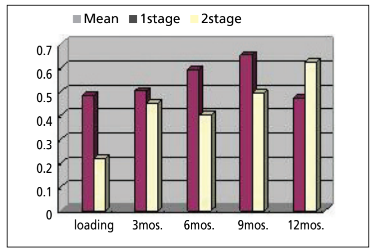
Diameter	Baseline (loading)	3Mos.	6Mos.	9Mos.	12Mos.
3.5mm	0.21±0.26	0.31±0.34	0.34±0.26	0.43±0.39	0.63±0.45
4.0mm	0.44±0.44	0.65±0.59	0.74±0.49	0.85±0.59	0.87±0.61
4.5mm	0.43±0.49	0.56±0.61	0.14±0.32	0.04±0.08	0.08±0.17

Table 7.

Graft	Baseline (loading)	3Mos.	6Mos.	9Mos.	12Mos.
No graft	0.4±0.39	0.50±0.45	0.54±0.45	0.66±0.57	0.78±0.55
Bone graft	0.13±0.28	0.42±0.62	0.30±0.25	0.33±0.35	0.34±0.36

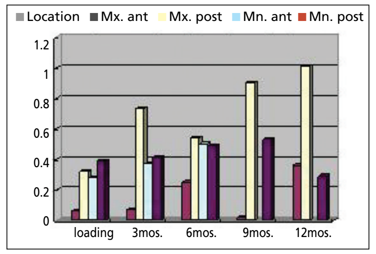
<Stage>

Fig 7.



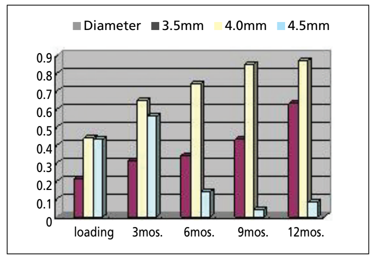
<Location>

Fig 8.



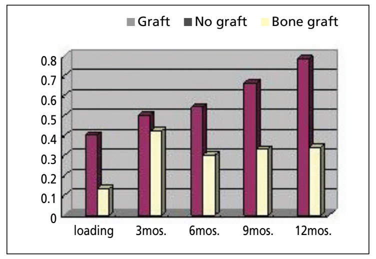
<Diameter>

Fig 9.



<Bone Graft >

Fig 10.



Discussion

This study noted a 0.6 mm resorption of marginal bone around the implants over 12 months, which is a satisfactory result. There was no difference in the resorption level between the maxilla and the mandible, although the greatest resorption was found in the posterior maxilla. Moreover, there was no difference in bone resorption level by stage; the bone-grafted area showed lower loss level than the non-grafted area, but the difference was not statistically significant. This study used implants designed with a microthread in the neck to reduce bone resorption. The interlocking between bone and implant interface is known to distribute stress due to external load; thus preventing bone loss. Note, however, that the deficiency in available data made examining the statistical significance difficult. For a more precise result, consistent development observation is required.

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Evaluation of Stability of Dual Thread Implant - Clinical Assessment During Osseointegration; PART II

Jin-Ho Heo[1)], Ju-Youn Lee[2)], Chang-Mo Jeong[3)], Yong-Deok Kim[1)*]

Purpose

This study was performed to evaluate the stability of dual thread implant using resonance frequency analysis in human.

Materials and Methods

Fifty-five patients(32 males and 23 females) with a mean age of 50 years and 1 month who were treated during March, 2005 to July, 2007 in Pusan National University hospital. Totally 145 dual thread Implants were installed and initial stability was measured by Osstell Mentor. After 3-6 Months, secondary stability was measured at the time of second surgery or before prosthetic treatment.

Results

At the time of 1st surgery, average ISQ value was 75.12±12.06. Only 1 implant was failed during the healing period. Before prosthetic treatment, ISQ values were measured and its mean value was 80.94±6.12.

Table 1. Average ISQ value at the time of 1st surgery

Site	Data	Maxilla	Mandible	Maxilla +Mandible
	Mean	67.77	78.86	75.46
Molar	SD	15.28	10.64	13.26
	n	31	70	101
	Mean	71	76.25	74.6
Premolar	SD	9.996	7.89	8.94
	n	11	24	35
	Mean	75	70.5	72.75
Anterior	SD	7.04	6.69	7.22
	n	4	4	8
Total Mean		69.17	77.89	75.12
Total SD		13.81	10.02	12.06
Total n number		46	99	145

Table 2. Average ISQ value Before prosthetic treatment

Site	Data	Maxilla	Mandible	Maxilla +Mandible
	Mean	77.10	84.00	81.88
Molar	SD	7.88	4.03	6.36
	n	31	70	101
	Mean	76.45	80.29	79.09
Premolar	SD	5.31	4.73	5.24
	n	11	24	35
	Mean	78.00	76.50	77.25
Anterior	SD	2.12	0.87	1.79
	n	4	4	8
Total Mean		77.02	82.79	80.94
Total SD		7.01	4.62	6.12
Total n number		46	98	144

Conclusions

These results suggest that the increased stability of the implant verifies the clinical relevance of double thread implant.

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[2)]Dept. of Periodontology, School of Dentistry, Pusan National University, South Korea
[3)]Dept. of Prosthodontics, School of Dentistry, Pusan National University, South Korea

Esthetic Implant Restoration in the Collapsed Ridge; A Case Report Using GS II Implant System

Yin-Shik Hur[1)*]

The alveolar ridge resorption occurred after the extraction of maxillary anterior tooth it difficult for patients and dentist to provide esthetic conventional prosthesis and implant prosthesis. In many cases, it brings about the longer crown compared to the adjacent tooth. So, in procedeeing the prosthetic procedure of implant, it is essential to consider the above things to get the esthetic results. The objective of this case report is to describe the surgical and prosthetic procedure for restoring the esthetic and healthy results of the old faulty restoration.

Fig 1. Uneasthetic faulty restoration on maxillary anterior tooth.

Fig 2. Horizontal alveolar collapse of the left maxillary central incisor region is observed.

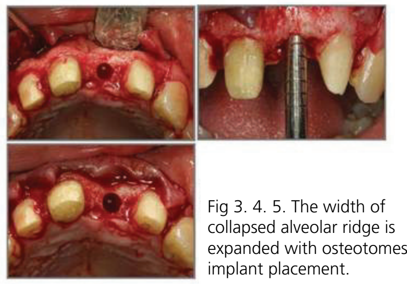


Fig 3. 4. 5. The width of collapsed alveolar ridge is expanded with osteotomes for implant placement.

Fig 6. The GS II fixtute(OSSTEM® Co.,Korea, diameter 4mm, length 10mm) is placed on the prepared site.

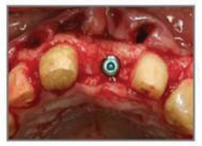


Fig 7. Occlusal view. After the implant placement, the buccal contour of the left maxillary central incisor regiondiffer from the one of the rigth central incisor.

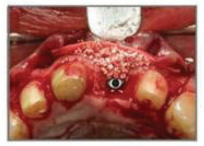


Fig 8. For augmentiong the horizontal width of the collapsed ridge, the alloplast (MBCP, Biomatlante Co., France)material is used.

Fig 9. The grafted site is covered with resorbable collagen membrane. (BioArm, Ace Surgical Co., USA)

Fig 10. The flap is sutured with nylon suture material.

Fig 11. At 2 weeks of healing after the implant placement, the cover screw was early exposed.

Fig 12. The cover screw is changed with healing abutment. The buccal contour of the collapsed ridge is restored to the level of the adjacent tooth.

Fig 13. 14. Impression taking at 3 months of healing after the impant placement.

Fig 15. Final prosthesis.

Fig 16. Occlusal view. the buccal contour of the left maxillary central incisor is restored to the similar one of the adjacent central incisor.

Fig 17. Facial view of the final restoration. Buccal contour and length of the restoration is esthetically acceptable.

The maxillary anterior region is difficult to gain the esthetic final results of the dental implant. Severe reduction of the bucco-palatal width following the tooth extraction complicate the esthetic results of the implant treatment, so, if the severe ridge resorption is present, we should restors the alveolar ridge width and height before the implant placement and the implant have to be placed on the correct position mesiodistally and buccaopalatally. This case report demonstrate the importance of the restoration of buccal contour of the collapsed alveolar ridge.

[1)]Diector of Merit Dental Clinic, South Korea

Immediate Implant Installation and Immediate Loading with OSSTEM® GS II Implant System; Case Report

Sang-Un Han[1)*]

Intruduction

Immediate implant installation and immediate loading after tooth extraction have many advantages such as shortening of entire treatment period, preservation of residual alveolar bone and soft tissue and earlier recovery of esthetic and function. Nowadays many patients ask for a condition in which they can eat and do social life immediately after the surgery. To fulfill this requirement, OSSTEM® GS II implant system have been developed which can be immediate implant installation and immediate loading after tooth extraction using dual thread design for high initial stability. I report the results that I have got satisfactory from the cases using the CellNest surface and new RBM surface on GS II implant.

Case 1. Pt : 41Y / M
Autogeneous bone graft + PRP
Ø3.5×11.5mm, Oxidizing
Insertion torque : 25N ↑


Fig 1.~2. Pre-operative x-ray & clinical view


Fig 3. Post-operative clinical view


Fig 4. Provisionalization


Fig 5.~6. Check-up (PO 5M): clinical & x-ray view


Fig 7. Post-temporary crown remove


Fig 8. Impression coping mounted


Fig 9. Impression cap mounted


Fig 10. Abutment mounted


Fig 11.~12. Final restoration: clinical & x-ray view

Case 2. Pt : 52Y / F
PRP
Ø4.0×13mm, RBM
Insertion torque : 30N ↑


Fig 1.~2. Pre-operative x-ray & clinical view


Fig 3. Post-operative clinical view


Fig 4. Post-operative x-ray view


Fig 5. Provisionalization


Fig 6. Check-up (PO 4 M): clinical view


Fig 7. Impression taking

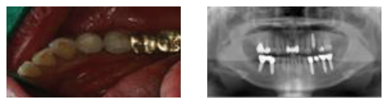


Fig 8.~9. Final restoration: clinical & x-ray view

[1)]Director of Ye Dental Clinic, Gwangju, South Korea

Case 3. Pt : 36Y / M
BBP(0.5cc) + Calforma + PRP
Ø4.5×13mm, Oxidizing
Insertion torque : 25N ↑

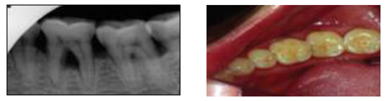


Fig 1.~2. Pre-operative x-ray & clinical view


Fig 3. Post-operative clinical view

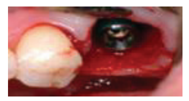


Fig 4. Post-installation clinical view


Fig 5. Calforma


Fig 6. Post-operative clinical view


Fig 7. Provisionalization (PO 3 days)


Fig 8. Impression cap mounted

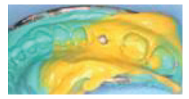


Fig 9. Impression


Fig 10. Abutment mounted


Fig 11.~12. Final restoration: clinical & x-ray view (PO 4M)

Conclusions

To achieve long-term success in immediate implant installation and immediate loading, it requires regular observation and maintenance, and needs more detailed study about occlusion and initial fixation.

Case Report; GS II Implant Placement after Distraction Osteogenesis

Sung-Min Cho[1)], Min-Kyu Park[1)], Sung-Hun Yun[1)], Chang-Hyen kim[1)], Je-Uk Park[1)*]

Introduction

Common causes of alveolar bone defects include bone resorption due to loss of teeth, infection, or trauma. There is often insufficient height or width of residual bone, and ridge augmentation may be required prior to implant placement. To correct this situation, a variety of surgical procedures have been proposed, including onlay bone grafts, guided bone regeneration, and alveolar distraction osteogenesis.

17-year old boy has lost 6 adjacent teeth in anterior maxilla and 5 adjacent teeth in anterior mandible with deficient hard and soft tissues after traffic accident before 1 year. Maxillary anterior alveolar ridge was preserve sufficient for implant placement and baseline conditions for implant placement were improved by alveolar distraction to enhance hard and soft tissues around the mandibular anterior alveolar ridge.

Case Report

Fig 1. Pre-op facial photo

Age/Sex: 17/M
History: Traffic accident(2004.11)
Intraoral state:
1) Maxilla: #12, 11, 21, 22, 23, 24 missing : 2mm vertical alveolar bone resortion
2) Mandible: #32, 31, 41, 42, 43 missing : Severe vertical and horizontal alveolar bone resorption at lower dentulous alveolar ridge
Extraoral: lower smile line

Fig 2. a,b,c,d Pre-op intraoral photo. Severe alveolar bone resoption at lower edentulous alveolar ridge.

Fig 3 a,b,c Pre-op dental cast: severe alveolar bone resorption at lower edentulous alveolar ridge.

Pre-op preparation for implant installation and distraction osteogenesis.

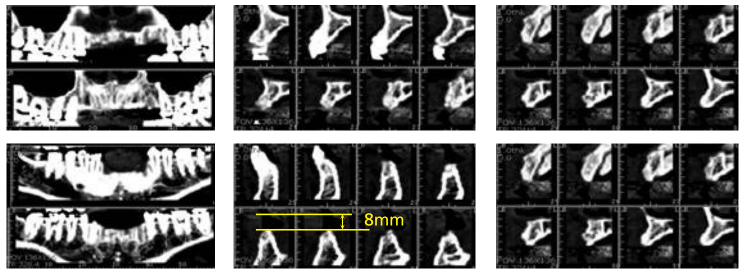


Fig 4. Pre-op dental CT

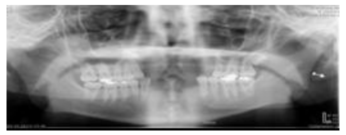


Fig 5. Pre-op panoramic X-ray view

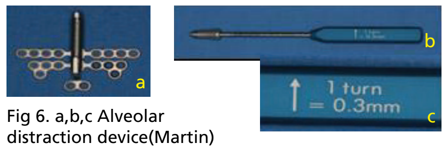


Fig 6. a,b,c Alveolar distraction device(Martin)

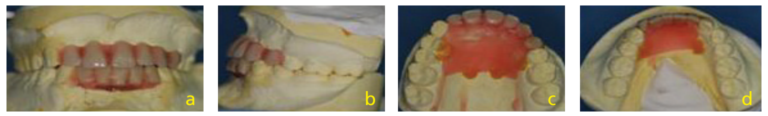


Fig 7. a,b,c d Diagnostic wax up for surgical stent

[1)]Dept. of Oral and Maxillofacial Surgery, St.Mary's Hospital, Catholic University, South Korea

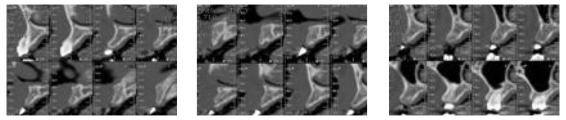


Fig 8. Maxillary dental CT taking after surgical splint inserted.

Operation and procedures

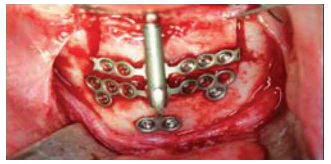


Fig 9. Alveolar distraction device(Martin) was bended and adapted over the chin area
Latency phase: 12 days
Distraction phase: 9 days(3 turn/day; 1 turn = 0.3mm)

Fig 10. Post-op panorama. Mesiodistal vector direction was good.

Fig 11. Post-op lateral Ceph. Labiolingual vector direction was good.

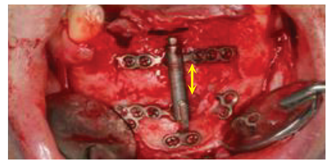


Fig 12. Bone was formed newly between two distracted segment . Alveolar distraction device was removed after consolidation period(5months).

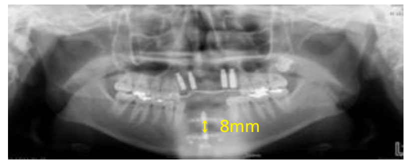


Fig 13. After distraction phase; 8mm alveolar bone distraction was done.

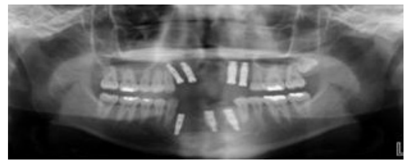


Fig 14. Alveolar distraction device was removed, and simultaneously implants(GS II) were placed after 4 months consolidation period.

Fig 15. 2nd implant surgery and prosthetic procedures were performed after 3 months later.

Fig 16. A radiograph at impression taking. Three implants in distraction osteogenesis area were successfully osteointegrated.

Fig 17. The most recent X-ray picture. Implants was being used well so far without failure.

Discussion

17-year old boy has lost multiple anterior maxillary and mandibular teeth with deficient hard and soft tissues after traffic accident. 2mm maxillary anterior alveolar ridge was lost but smile line was low, so direct implant installation was done and and severe vertical and horizontal alveolar bone resorption was found at lower edentulous ridge. The treatment chosen was distraction osteogenesis. By mean of distraction osteogenesis, hard and soft tissue around the mandibular anterior alveolar ridge was improved. Successful esthetic results of dental implant placement in the esthetic zone require knowledge of various concepts and techniques. Careful preoperative treatment planning, augmentation of hard and soft tissues and attention to the details of implant surgical and prosthetic techniques are areas that must be addressed when treating the anterior esthetic area.

Socket Elevation Using Piezosurgery

Jong-Seon Jeong[1)] Hyeon-Min Kim[1)*]

Instroduction

History of socket elevation

1977 : crestal approach was first described : Tatum
1994 : sinus floor infracture, "bone-cushioned" : Summer's
2005 : hydraulic sinus condensing technique : Chen

Methods of crestal sinus floor elevation

1. OSFE (osteotome sinus floor elevation)

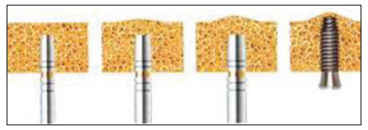


Fig 1.

2. BAOSFE (bone added osteotome sinus floor elevation)

Fig 2.

Fig 3.

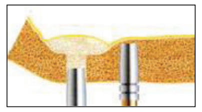


Fig 4.

Fig 5.

Fig 6.

Advantages of osteotome technique

1. Less invasive technique than lateral approach
2. More effective blood supply than that of the lateral approach

Disadvantages of osteotome technique at socket elevation

1. Technique sensitive ;
   Unwanted implant path
   Possibility of primary stability breakdown
2. Hard to mallet septated sinus or inclined sinus floor
3. Discomfort of malleting : headache
4. BPPV (Benign Paroxysmal Positional Vertigo) by Miguel Pen~arrocha 2001
   : common vestibular end organ disorder characterized by short, often recurrent episodes of vertigo that are triggered by certain head movements in the plane of the posterior semicircular canals

   : may be idiopathic or secondary to a number of underlying conditions such as head injury, viral labyrinthitis, stapes surgery, and chronic suppurative otitis media
5. Blind technique
   *HBC technique (hydraulic sinus condensing) by Leon Chen 2005

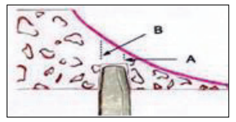


Fig 7.

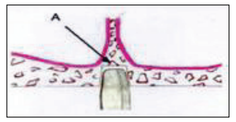


Fig 8.

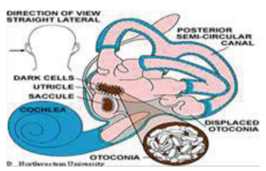


Fig 9.

Fig 10. Use 3mm, 2mm round bur **Fig 11.** Gently push the material

Characteristics of Piezosurgery

1. Micrometric cut / Accurate osteotomy line
2. Selective cut / Safety to soft tissue / Minimal invasion to schniderian membrane
3. Blood-free surgical site/ Maximum intra-operative visibility

[1)]Dept. of Oral and Maxillofacial Surgery, Gil Medical Center, Gachon University, South Korea

Surgical procedure of socket elevation with Piezosurgery

1. Drilling ceases about 1mm short of the sinus floor
2. Removal of bone of sinus floor with piezosurgery & sinus membrane detached
3. Gently push the material

Fig 12.~17.

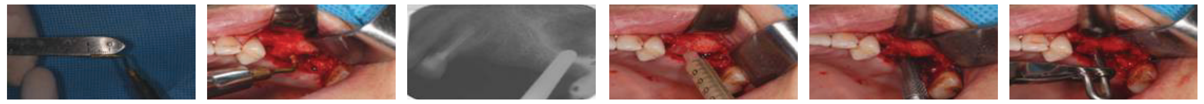


Fig 18.~23.

Case Presentations

Case 1. 40/F
C/C :Restoration on edentulous area

Fig 24.

Fig 25.

Case 2. 45/M

Fig 26.

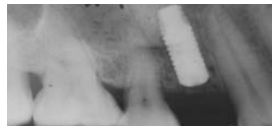


Fig 27.

Case 3. 61/F

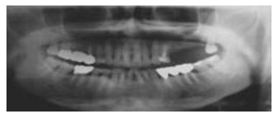


Fig 28.

Fig 29.

Discussion

In cases of bone augmentation in sinus, crestal approach is less invasive technique than lateral approach. Also, its blood supply is better than that of the lateral approach . But, osteotome method is a technique-sensitive method. And it causes discomfort at malleting, headache, and even benign paroxysmal positional vertigo. It is very difficult to mallet the septated sinus and inclined sinus floor. It is possible that selective cutting for hard tissue by Piezosurgery. We used Piezosurgery to decrease the complications of osteotome technique. In our clinic, the patient who needed osteotome technique was treated using Piezosurgery which has selective cutting and hydraulic pressure instead of osteotome and mallet. We can do socket elevation safely. So. This report describes socket elevation using Piezosurgery with literatures.

GS System
Clinic

A Maxillary Ridge-Splitting Technique Followed by Immediate Placement of GS II Implant

Chung-Hwan Lee[1)*]

Purpose

The aim of this study case was to evaluate the effectiveness of a split-crest bone augmentation technique performed for immediate implant(GS II) placement in this edentulous anterior maxillary ridge.

Materials and Methods

- Maxillary buccal wall were split, expanded and grafted w/ a combination of platelet-rich plasma, Bio-oss and autogenous bone from suction trap.
- Two 3.5mm wide by 13mm long, one 4.0 wide by 13mm long (GS II, OSSTEM®, Korea) threaded implants were placed immediately within the split ridge.
- The Resorbable membrain(ossix) were used.
- Second stage surgery was performed after 4 months.
- Transfer temporary abutment were used for temporary crown which provided esthetic gingival forming & maturation (1 month) gold cast abutment cement type (UCLA Type)were produced.

■ Before

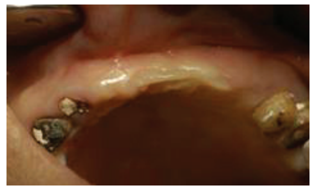


Fig 1.


Fig 2.

■ Surgery

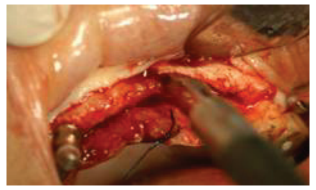


Fig 3. Surgery(2005. 11.18)

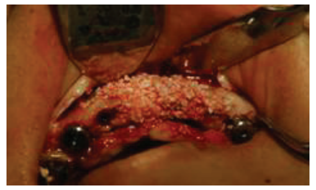


Fig 4. PRP w/Bio-oss and autogenous bone


Fig 5. After 4 months

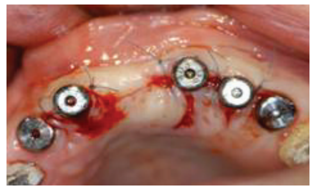


Fig 6. Second stage / Pk Flap


Fig 7. Transfer temporary abutment


Fig 8.


Fig 9. Gold cast abutment

[1)]Neul SaLang Dental Clinic, UCLA NSL IMPLANT Institution

Results

All implants osseointegrated successfully and underwent loading after 5 months optimal healing occurred 3 to 4 months earlier than the usual 6 to 9 months required. The crest-splitting bone expansion technique enables single-stage immediate implant placement.


Fig 10. Final setting

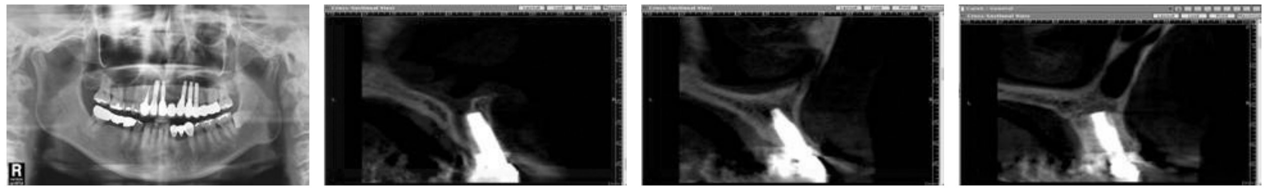


Fig 11. After 1 year CT, Panorama

Discussion

The split-crest surgical technique is a valid reconstructive procedure for sharp maxillary anterior ridge. Recommend to use Piezosurgery, Stoma ridge split bone chisel, Mis bone expansion Instruments, it will help to precise bone cutting and expansion w/o breaking buccal bone plate. If performed using PRP, Bio-oss and Antogeous bone, it can shorten the osseointegration period Especially in the maxilla, this will lead to a better prognosis of the survival rate of the implant and to better esthetic results of the find prosthetic restoration.

Flapless Surgery and Immediate Loading with GS II Implants Utilizing CAD/CAM Technology

Choon-Mo Yang[1)*]

Introducton

According to the classic osseointegration protocol the time period for the osseointegration of an implant in preparation for loading was between 3 and 6 months. Although this protocol gives excellent long-term results when proper implant geometry and a proper surface are used there are indications for early or even immediate loading of implants. The success of immediate loading of implants has been well documented. The highest success rates have been reported for splinted multiple implants in sites with sufficient bone density. The advantages of Immediate Function are obvious: less trauma for the patient and a shorter treatment time, resulting in better clinical efficiency. Postoperative pain and swelling are major complications after implant surgery. A flapless surgical technique has several advantages compared to the conventional surgical procedure, which includes the opening of a flap before implant insertion. Flapless surgery generates less postoperative bleeding, less discomfort for the patient, shorter surgery time, and a reduced healing time. The patients heal with minor or no swelling. There are many suggested treatment modalities to achieve optimal prosthetic design such as the conversion prosthesis, retrofitting an existing denture by converting it into a provisional restoration using acrylic resin or acrylic resin metal-reinforced frameworks. Another method is a laboratory-processed provisional utilizing a precast framework and processed complete denture that is connected intraorally after implant placement. Creating a provisional prosthesis after the surgical procedure can be difficult and time-consuming for both the patient and the clinician. The purpose of this article is to describe the use of surgical guides derived from CAD/CAM design for flapless surgery and immediate loading through a case report.

Materials and Methods

OSSTEM® GS II System (mini and regular diameter) / Convertible Abutments
CT Data (converted from DAICOM) / 3D Planning software (SimPlant, Materialis)
Surgical Guides (made by Materialis, Belgium)

Treatment Procedure

1. Patient Evaluation / 2. Treatment Planning / 3. Fabrication of CAD / CAM-derived Surgical Guide and Provisional Prosthesis
4. Flapless surgery / 5. Immediate Loading

1. Patient Evaluation

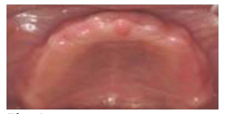


Fig 1.


Fig 2.


Fig 3.

Female, 57 years old
Denture Wearer Upper complete denture for 1 month Lower partial denture for several years
CC : Movable upper Denture
Remark : Very fearful to surgery and pain


Fig 4. Maxilla : Sufficient bone height but Questionable bone quality

2. Treatment Planning

Treatment Plan	Plan of Treatment
Fixed Prosthesis	Scan Prosthesis
Flapless Surgery	CT Taking
Immediate Loading	SimPlant Planning
	Provisional Prosthesis
	Surgery
	Delivery of Provisional


Fig 5. Scan Prosthesis duplicated from old denture

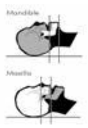


Fig 6. Scan Protocol

[1)]Yena Dental Clinic, Jeju, South Korea

SimPlant Planning

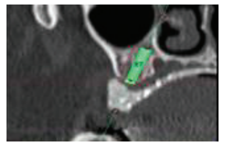


Fig 7. Cross-section

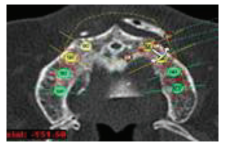


Fig 8. Axial

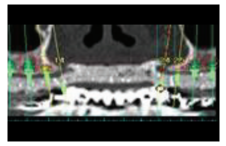


Fig 9. Panoramic

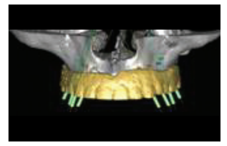


Fig 10. 3D

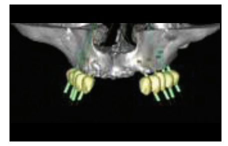


Fig 11. Vertual Teeth

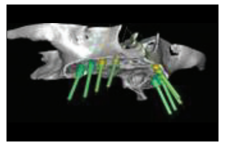


Fig 12. 3D Axial

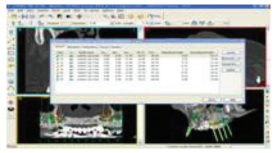


Fig 13. Implant List 8 Implants on 17, 16, 15, 14, 24, 25, 26, 27

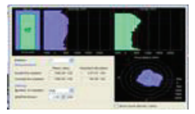


Fig 14. Bone Density

3. Surgical Guides and Provisional Prosthesis

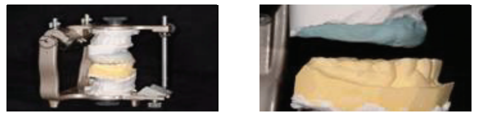


Fig 15.~16. Jaw Relationship


Fig 17. SurgiGuide
4 sets for different drill diameter made by Materiaise in Belgium
CAD/CAM manufactured

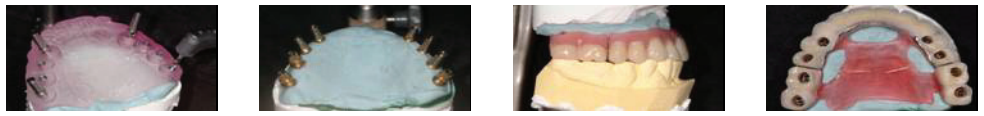


Fig 18.~21. Provisional Prosthesis reinforced by cast metal frame-work

4. Flapless Surgery and Immediate Loading


Fig 22.~24.Stable Surgical Guide

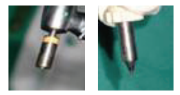


Fig 25.~26. Punch Out

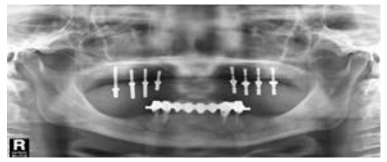


Fig 27. Initial Osteotomy


Fig 28. GS II Implants Mini and Regular Diameter

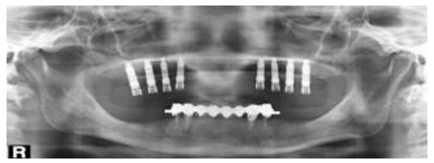


Fig 29.


Fig 30. Convertible Abutment


Fig 31. Try-in of Prefabricated Provisional Prosthesis

5. Immediate Loading

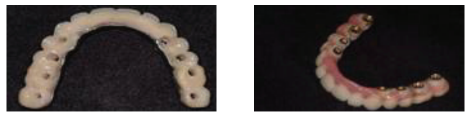


Fig 32.~33. Screw-retained Fixed Provisional Prosthesis
Abutments are connected with provisional restoration by autoploymerizing composite resin (Luxa Core) in the mouth

Fig 34.~35. Implant Placement and Immediate Loading are done in a same day

Fig 36. Postoperative no Swelling, no Pain

Fig 37. 6 months after surgery

Discussion

Advantages of flapless surgery and Immediate loading less postoperative bleeding less discomfort for the patient shorter surgery time reduced healing time minimal changes in crestal bone loss a shorter treatment time better clinical efficiency.

Conclusions

The present report indicates that three-dimensional oral implant planning software has to be considered as very helpful tools for successful surgery. Prefabrication of both surgical guides for flapless surgery and provisional prostheses for immediate loading is a very reliable treatment option.

Crown Height Space Formation in the Posterior Maxilla Using Corticotomy & SAS

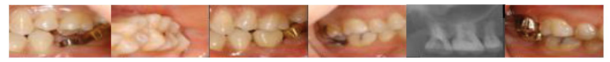
Joo-Il Na[1)], Chul-Hyun Moon[2)], Hyeon-Min Kim.[1)*]

Introduction

The crown height space (CHS) which term had been proposed by Misch for implant dentistry is measured from the crest of the bone to the occlusal plane in the posterior. Misch et al said that the ideal CHS needed for a fixed implant prosthesis should range from 8 to 12mm. This space accounts for the biologic width, abutment height for cement retention or prosth esis screw fixation, occlusal material for strength, esthetics, and hygiene considerations around the abutment crowns.

Methods for making CHS

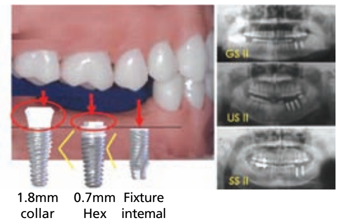
Oppositing Teeth approach	Implant selection	Surgical approach	Prosthetic approach
Grinding	Submerged	Alveolar ridge grinding	Screw type
Crown	Non-Submerged		Fixture level Prosthetics
			UCLA
Lengthening+ Crown	SAS		ComOcta Gold
Orthodontic tx (intrusion)	Corticotomy		SCRP



Grinding (especially palatal cusp)

Crown making (with / without gingivectomy)

Implant selection



Methods for making CHS

Fig a,b,c,d. Corticotomy using Piezosurgery on #26, 27 buccal area. plate-type SAS application.

Fig e,f,g,h. Corticotomy using Piezosurgery on palatal area & screw-type SAS application.

Case Reports

Csae 1.

- Name : Lee OO, 46/F
- P/I : #46, 47 missing & #16, 17 extrusion
- Tx plan : Segmental osteotomy on #16,17

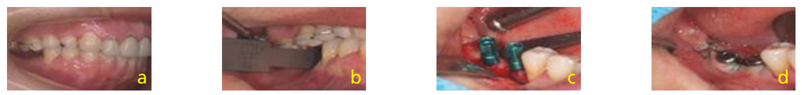


Fig a. Initial intraoral photo of #16,17 area.

Fig b. 4 months later after segmental osteotomy.

Fig c,d. Operative intraoral photo, GS II implant placement on #46, 47 area.

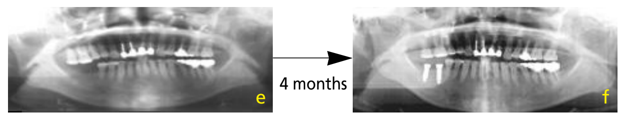


Fig e. Initial panoramic view.

Fig f. Panoramic view after implant placement.

[1)]Dept. of Oral and Maxillofacial Surgery, Gil Medical Center, Gachon University, South korea
[2)]Dept. of Orthodontics, Gil Medical Center, Gachon University, South korea

Case 2.
- Name : Choi OO, 33/M
- P/I : #26, 27 extrusion, #36, 37 missing
- Tx plan : Corticotomy of bone segment on #26, 27 area for Orthodontic intrusion & implant placement on 36, 37 area


Fig a. Initial intraoral photo of #26, 27 area.

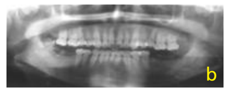


Fig b. Initial panoramic view.


Fig c. Corticotomy & plate-type SAS application.


Fig d. Orthodontic force application after 2 weeks later.


Fig e. 6 months later after intrusion start.

Case 3.
- Name : Kim OO, 28/F
- P/I : #26, 27 extrusion, #36, 37 area alveolar bone resorption
- Tx plan : Corticotomy of bone segment on #26, 27 area for Orthodontic intrusion & implant placement on 36, 37 area with block bone graft


Fig a,b. Initial intraoral photo of #16, 17 area & #36, 37 area.


Fig c. Corticotomy & plate-type SAS application on #16,17 buccal area.

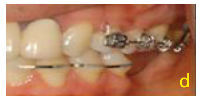


Fig d. 4.5 months later after orthodontic intrusion.


Fig e,f. Block bone graft on #36, 37 area.


Fig g,h. Implant placement & free ginigival graft on #36, 37 area.


Fig i. Intraoral photo after prosthetic procedure.

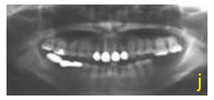


Fig j. Initial panoramic view.

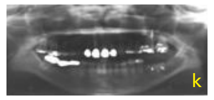


Fig k. Panoramic view after block bone graft.

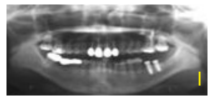


Fig l. Panoramic view after implant placement.


Fig m. Standard view after prosthetic procedure.

Discussion

We experienced orthodontic intrusion using skeletal anchorage system with corticotomy in posterior maxilla with insufficient CHS for dental implantation (GS II System) and acquired good results.
For success of method using SAS & corticotomy for lower CHS in the posterior, sufficient diagnosis and treatment planning are important. And then cautious surgical approach & accurate prosthetic management are needed for successful implantation.

Full Mouth Implant Rehabilitation; Case Report

Ki -Won Na[1], Se-Woung Kim[1)*], Soon-Ho Jeong[1], Man-Young Kim[1]

Introduction

For patients needed to extract almost teeth for severe periodontal diseases, implant-supported prosthesis by the placement of a sufficient number of implants can be considered. The type of prosthesis is dependent on the number of implants, so the number and position of implants should be considered sufficiently in the diagnostic and treatment planning phase.

Table 1. Number of Implants and type of prosthesis

Location	Implants	Type of prostheses	Remarks
Lower Jaw	2	Overdenture Bar	
		Overdenture Ball anchor	Design of complete
*anterior	3-4	Overdenture Bar (rigid)	
	4-6	Fixed cantilever prosthesis (screw-retained)	Cantilevers
		Bridgework Cantilever	
*Ant./post.	>4	Bridgework	2-3 segments
Upper jaw	2	Overdenture Ball anchor	Not standard complete denture
	4-5	Overdenture Bar (rigid)	Horseshoe-design
	>4-8	Bridgework	2-3 segments
		Individual abutments	Correction of axis

Case presentation

Patient information

- Patient : Yang O O (45/F)
- C.C. : Avulsion of Mx. incisors, Multiple teeth missing, Wants fixed prostheses
- P. I.

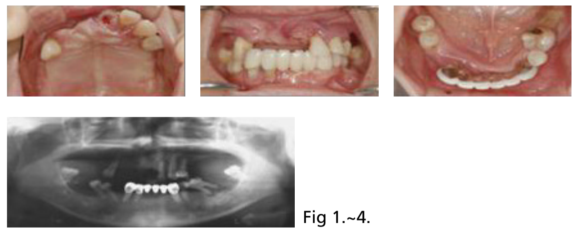


Fig 1.~4.

1. Tooth avulsion on #12, #21
2. Floating on #13, 22, 23, 24, 36, 44, 45
3. Pus discharge on Lt. ant. labial side
4. Missing tooth on #14, 15, 16, 17, 25, 26, 27, 35, 37, 46, 47
5. Tooth mobility(+++) on #42, 43
6. Severe alveolar bone resorption
7. Atrophic resorption of Mx.⇨ Class III tendency
8. Intact teeth on #33, 34

Treatment Plan

* Maxilla
1. Extraction of the remaining teeth
2. Temporary complete denture
3. 6 implants placement with bone graft
   - Socket elevation on most posterior implants
4. Purely implant-supported overdenture
   - Milled bar type overdenture
   - Magnetic attachment

* Mandible
1. Extraction of the remaining teeth except for #33, 34
2. Temporary RPD
3. 7 implants placement with bone graft
4. Fixed ceramometal restoration

† Because it may be loss of retention by reduction of friction between milled bar and metal housing, additional use of attachments was considered.
† Magnetic attachment was selected for horizontal stability supported by milled bar and ease of long-term maintenance.

1)Dept. of Prosthodontics Gil Dental Center, Gacheon Medical University, South Korea

Treatment Procedure

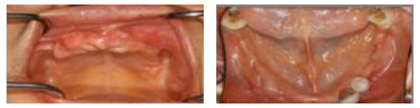


Fig 5.~6. 1.5 months after extraction

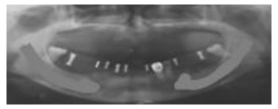


Fig 7. Radiographic stent

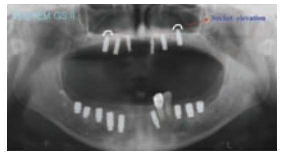


Fig 8. Implant placement
- For panorama tracing error and possibility to damage IAN, shorter implants than planned length were placed in the posterior position of mandible.
- Additional 2 implants were placed in the 1st molar positions for biomechanical aspects

Fig 9.~10. 4 months later after implant placement

Fig 11. 2nd surgery of mandible

Fig 12. Transfer impression for provision

Fig 13.~14. Implant-supported recording base using temporary abutments

Fig 15. CR bite registration

Fig 16. Provisional restoration delivery

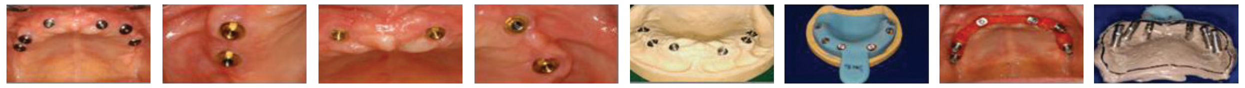


Fig 17. 2nd surgery of maxilla after 5 months

Fig 18.~20. Internal connection type was converted to external connection type by connecting convertible abutments for passivity of the bar assembly

Fig 21.~22. After transfer impression taking, open tray was made

Fig 23~24. Splinted pick-up impression taking

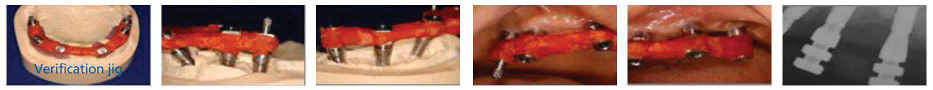


Fig 25.~30. First, One-screw test was done in the model / One-screw test was also done in the mouth / Accuracy of the model was confirmed

Fig 31. VD check

Fig 32. Face-bow transfer

Fig 33.~34. Pick-up impression using provisional restorations as pick-up impression copings

Fig 35~37. Mandibular provisional restoration delivery & Maxillary wax denture try-in

Fig 38.~41. Customized cemented abutment using UCLA abutment

Fig 42.~45. Metal framework

Fig 46.~48. Combination cylinder selection for bar assembly

Fig 49.~51. Bar assembly was cemented to the abutments by luting method using Super-Bond C&B

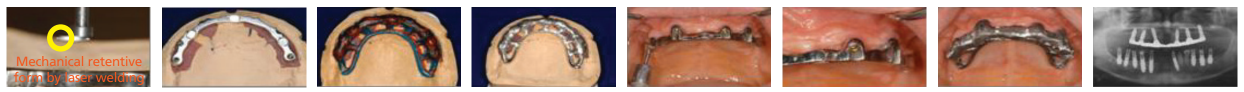


Fig 52.~53. Attachment of keeper

Fig 54.~55. Metal framework

Fig 56.~59. Bar & Metal framework try-in : one screw test

Fig 60.~67. Mandibular final restoration

Fig 68.~69. Wax denture try-in & check bite registration

Fig 70.~71. Group function occlusion

Fig 72. Attachment of magnet with Super-bond C&B

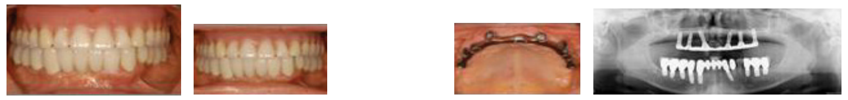


Fig 73.~74. Final delivery

Fig 75.~76. 6 months R/C

Conclusions

It was demonstrated implant-supported prostheses were successful in a almost edentulous patient. It may be possible that maxillary resin artificial teeth are worn by mandibular porcelain occlusal surface for a long-term maintenance period. So, 6-month periodic recall check is required, and if maxillary occlusal surface is worn, it will be changed to gold occlusion.

Preliminary Retrospective Study of GS II Implant System

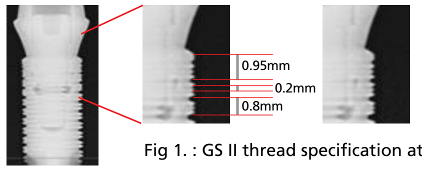
Jong-Chul Park[1)*]

Purpose

GS II implant system has some unique features, compared with other implant systems. For example, at the apical portion, one micro thead and one macro thread merge into forming dual thead, which is designed for better shear stress resistance than other implant systems. The dual thread merges with another micro thread at the top 3.5mm for optimal bone stress distribution and good initial stability. And cell nest surface architecture of GS II system proved to be more favorable to osseointegration in a laboratory study. Since this system was bringed to the market, meanwhile, there has been no available clinical study on the prognosis of this system.

Materials and Methods

Retrospectively, we investigated total 342 fixtures (175 patients) operated from Sept. 2005 to Nov. 2006 by 8 dentist at Armed Forces Capital Hospital. For the short term of follow up, we focused on the clinical data during the period from fixture installation to final prosthetic insertion. We analyzed fixture site distribution, age distribution, fixture diameter and fixture length distribution, immediate installation after extraction, radiographic examination for marginal bone change (Kodac 2000. intraoral x-ray system. Kodac dental imaging software ver 6.4). For each implant, the radiographs were evaluated according to marginal bone height at the insertion and we assessed its change over time. Marginal bone level was examined at the mesial and distal implant faces. We measured the distance between the top of the thread portion and bone level using GS II specification (lead : 0.8mm, pitch : 0.2mm at the top 3.5mm, 0.8mm at the remaining apical portion. Fig 1.) with micro caliper with an accuracy of 0.01mm. We only examined the radiographic film taken vertically to the fixture axis. With these method, we could exclude the radiographic magnification and distortion of the film.
At insertion the fixtures were placed at a depth according to the guidelines given by the manufacturers.



lead : the advancement of a fixture during only one rotation.
pitch : the distance between micro-thread

Fig 1. : GS II thread specification at the top; lead 0.8mm, pitch 0.2mm

Results

Of the 342 fixtures installed, only 5 implants was removed before loading. After completion of prosthetic treatment, there was no further fixture failed till now. Of the 342 fixtures, we can make the final prosthetics at the 284 fixtures.
Immediate installation after extraction(93/342) did not decrease the survival rate of GS II implant system. Only 1 implant was removed after immediate installation. we preferred fixture diameter 4.0mm and 4.5mm (41%, 30%). In the case of immediate installation after extraction, we preferred 4.5mmx13 or 15 fixture(23%, 12%).

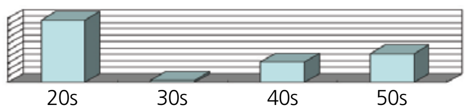


Fig 2. Age distribution of patients
20s : 97 30s: 3 40s : 32 50s : 45

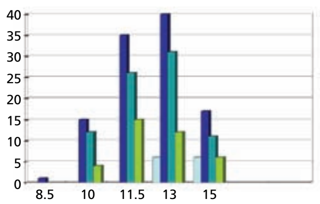


Fig 3. Fixture diameter and length distribution

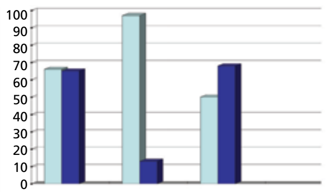


Fig 4. Localization of implant

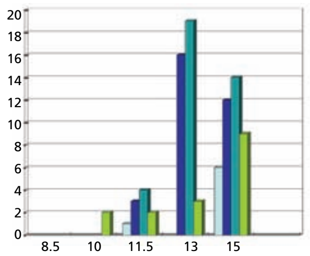


Fig 5. Fixture diameter and length distribution

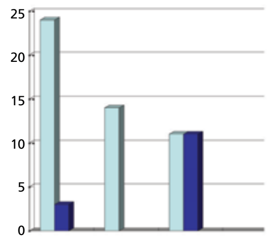


Fig 6. Fixture distribution with Immediate installation : n = 93

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GS System Clinic

Fixture distribution with bone graft (sinus lifting, ridge expansion, distraction etc) Time interval from fixture installation to final prosthetic insertion : Maxilla = 205 days, Mandible = 188 days In the case of immediate installation(93/342), 63 fixtures were connected to healing abutment at the insertion. 66 sites were filled with allogenic bone material for bridging the fixture and socket wall. There are 81 sites at the anterior jaw, 77 sites at the incisor and premolar area of maxilla. In only 30 cases, we fabricated the temporary prosthetics in average 77days after insertion, in contrast to 191 days for the final prosthetics(Fig 7.).

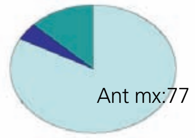

Fig 7. Site distribution at the immediate installation after extraction (total N = 93)

Average Marginal bone loss (Fig 8.) from fixture installation to final prosthetic insertion was 0.466mm. of the 242 fixtures buried by primary closure, 23 sites were exposed during healing, marginal bone loss of this case was 0.835mm(max : 6.10mm), contrast to 0.39mm of the fixtures which were not exposed (max : 2.9mm). Of the 342 fixtures, we could investicate 33 fixtures over 4 months after final prosthetic insertion. The average marginal bone loss during this time was 0.269mm. There was no difference of max bone loss between the non-exposed and the exposed(0.150mm). The sites exposed early had 0.275mm marginal bone loss during 4months.

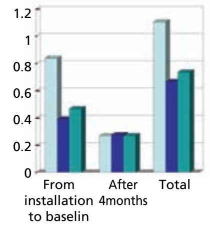

Fig 8. Marginal bone loss (T = 231) The complicated N = 23, The non-complicated N = 208

	to baseline	after 4months	total
Complicated	0.835	0.268	1.103
Non-complic	0.391	0.275	0.666
Average	0.466	0.269	0.735

Fig 9.

Fig 10.

Fig 11.

The sites of which marginal bone loss exceed 1.6mm from installation to baseline.
Fig 9. The fixture located too buccally.
Fig 10.~11. Same patients, the axis tilted to palatal area.

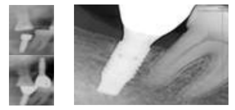

Fig 12. No bone resorption was detected.

We had 5 failed implant off of 4 patients. Only one case was related to immediate installation after extraction. All the failed implants were in maxilla. 2 cases were related to non-resorbable membrane exposure and following inflammation and poor bone quality to insert the fixture with not drilling, but only condensing by osteotome.

In the 6 case, we found healing abutment and temporary abutment screw loosening. In the 2 case, one patient complain of screw loosening after final insertion.

We examined 77 faces which showed the marginal bone lose above 1mm till baseline. 47 faces were related to shallow installation at surgery. 23 faces of the remaining 30 faces experienced the complicated event, as like membrane exposure, thin bone bed, diffuse bony defect, inflammation.

Discussion

The bone level change from fixture installation to final prosthetic insertion (pre loading period) varied according to implant system. Engquist et al (clin.oral.impl.res.2002) reported 1.52mm(Mx) and 0.99mm(Mn) bone loss of the Astra system. Chou et al(j.ora.impl.2004) said 1.51 mm of the Ankylos system. From the data collected by us, we can confirm the initial bone reaction of GS II implant system to be comparable to the other internal connection type, 2 stage implant system.

Conclusions

The survival rate of GS II system is 98.5%. But if we excluded the complicated case, the survival rate from installation to baseline would be 100%. This result is superior than other implant system. But further study will be needed, especially about the fixture and abutment connection.

GS II Fixture Implant Placement; Review of The Factors Affecting Failure

Kyung-Hwan Kwon[1)*], Jung-Goo Choi[1)], Seung-Ki Min[1)], Seung-Hwan Oh[1)], Moon-Ki Choi[1)], Jun Lee[1)]

Introduction

There are a lot of reasons that affect Implantation & implant failure. Some contribute as a generalized factor, another could be a localized factor, and the other could be relate with patient's habit. Now we survey about the factors that affect the implant failure in the case of GS II fixture (OSSTEM® Implant Co., Korea) implant placement.

Background

GS II Fixture Properties

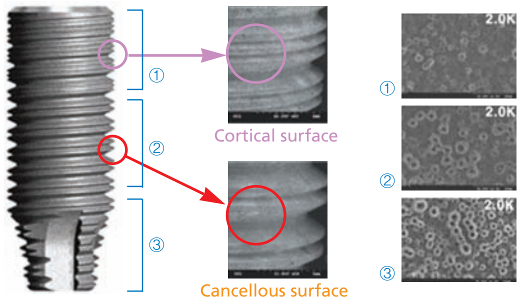

Fig 1. GS II Fixture

Dual Thread that mixed macro and micro thread considering the Cortical bone and cancellous bone.
Cortical Surface : Merged two micro & one macro thread for optimal bone stress distribution for good initial stability.
Cancellous Surface : Merged one micro & one macro thread for bone thread care at hard bone for superior bone contact rate.

Bioactive surface structure
(CellNest surface-oxidized surface).
Upper TiO_2 oxidized layer thickness : 0~3㎛
Lower TiO_2 oxidized layer thickness : 3~5㎛

Case Presentation

Materials and Methods

We research the 185 fixtures of 74 patient who has been implanted with GS II fixture by the implant clinic center at Wonkwang university dental hospital.

129 fixtures were placed in male patient and 56 fixtures were placed in female patient.
11 fixtures were immediately implanted on post-extraction socket.

78 fixtures were placed in anterior portion and 107 fixtures were placed in posterior portion.

87 fixtures were placed in Maxilla and 98 fixtures were placed in Mandible.

Fig 2. Success rates

178 fixtures have been successed and
7 fixtures were failure.
(The success rates; 96.22%)

Case 1.

Pt. : Kim O O (48/M)
2005.08.22 : Implantation on #36,#37
2005.08.25 : Explantation on #37
2005.12.21 : Explantation on #36
and Re-implantation #36,#37
Symptom : Postoperative numbness (#37)
Peri-implant bone loss (#36)
Fixture mobility (#36)
Soft tissue inflammation

Fig 3. Pre-operative X-ray view

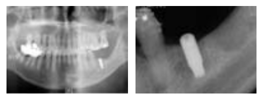

Fig 4. Explantation after 4M; peri-implant bone loss

Fig 5. Implantation and fixture affect the inferior alveolar nerve

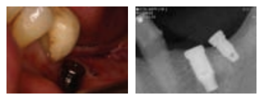

Fig 6. Explantation -Soft tissue inflammation

Factors affecting failure :
Jaw bone shape - Too much resorbed jaw.
Implant length - 8mm; Good for stability but too long in this case.
Fixture macro curve - too much forces are distributed laterally on cortical area

[1)]Dept. of Oral and Maxillofacial Surgery, School of Dentistry, Wonkwang University, South Korea

Case 2.

Pt. : Seol O O (60/M) - Diabetes mellitus Hx.
2005.08.16 : Implantation on #46
2006.04.27 : Final Prosthetics setting
2006.06.27 : Explantation

Symptom : Pain when mastication (two weeks ago)
Mobility on Prosthetics
Sign : No loosening of screw
Mobility of fixture

Fig 7.~11. Implantation on #46 : Post-extraction immediate implantation

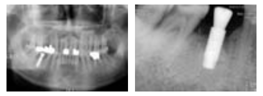

Fig 12.~13. Incomplete osteointegration; after 6M

Fig 14. Final Prosthesis was set and no sign and symptom for 6weeks

Factors affecting failure :
Fixture structure - Primarily initial stability is depend on upper third of fixture
Inappropriate prosthetics - Mesial cantilever
Bad habit - Bruxism

Fig 15.~16. X-ray view when explantation & explanted fixture

Case 3.

Pt. : Jo O O (66/M) - HTN, Fatty liver Hx.
2006.03.09 : Implantation on #35,#36,#37
2006.04.17 : Explantation on #35, #36
Sign : Mobility on #35, #36 Failure of osteointegration.

Factors affecting failure :
Bone quality - Cortical bone is too dense
Fixture surface & shape - Lateral compression force develop when drilling

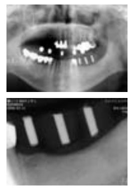

Fig 17.~18. Pre-operative X-ray view

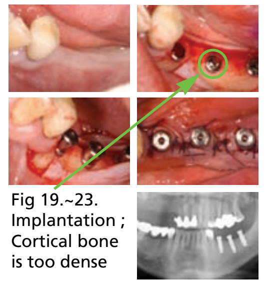

Fig 19.~23. Implantation ; Cortical bone is too dense

Fig 24.~28. Explantation; No evidence of osteointegrati on

Conclusions

Multiple reasons for implant failure or success, including smoking, systemic illness and medications, extremes of implant length, immediate implant placement, implant location, and skills of the clinician have been reported in the international literature.
So not a single factor but multi factors affect implantation and implant failure.
Another true is that patient selection appears to be of importance for increasing implant success rates.

GS System Clinic

Analysis of Clinical Application of OSSTEM® (Korea) Implant System for 6 Years

Young-Kyun Kim[1)*], Pil-Young Yun[1)], Dae-Il Son[1)], Bum-Soo Kim[1)], Jung-Won Hwang[2)]

Purpose

We evaluated various applications and clinical outcomes of OSSTEM® implants installed by an oral and maxillofacial surgeon from January 2000 to December 2005 retrospectively.

Materials and Methods

1. Total 534 fixtures of OSSTEM® implant system were installed to 133 patients.
2. The patients ranged from 20 to 95 years in age (mean 51.5). There were 72 male and 61 female patients.
3. From the 534 fixtures, 305 fixtures were installed in mandible and 229 fixtures in maxilla.

Results

1. The major operating method was guided bone regeneration with implant fixture installation (66 patients), followed by osteotome technique (32), simple technique without supplementary procedure (28), and others.
2. From the 534 fixtures in 133 patients, early failure of implant was found in 13 fixtures (2.4%) from 10 patients (7.5%). From the 318 fixtures in 98 patients who have functioned for more than 1 year after prosthesis delivery, there were two failures and 97.6% 6-year cumulative survival rate. One case failed after 2.5 years, and the other case after 4 years.
3. Major causes of early failure were detected as lack of initial stability (4 patients).

Table 1. Surgery distribution

Surgery	Number
Simple placement	28
GBR	66
Sinus bone graft	22 (simultaneous: 20 delayed: 2)
Extraction and Immediate placement	20
Osteotome Tq.	32
Redge splitting	7
Inferior nerve Repositioning	4
Distraction osteogenesis	3
Segmental osteotomy	4
etc	17

Table 3. Early failure according to surgery

Types of surgery	No. of patient	No of fixtures
Ext. and immediate implant, GBR	2	3
Simple placement	3	4
BAOSFE	1	1
Sinus graft and simultaneous placement	3	4
Sinus graft and delayed placement	1	1

Table 2. 6-year cumulative survival rate

Period(F/U) (year)	Number Of Implants	survival	failure	Failure rate (%)	Drop-out	Survival rate(%)
Placement ~ 1	534	521	13	2.4		97.6
1-2	308	318	0	0	216	97.6
2-3	129	128	1	0.8	189	96.8
3-4	101	100	1	1	28	95.8
4-5	81	81	0	0	20	95.8
5-6	81	81	0	0	0	95.8

Conclusions

From the results of our mid-term and short-term follow-up study, OSSTEM® implant system showed good clinical outcomes and high success rate. Furthermore, in spite of extensive surgical procedure, excellent final clinical results were obtained.

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Histomorphometric Analysis of Different Type Immediate Loaded Implants in Human

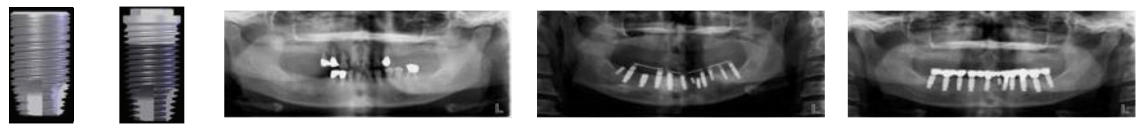
Se-Hoon Kahm[1)*], Yong-Chul Bae[2)], Sung-Eun Yang[1)], Chang-Hyen Kim[1)], Je-Uk Park[1)]

Introduction

The immediate loading of implants appears to be a viable treatment option in the edentulous mandible. Some reports have shown favorable histologic results. Various designs of implant and prosthetic components are recommended by different manufacturers for immediate loading of implants. Various root form implants are successfully for immediate loading. Though histomorphometric studies in humans as well as in animals have been reported for some implant systems, a few showing remarkable results, it is not possible to extrapolate these results to other implant designs. The aim of this study was to perform a histologic and histomorphometric analysis of the peri-implant tissue reaction and bone-implant interface in 2 immediately loaded implants and 1 submerged implant from a patient after 4 months functional loading periods.

Materials and Methods

A 50-year-old patient with advanced periodontitis came in for restorative treatment. A complete denture and implant-fixed restoration were planned for the maxilla and the mandible, respectively. 12 implants were installed (10 GS II implants, 2 US II implants; 2 control: submerged D3.5 x L8.5mm GS II implant, 2 test: immediately loaded implants D3.3 x L8.5mm US II implant and D3.5 x L8.5mm GS II implant). 8 implants were immediately loaded including 1 US II implant and 1 GS II implant. 4 months later, 2 test implants (1 GS II implant, 1 US II implant) and 1 control implant(1 GS II implant) were retrieved with a trephine bur during second surgery. Histologic samples were prepared and examined by light microscope. Measured data were converted to digital images. The BIC (percentage of bone-to-implant surface contact, %), bone volume (proportion of mineralized bone within the limits of the three consecutive implant threads, %) of specimens were calculated with an image analysis software (Axiovision 4.1, Carl Zeiss, Germany). 2 additional implants (GS II implant, D5 x 13mm) were installed replacing test implants. After 2 months, the definitive prosthesis was delivered.



GS II Implant   US II Implant

Results

At low magnification, it was possible to observe that bone trabeculae was present around the implants. Areas of bone remodeling and haversian systems were present near the implant surface. In the control implant (GS II, submerged), the infiltration of inflammatory cells and retarded healing process were observed. However, compact, cortical and mature bone with well-formed osteons was present at the interface of the test implants (GS II, immediately loaded / US II, immediately loaded). BIC of control implant was 52.66±8.34% and bone volume of control implant was 12.63±7.17%. BICs of test implants were 82.96±15.60% in GS II immediate loaded implant, 70.02±2.99% in US II immediate loaded implant. Bone volumes of test implants were 65.63±5.79% in GS II immediate loaded implant, 67.73±2.35% in US II immediate loaded implant. Under light microscopy, it was possible to observe that the healing process and maturation of bone around the US II immediate loaded implant which was slightly better than GS II immediate loaded implant histologically.

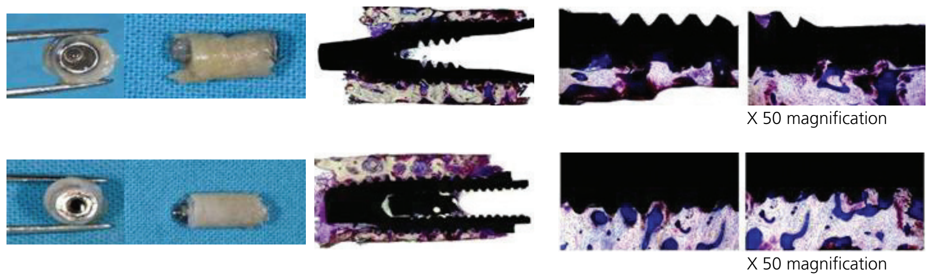
GS II Submerged

X 50 magnification

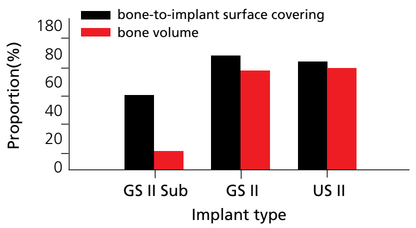
[1)]Kang-Nam St. Mary's Hospital, the Catholic University of Korea, Seoul, South Korea
[2)]Dept. of Oral Anatomy, School of Dentistry, Kyungpook National University, Daegu, South Korea

GS II Immediately loaded

US II Immediately loaded



	Percentage of bone-to-implant surface contact (BIC%)	Bone volume (%)
GS II Sub	52.66±8.34	12.63±7.17
GS II	82.96±15.60	65.63±5.79
US II	70.02±2.99	67.73±2.35



Discussion

2 immediately loaded implants showed higher BIC and bone volume values than 1 submerged implant. It seemed that the submerged implant had the initial problems such as overheating, poor stability, soft tissue invasion and so on. BIC and bone volume of 2 different implants were almost similar. Surface characteristics, thread designs, connection types, and inclusion of microthreads differ between US II implant and GS II implant. US II implant is hybrid type implant including main RBM surfaces and upper machined surfaces, traditional body designs, external connections. GS II implant is a dual-threaded internal connection type implant body with upper microthreads and CellNest surfaces (anodic oxidation treatment). Modification of implant designs, implant surface treatments, and connection types could contribute to more stable stress distribution, higher initial stability, enhanced biocompatibility to bone cells, and less micro gap. This study shows that BIC values of GS II implant were higher than US II implant's. However, this difference was not statistically significant. Due to the small sample size, statistical interpretation was not possible.

Conclusions

The histologic data showed that the osseointegration was achieved in immediately loaded implants surface treatments, micro-designs, connection types are all different in 2 tested implants. An implant design modification and an implant surface treatment can affect bone responses in immediate loading of implants. Maybe these developments could lead to favorable bone responses. However, more prospective studies and randomized controlled trials are needed.

Gene Expression of MC3T3-E1 Osteoblast Cell Cultured on Anodized Titanium Surface and Machined Titanium Surface by Means of cDNA Microarray

Ju-Mi Park[1)*], Ju-Yon Lee[1)], Myung-Rae Kim[2)], Na-Ra Kang[2)]

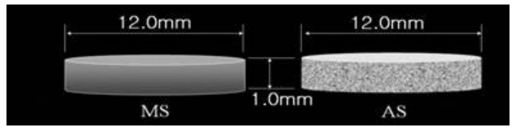
Introduction

The chemical property in implant surface is one of the most important key factor in the reaction of osteoblast to the implant since it influences charge and wettability. One of the techniques for modifying Ti implant surface is an anodization. The purpose of this study is to evaluate adhesion and gene expression of the MC3T3-E1 cells cultured on machined titanium surface and anodized titanium surface using MTT test, scanning electron micrograph and cDNA microarray.

Materials and Methods

1. Titanium preparation**

1) Grade 4 commercially pure Ti (Dynamet, Inc. A Carpenter Co., Washington, PA, USA)



2) Machined surface Group (MS): Sa = 0.1-0.2 ㎛

3) Anodized surface Group (AS): Sa = 0.8-1.2 ㎛

- Pretreatment with 1HF and $3HNO_3$
- Electrolyte solution contained 0.25 M sulfiric acid and 0.25 M phosphoric acid.
- 380 A/m2, 300 V

2. Surface analysis

1) SEM (before cell culture & 12h after)

3. Cell cultures and RNA extraction

1) MC3T3-E1 cells: osteoblast like cells from Rat calvaria

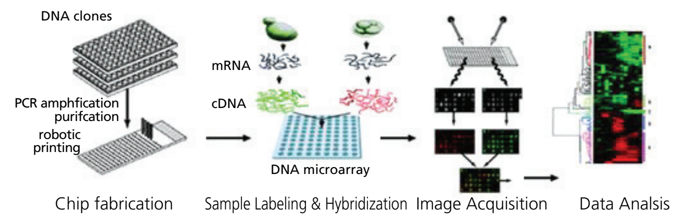
2) Cultured for 48 h

4. Cell adhesion assay

1) MTT Assay at 24 and 48 h

5. Microarray analysis

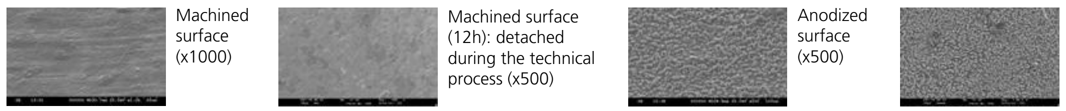
1) cDNA microarray Agilent Rat 22K chip (Digital Genomics, Seoul, Korea)-monitor the expression of 21575 genes



6. Statistical analysis: Mann Whitney test

Results

1. Surface analysis (SEM)



Machined surface (x1000)

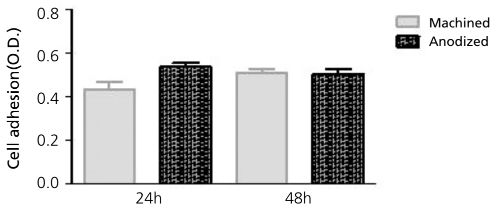
Machined surface (12h): detached during the technical process (x500)

Anodized surface (x500)

Anodized surface cultured for 12 h (x1000)

[1)]Ewha Womans University Graduate School of Clinical Dentistry, Seoul, South Korea,
[2)]Ewha Womans University School of Medicine, Seoul, South Korea

2. Cell adhesion assay: MTT Assay



3. Microarray analysis

Table 1. Gene expressions between the machined surface and anodized surface Ratio = log2 Cy5/Cy3 (Cy5: MS, Cy3: AS)

Up/down	Gene name	Ratio
Up	Connective tissue growth factor	-1.019226
Down	Insulin-like growth factor 1 receptor	1.199063

Discussion

1. The goal of modifying implant surface
   : immobilize proteins, enzymes or peptides on biomaterials for the purpose of inducing specific cell and tissue responses or to control the tissue-implant interface with molecules delivered directly to the interface.
   1) One approach to biochemical surface modification: use biomolecules involved in bone development and fracture healing which affect mitogenecity (e.g. IGF-1, FGF-2, PDGF-BB) to increase activity of bone cells (e.g. TGF-β1) and osteoinduction (e.g. BMPs)
   2) Second approach to control cell-biomaterial interactions: utilize cell adhesion molecules (e.g. fibronectin, vitronectin, type1 collagen, osteopontin, and bone sialoprotein, etc)
2. Hybridization of mRNA-derived probes to cDNA microarrays allows us to perform systemic analysis of expression profiles for thousands of genes simultaneously and provides primary information on transcriptional changes related to different implant surfaces.
   1) Connective tissue growth factor (CTGF): binds IGF and regulates cell growth
   2) Insulin-like growth factor 1 receptor: tyrosine kinase, plays a critical role in transformation events
3. Titanium surfaces are important to influence the timing of bone healing, and rougher surfaces induced a higher quantity of bone-implant contact percentage and higher removal torque values.

Conclusion

Microarray assay 48 hours after culturing the cells on the machined and anodized surface revealed that osteoinductive molecules appeared more prominent on the anodized surface, whereas the adhesion molecules on the biomaterial were higher on the machined surface than anodized surface, which will affect the phenotype of the plated cells depending on the surface morphology.

** The Titanium disks were provided and supported technically by OSSTEM (Seoul, Korea).

Scanning Electron Microscopial and Energy Dispersive X-ray Spectrometer Analysis of Dental Implant Surface After Er,Cr:YSGG Laser Treatment

Kyung-Hwan Kwon[1)*], Seung-Ki Min[1)], Sung-Hwan Oh[1)], Moon- Ki Choi[1)], Pil-Kwy Jo[1)]

Introduction

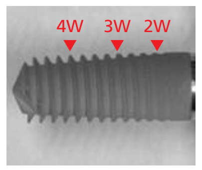
Recently, in addition to these conventional tools about peri-implantitis, the use of different laser systems has also been proposed for treatment of peri-implant infections. As lasers can perform excellent tissue ablation with high bactericidal and detoxification effects, they are expected to be one of the most promising new technical modalities for treatment of failing implants. Recently, Hao and Lawrence found that the improved wettability of the zirconia-based bioceramic following CO_2 laser irradiation resulted favourable fibroblast and osteoblast cell response. It is introduced that Er,Cr:YSGG laser, operating at 2780nm, ablates tissue by a hydrokinetic process that prevents temperature rise. We studied the change and elemental composition of the titanium implant surface under scanning electron microscopy and energy dispersive X-ray spectrometer after using Er,Cr:YSGG laser at various energies.

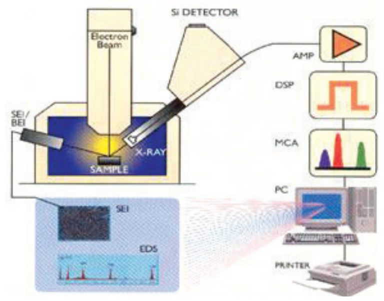
Characteristics of SEM-EDS

Scanning electron microscopy (SEM) coupled with an energy dispersive X-ray spectrometer analyzer (EDS) were used to study the morphology (shape and size) and elemental composition of material surfaces. Lately, these techniques have been increasingly used in areas other than material sciences. In 1980, Pearl and Brody reported the presence of aluminum in the neurons of patients with Alzheimer's disease by using EDS/SEM. In biology these techniques are applied to monitor human vascular cell calcification (Proudfoot et al.,1998), and the in vivo tissue response to implants (Liao et al.,2000).

Materials and Methods

This study used 2 Puretex (NANO surface) implants (experimental group, control group), 2 OSSTEM (RBM surface) implants (experimental group, control group) and 2 DIO (RBM surface) implants(experimental group, control group). Each implant is irradiated by water laser for 10sec at power settings of 2, 3, 4W on 1st thread, 4th thread, 8th thread of implant. Er,Cr:YSGG laser is setted in 20% air and 20% water. Every specimens were examined under a scanning electron microscope (JSM-6360; JEOL) at 2 magnifications (1:200,1:2000) and analyzed by energy dispersive X-ray spectrometer (Oxford).





SEM/EDS system

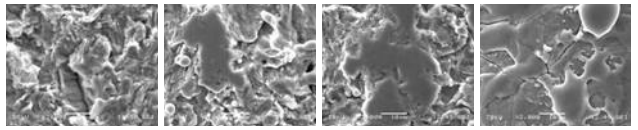
Atomic weight% change

	C	O	Al	P	Cl	Ca	Ti	Cr
RBM surface (OSSTEM)	–	↑	–	↓	–	–	↓	–
RBM surface (DIO)	–	↑↑	–	–	–	↓	↓↓	–
NANO surface (Pure-tex)	–	↑↑	–	↓	–	–	↓↓	–

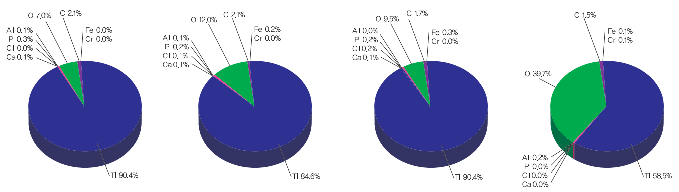
[1)]Dept. of Oral & Maxillofacial Surgery, School of Dentistry, Wonkwang University, South Korea

Results

RBM surface (OSSTEM)

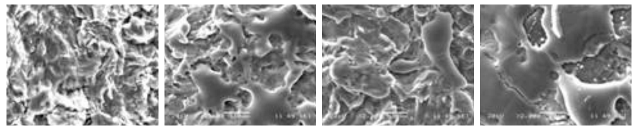


Control (X2000) 2W10sec (X2000) 3W10sec (X2000) 4W10sec (X2000)

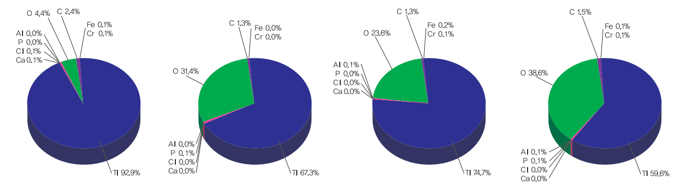


Control (X2000) 2W10sec (X2000) 3W10sec (X2000) 4W10sec (X2000)

RBM surface (DIO)

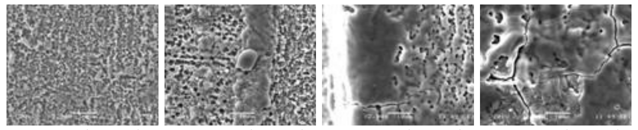


Control (X2000) 2W10sec (X2000) 3W10sec (X2000) 4W10sec (X2000)

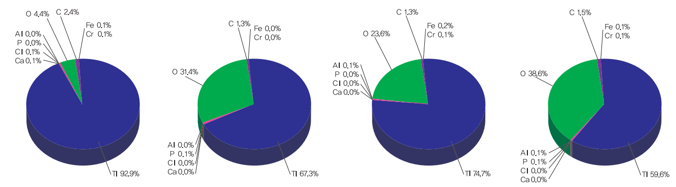


Control (X2000) 2W10sec (X2000) 3W10sec (X2000) 4W10sec (X2000)

NANO surface (Puretex)



Control (X2000) 2W10sec (X2000) 3W10sec (X2000) 4W10sec (X2000)



Control (X2000) 2W10sec (X2000) 3W10sec (X2000) 4W10sec (X2000)

Table 1. Oxygen weight%

	Control	2W	3W	4W
RBM surface (OSSTEM)	6.96%	12.84%	9.46%	39.67%
RBM surface (DIO)	4.43%	31.37%	23.56%	38.58%
NANO surface (Pure-tex)	5.42%	18.35%	37.76%	41.48%

Conclusions

In this study, water laser irradiation of implant fixture showed different effects according to implant surface. Er,Cr:YSGG laser irradiated in RBM surface (OSSTEM) not alter the implant surface under power setting of 3W. But in RBM surface (DIO) and nano surface (Pure-tex) alter above power setting of 2W. And as oxygen weight% is increased, microfracture and melting of implant surface is increased. But It was found that the improved surface roughness, surface oxygen content and surface energy generated by the high power diode laser treatment were accounted for the better wettability characteristics of the material and enhancement of the work adhesion with the biological liquids used (L. Hao et al).

So we concluded that surface oxygen content will provide the better wettability and enhancement of cell adhesion when irradiating Er,Cr:YSGG laser within limit not altering implant microstructure.

The Effedt of Ca-P Coated Bovine Mineral on Bone Regeneration Around Dental Implant in Dogs

Su-Yeon Cho[1)], Hye-Ran Jeon[2)], Sun-Kyoung Lee[1), 2)], Seoung-Ho Lee[1), 2)*], Jun-Young Lee[2)], Keum-Ah Han[2)]

Purpose

The purpose of this experiment is to investigate the effect of Ca-P coated bovine bone mineral on bone regeneration in circumferential bone defect around implants.

Materials and Methods

Two mongrel dogs were used for this study. After 6 weeks after extraction, the surgical procedure including defect preparation and implant installation was performed. The circumferential peri-implant defect of 5 mm depth and 7.5 mm diameter was made using a trephine bur. After that, 3.5 mm diameter and 15 mm length of implant was installed in the center of the defect. As a result, 2.0 mm circumferential gap was made between implant fixture and the surrounding bone. The autogenous particulate bone or Biocera® were filled into the prepared defect. One animal was sacrificed 4 weeks later and the specimens were harvested to investigate. The other animal was sacrificed 8 weeks later and the specimens were harvested to investigate. Block biopsy was performed to evaluate histologic features.

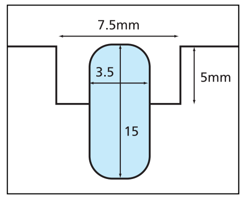


Fig 1. Defect preparation (Diameter: 7.5 mm, Depth: 5 mm)

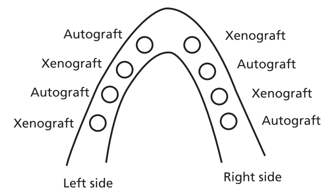


Fig 2. The location of the autograft sites and xenograft sites.

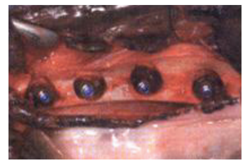


Fig 3. Four implants were placed into the defect sites

Fig 4. The each gap was filled with autogenous particulate bone or Biocera®

Results

Both group exhibited complete bone fill clinically.

Fig 5. Ground section (mesio-distal plan) of xenograft sites after 4 weeks (left) and 8 weeks (right) of healing. Note the dense layer of mainly lamellar bone that occupies the marginal portion of the implant site. Magnification X 10

Fig 6. Ground section (mesio-distal plan) of autograft sites after 4 weeks (left) and 8 weeks (right) of healing. The newly formed bone appeared to have properly filled the marginal defect. Magnification X 10

On the autogenous bone graft sites the average of bone-to-implant contact (BIC) was 28.2±19% at week 4 and 44.9±9% at week 8, respectively. On the Biocera® sites the average of BIC was 34.6±27% at week 4 and 27.6±23% at week 8, respectively. On the autogenous bone graft sites the average of bone density was 39.7±21% at week 4 and 41. 7±11% at week 8. On the Biocera® sites the average of bone density was 32.7±25% at week 4 and 37.4±17% at week 8 respectively. The mean percentage of the bone-to-implant contact and bone density were similar.

Histologically, both autograft site and xenograft site were harmonized well with bone and showed similar healing appearance. There was no significant difference between autograft site and xenograft site (P>0.05).

Conclusions

In case that there existed bone defect of 2 mm in peri-implant, we concluded that it was filled with new bone in autograft and xenograft and the result was similar for both cases. The results suggest that Biocera® can be used as a predictable bone substitute for autogenous bone to augment bony defect around implant.

[1)]Dept. of Periodontology, Graduate School of Clinical Dentistry, Ewha Womans University, Seoul, South Korea
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GS System
Biology

Influence of Implant Fixture Design on Implant Primary Stability

Gap-Yong Oh[1)], Sung-Hwa Park[1)], Seok-Gyu Kim[1)*]

Statement of Problem

Current tendencies of the implant macrodesign are tapered shapes for improved primary stability, but there are lack of studies regarding the relationship between the implant macrodesign and primary stability.

Purpose

The purpose is to investigate the effect of implant macrodesign on the implant primary stability by way of resonance frequency analysis in the bovine rib bones with different kinds of quality.

Methods

Fifty implants of 6 different kinds from two Korean implant systems were used for the test. Bovine rib bones were cut into one hundred pieces with the length of 5 cm.

Among them forty pieces of rib bones with similar qualities were again selected. For the experimental group 1, the thickness of cortical part was measured and 20 pieces of rib bones with the mean thickness of 1.0mm were selected for implant placement. For the experimental group 2, the cortical parts of the remaining 20 pieces of rib bones were totally removed and then implants were placed on the pure cancellous bone according to the surgical manual. After placement of all implants, the implant stability quotient(ISQ) was measured by three times, and its statistical analysis was done.

Fig 1. Aluminum block for stabilizing bone specimen.

Fig 2. Bone specimen fixed in aluminum block.

Fig 3. Tapered(TH:left) and straight(SH:right) implants in Oneplant system.

Fig 4. SS III, US III, US II, GS II in OSSTEM System

Table 1. Implant types used in this stuty

Implant type	Number	Size	System	Characteristics
Tapered hexplant(TH)	5	4.3×10	Oneplant	tapered, submerged
Straight hexplant(SH)	5	4.3×10	Oneplant	straight, submerged
US II	10	4.0×10	OSSTEM	straight, submerged
US III	10	4.0×10	OSSTEM	tapered, submerged
GS II	10	4.0×10	OSSTEM	straight, submerged
SS III	10	4.0×10	OSSTEM	tapered, non-submerged

Table 2. Surgical manual of OSSTEM Implant System

(US II, US III, SS III : D3 bone)
(1) guide drill, (2) Ø2.0 twist drill, (3) depth gauge, (4) parallel pin, (5) Ø2.0/3.0 pilot drill, (6) Ø3.0 twist drill, (7) Ø4.0 implant
(US II : D1 bone)
(1)~(6) ⇒ (7) Ø3.3 marking drill, (8) countersink, (9) Ø4.0 tap drill, (10) Ø4.0 implant
(US III, SS III : D1 bone)
(1)~(6) ⇒ (7) shaping drill, (8) tapered drill (9) Ø4.0 implant
(GS II : D3 bone)
(1)~(6) ⇒ (7) Ø3.3 marking drill, (8) Ø4.0 implant
(GS II : D1 bone)
(1)~(6) ⇒ (7) Ø3.6 marking drill, (8) Ø3.8 step drill (9) Ø4.0 implant

[1)]Dept. of Prosthodontics, Graduate School of Clinical Dental Science, The Catholic University of Korea, South Korea

Table 3. Surgical manual of Oneplant Implant System

(TH : soft bone)
(1) point drill, (2) Ø2.0 twist drill, (3) depth probe, (4) Ø3.3 step drill, (5) Ø4.3 implant
(TH : hard bone)
(1)~(4) ⇒ (5) Ø4.3 conical drill, (6) Ø4.3 tap drill, (7) Ø4.3 implant
(SH : soft bone)
(1)~(3) ⇒ (4) Ø2.0/3.0pilot drill, (5) Ø3.0 twist drill, (6) Ø4.3(4.1)implant
(SH : hard bone)
(1)~(3) ⇒ (4) Ø2.0/3.0 pilot drill, (5) Ø3.0 twist drill, (6) Ø3.5twist drill, (7) Ø4.1 cortical drill, (8) Ø4.1 tap drill (9) Ø4.3(4.1) implant

Results

There are statistically significant differences in ISQ values among 4 different kinds of OSSTEM system implants in the experimental group 2. For the experimental group 1, OSSTEM system implants showed significantly different ISQ values, but when differences in the thickness of cortical parts were statistically considered, did not show any significant differences in ISQ values. Among Oneplant system implants, there are no significant differences in ISQ values for the experimental group 2 as well as for the experimental group 1.

Table 4. Mean ISQ values in the experimental group 1

Implant	N	Mean	SD
TH	5	54.30	11.73
SH	5	58.83	7.52
US II	10	64.83	8.88
US III	10	65.00	5.47
GS II	10	57.70	5.89
SS III	10	60.30	9.45

Table 5. Mean ISQ values in the experimental group 2

Implant	N	Mean	SD
TH	5	53.73	9.38
SH	5	59.80	11.46
US II	10	47.27	11.09
US III	10	50.63	11.85
GS II	10	45.17	9.65
SS III	10	55.97	11.72

Table 6. Mean thickness of cortical bone in the experimental group 1

Implant	N	Mean	SD
TH, SH	10	0.9	0.3
US II, US III, GS II, SS III	10	1.25	0.5

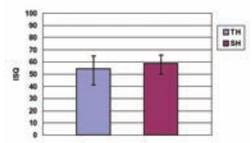


Fig 5. Mean ISQ values of Oneplant implants in the experimental group 1.

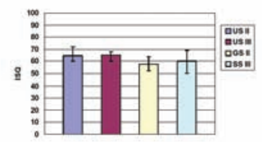


Fig 6. Mean ISQ values of OSSTEM implants in the experimental group 1.

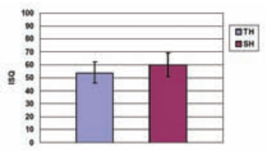


Fig 7. Mean ISQ values of Oneplant implants in the experimental group 2.

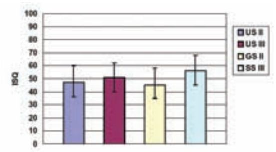


Fig 8. Mean ISQ values of OSSTEM implants in the experimental group 2.

Conclusion

Within the limits of this study, bone quality and implant design have some influences on the primary stability of implants. Especially in the bone of poor quality, tapered shape of implants are more favorable for the primary stability of implants.

A Comparative Analysis of the Accuracy of Impression Technique

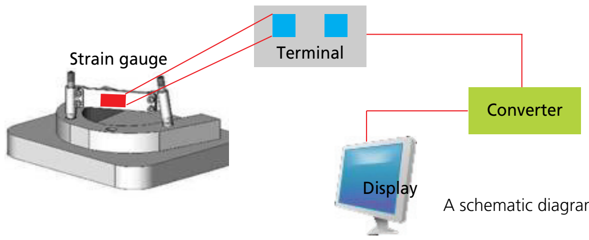
Ji-Hoon Yoon[1)], Kwang-Hoon Kim[1)], Chang-Mo Jeong[2)*], Tae-Gwan Eom[1)], Sang-Hoon Eom[3)], Gye-Rok Jeon[3)]

Purpose

This study was conducted to evaluate the effect of impression taking method and test level.

Apparatus

Our study used strain gauge for measuring of precision in impression, and this apparatus can measure difference between base model and master cast accurately. To measure the accuracy of impression, the difference of distortion in both horizontal and vertical dimensions between base model and master cast was measured by the strain gauge.



A schematic diagram of measurement of impression error

Materials

The applied impression system was the internal GS system made in OSSTEM® implant and the polyether was used as impression materials.

	Fixture Angulation	Impression Coping	Method
Group I	0 degree	Pick-up type (GSCP1480-1)	non splitting
Group II	0 degree	Transfer type (GSCT1480)	non splitting
Group III	0 degree	Pick-up type (GSCP1480-2)	non splitting
Group IV	0 degree	Pick-up type (GSCP1480-1)	splitting

	Fixture Angulation	Impression Coping	Method
Group I	22 degree	Pick-up type (GSCP1480-1)	non splitting
Group II	22 degree	Transfer type (GSCT1480)	non splitting
Group III	22 degree	Pick-up type (GSCP1480-2)	non splitting
Group IV	22 degree	Pick-up type (GSCP1480-1)	splitting

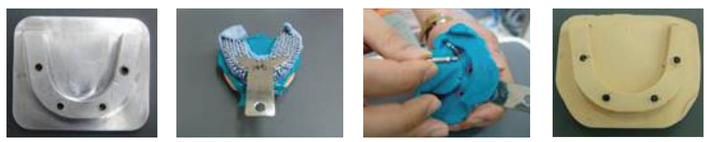

GSCPI480-1 GSCPI480-1 GSCPI480-2 GSCTI480


Group I Group II Group III Group IV

Methods

Master cast was fabricated common method. For comparison of difference between base model andmaster cast, we measured base model and master cast. Four groups of 5 specimens each were made with different impression techniques. The above process was repeated by another tester.

Fabrication of master cast



Measurement of base model

Measurement of master cast

Results

2-way ANOVA about impression skill & materials :
1) There were significant difference between Group V,VIII and others (p<.05).
2) The accuracy of impression taking was more effective impression skill than materials.
3) There was not considerable interaction between skill and material (p<.05).

Individual 95% CI about materials

```
           Ave.    --+---------+---------+---------+-------
Group I    21.3950    (------*-----)
Group II   26.1317        (------*-----)
Group III  20.0233   (------*------)
Group IV   22.8833      (------*-----)
Group V    40.8467                     (------*------)
Group VI   23.5450      (-----*------)
Group VII  25.4850        (------*-----)
Group VIII 37.3183                  (------*-----)
                   --+---------+---------+---------+-------
                    16.0      24.0      32.0      40.0
```

Individual 95% CI about Tester level

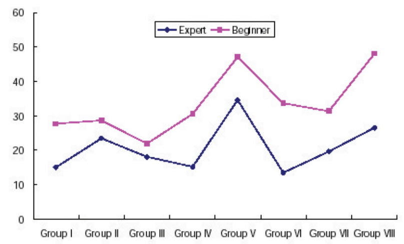
```
           Ave.    ----+---------+---------+---------+-----
Beginner   33.6442                   (----*-----)
Expert     20.7629  (-----*----)
                   ----+---------+---------+---------+-----
                      20.0      25.0      30.0      35.0
```

condition : 1) A person experienced in impression taking.
2) A person not experienced in impression taking.

Validation : One way ANOVA & Turkey Test

Mean Values

	Expert	Beginner
Group I	15.031	27.777
Group II	23.55	28.713
Group III	18.153	21.893
Group IV	15.173	30.593
Group I	34.577	47.117
Group II	13.437	33.653
Group III	19.643	31.327
Group IV	26.557	48.08



Conclusions

In case of expert, there was significant difference between Group III and Group V,VIII (p<.05).
In case of beginner there was significant difference between Group I,III,IV and Group V,VIII (p<0.05).

[1)]Implant R&D Center, OSSTEM Implant Co. Ltd., Busan, South Korea
[2)]Dept. of Prosthodontics, Pusan National University Hospital, South Korea
[3)]Center for medical informatics, Pusan National University, Busan, South Korea

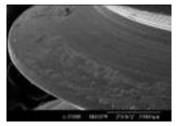
GS System
Biomechanics

Influence of Tungsten Carbide/Carbon on the Preload of Implant Abutment Screws

Jin-Uk Choi[1)], Chang-Mo Jeong[1)*], Young-Chan Jeon[1)], Jang-Seop Lim[1)], Hee-Chan Jeong[1)], Tae-Gwan Eom[1)]

Statement of Problem

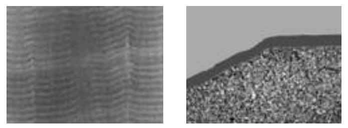
Recently, in order to increase preload with reducing the friction coefficient, abutment screws coated with pure gold and Teflon as dry lubricant coatings have been introduced. But the reported data indicate that if screw repeated tightening and loosening cycle, an efficiency of increasing preload was decreased by screw surface wearing off.



Robb TT, Porter SS. J Dent Res 1998;77(special issue):837 [abstract 1641, 1642]
Vigolo P. Int J Oral Maxillofac Implants 2004;19:260-265
Martin WC, Woody RD, Miller BH, Miller AW. J Prosthet Dent 2001;86:24-32

Purpose

This study was to evaluate the influence of tungsten carbide/carbon coating, which has the low friction coefficient and the high wear resistance, on the preload of abutment screws and the stability of coating surface after repeated closures.



Armorphous metal carbon coating
Multilamellar structure

Low Coefficient of Friction
Good Wear Resistance
High Load - Bearing Capacity

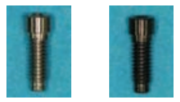
Materials

Features of Experimental Implant Abutment Systems (OSSTEM Implant, Korea)

Implant system	Implant Ø mm	Abutment / implant interface	Abutment	Abutment screw
US II	4.1	External butt joint (external hexagon)	Cemented	Ta, WC/CTa
SS II	4.8	8° Morse taper (internal octagon)	ComOcta	Ta, WC/CTa
GS II	4.5	11° Morse taper (internal hexagon)	Transfer	Ta, WC/CTa

Ta = titanium alloy; WC/CTa = tungsten carbide/carbon-coated titanium alloy.

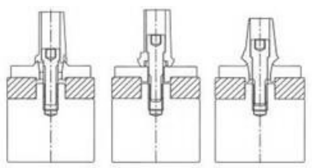
Implant fixture



Abutment screw

Preload Test

To evaluate the influence of WC/C coating on the preload of implant abutment screws, each assembly (n=5) was tightened to 30Ncm and compressive force between abutment and fixture were measured in implant systems with three different joint connections, one external butt joint and two internal cones.



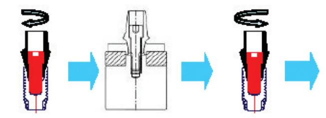
Schematic Diagram of Measurement Apparatus

Force sensor connection

Digital indicator for measuring compressive force

Consecutive Trial Test

To evaluate the stability and the alteration of coating screw, GS system assemblies (n=5) were examined by comparison of the compressive force and the removable torque values during 10 consecutive trials, and the surface change were observed.

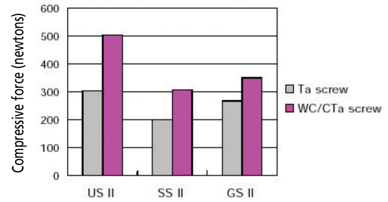


Preload Test Results

Application of coating on implant abutment screw resulted in significant increase of compressive force in all implant systems (P<.05). The increasing rate of compressive force by coating in external butt joint was greater than those in internal cones (P<.05).

Mean Values±SDs of Compressive Force (N)

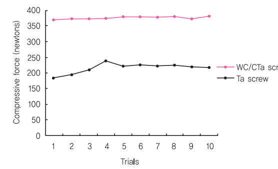
Implant system	Ta screw	WC/CTa screw	Percentage of increased compressive force
US II	303.8±12.7[c]	503.8° ±13.9[e]	65.8
SS II	199.6±7.8[a]	306.4±8.6[c]	53.5
GS II	266.6±11.0[b]	350.0±15.0[d]	31.3

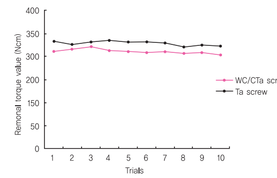


Consecutive Trial Test Results

Coated screw showed insignificant variations in the compressive forces during 10 consecutive trials (P<.05).
Removable torque values were greater with non-coated screw than that with coated screw (P<.05).

Trials	Compressive force (N)		Removable torque (Ncm)	
	Ta screw	WC/CTa screw	Ta screw	WC/CTa screw
1	180.4±10.1[a]	367.8±15.9	23.3±1.8	21.2±0.9[a,b]
2	192.6±11.3[a,b]	372.0±5.4	22.6±1.7	21.6±0.7[b,c]
3	209.4±23.6[b,c]	372.0±4.4	23.0±1.7	22.1±0.8[c]
4	233.4±25.6[c]	370.8±5.5	23.6±1.1	21.4±0.2[b,c]
5	221.4±13.6[c]	378.2±6.4	23.1±0.7	21.2±0.6[a,b]
6	222.6±15.7[c]	378.8±7.8	23.1±0.7	20.9±0.6[a,b]
7	219.8±19.9[c]	375.8±11.1	22.9±0.8	21.1±0.5[a,b]
8	222.0±22.4[c]	378.2±11.6	22.1±0.9	20.8±0.6[a,b]
9	217.8±17.3[b,c]	374.8±11.8	22.4±0.7	20.8±0.6[a,b]
10	216.6±16.8[b,c]	379.8±11.7	22.2±0.7	20.5±0.5[a]
Mean	213.6±15.7	374.8±4.0	22.8±0.5	21.2±0.5

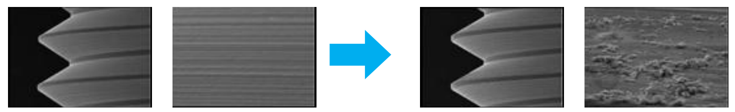




SEM Photomicrograph Results

Titanium alloy screw

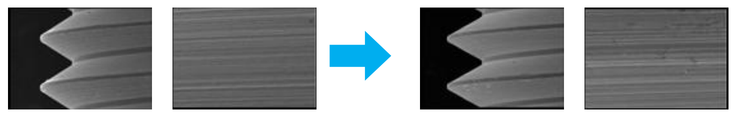
Pre-test Screws / Worn Screws



Magnification×100 Magnification×1,000 Magnification×100 Magnification×1,000

WC/C- coated titanium alloy screw

Pre-test Screws / Worn Screws



Magnification×100 Magnification×1,000 Magnification×100 Magnification×1,000

Conclusion

Tungsten carbide/carbon coating of implant abutment screw was effective in the increasing of preload and with favorable wear resistance.

[1)]Dept. of Prosthodontics, Pusan National University Hospital, Busan, South of Korea
[2)]Implant R&D Center, OSSTEM Implant Co. Ltd., Busan, South Korea

GS System
Biomechanics

The Effect of Implant Abutment Length, Surface and Cement Type on the Prosthesis Retention

Mun-Ji Hyun[1)], Cheol-Won Lee[1)*], Mok-Kyun Choie[1)]

Introduction

When implant abutment length is short, cement retained prosthesis is not designed because of it's low retention. There are many ways to increase retention force such as change of angle taper, surface treatment and cement selection. However there is no clinical guidelines about them.

The purpose of this study is to evaluate the effect of surface characteristics of the abutment and cement type on the retention of implant prosthesis when the abutment length is decreased.

Materials & Methods

Abutments & Cements

45 cement type abutments (Osstem Implant Co.Ltd, Seoul, Korea) were divided into 9 groups according to the several conditions.

1) Surface treatment :
   a) Smooth (no treatment)
   b) Sandblasting (Sand storm® 3.5kPa,50μm Alumina particle, 1mm away, 1 min)
   c) Diamond bur preparation (201R, Shofu Co., Japan, 3~4 times, evenly)
2) Cement type :
   a) Zinc oxide-eugenol cement (ZOE - Temp-bond®)
   b) Zinc phosphate cement (ZPC - Fleck's®)
   c) Resin cement (Panavia 21®)
3) Abutment length : 3mm, 5mm, 7mm(7mm tested in ZOE only)

Table 1. Experimental group and condition

Abutment: Length	Abutment: Surface treatment	Cement
3mm	Smooth surface	ZOE , ZPC, Resin
	Sandblasting	ZOE , ZPC, Resin
	Diamond bur preparation	ZOE , ZPC, Resin
5mm	Smooth surface	ZOE , ZPC, Resin
	Sandblasting	ZOE , ZPC, Resin
	Diamond bur preparation	ZOE , ZPC, Resin
7mm	Smooth surface	ZOE
	Sandblasting	ZOE
	Diamond bur preparation	ZOE

Methods

1) Measuring of retention :Tensile strength of prosthesis was measured by universal testing machine (Instron Engineering Co., U.S.A) (Velocity : 5mm/min)
2) Statistics : The Mean and SD from each specimen, and using One way Analysis of variance

Fig 1. Implant abutments and crowns
Upper is crown and loop
Lower is abutment with analogue
Surface was treated that none (left), sandblasting (middle), and diamond bur preparation (right)

Fig 2. Measurement of tensile strength
Instron Universal Test Machine, which was used to measure the tensile strength

[1)]Dept. of Prosthodontics & Implantology, St. Mary's Hospital. The Catholic Univ. of Korea, South Korea

Results

Table 2. Retention strength of cementation between abutment and crown (Unit : newton, N)

Abutment \ Cement	ZOE	ZPC	Resin
3mm Smooth surface	35.24±22.77	66.16±16.36	407.57±59.33
3mm Sandblasting	79.63±30.44	152.68±19.92	450.31±94.07
3mm Diamond bur preparation	98.25±29.67	161.53±25.35	504.15±117.81
5mm Smooth surface	67.74±14.05	170.73±40.77	420.53±118.53
5mm Sandblasting	142.63±28.62	245.85±43.91	612.53±66.11
5mm Diamond bur preparation	177.28±10.45	289.36±37.58	688.55±13.04
7mm Smooth surface	80.44±19.46		
7mm Sandblasting	209.83±19.46		
7mm Diamond bur preparation	232.24±29.07		

Analyze

When abutment length was increased, we could get higher retention value of the implant prosthesis. Retentive value of diamond bur preparation group was higher than that of the other group, sandblasting was higher than smooth group. Retentive value of resin cement group was higher than that of the other group, ZPC was higher than ZOE group.

1. In the 7mm abutment groups, retention of surface treated groups were statistically higher than that of smooth surface group. ($P<0.05$)
2. In the 5mm abutment groups, retention of surface treated groups were statistically higher than that of smooth surface group when ZPC and resin cement were used. ($P<0.05$)
3. In the 3mm abutment groups, retentive value was statistically increased only when the type of cement is changed. ($P<0.05$)

In conclusion, surface treatment of implant abutment and change of cement type are good method to increase the retention of prosthesis when the length of abutment is short.

Effect of Joint Design on Static and Dynamic Strength

Ji-Hoon Yoon[1)], Chang-Mo Jeong[2)*], Tae-Gwan Eom[1)], Mi-Hyun Cheon[2)]

Introduction

Mechanical failures of component loosening and fracture of implant system have been concerned. These clinical failures may result from overload or fatigue. Although several comparatives studies on static fracture strength of different implant-abutment joint designs have been reported, the fatigue endurance of these joints has not been fully investigated.

The purpose of this study is to evaluate compressive and fatigue strength of different joint designs.

Materials and Methods

In this study four OSSTEM(Korea) implants assemblies were used, External Butt Joint-Safe Abutment(BJS), External Butt Joint-Cemented Abutment(BJC), 11° Internal Conical Joint-Transfer Abutment(CJT) and 11° Internal Conical Joint-Convertible Abutment(CJC).

Implant-abutment Joint Design

	Connection type	Materials
BJS	External Butt Joint Modified Abutment + Screw	Abutment -Ti Gr3 / Screw - Ti Gr5
BJC	External Butt Joint Abutment + Screw	Abutment - Ti Gr3 / Screw - Ti Gr5
CJT	11° internal Conical Joint Abutment + Screw	Abutment - Ti Gr3 / Screw - Ti Gr5
CJC	11° Internal Conical JointAbutment + Cylinder + Screw	Abutment - Ti Gr5 / Cylinder - Ti Gr3 / Screw - Ti Gr5

Compressive and fatigue strength of four groups were evaluated according to specified test(ISO/FDIS-14801). Tightening torque of each assembly was 30Ncm. The result of compressive strength was verified by one-way ANOVA and Turkey test. Fatigue test was started at 80% of fracture strength and failure was defined as material yielding, permanent deformation or fracture of any component. Test had been continued until three specimens reached the specified number of cycles with no failures. The failure modes were identified by SEM.(S-4200; Hitachi, Japan)

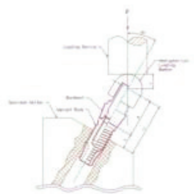

BJS


BJC


CJT


CJC

Compressive bending and Cyclic fatigue loading


Schematic Diagram of Test Condition


Cyclic Loading System (8516, Instron corp, USA)

Results

Compressive Strength

Implant-abutment Joint Design

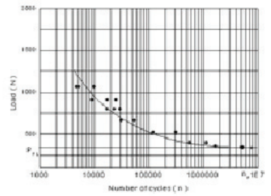
Groups(n=5)	mean
BJS	1392.1±52.6
BJC	1153.2±39.0
CJT	1016.2±116.4
CJC	968.3±86.0

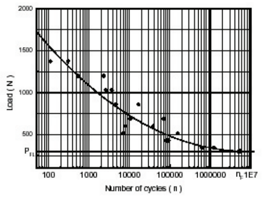
* Groups with the same letters are not significantly different. (P<0.05),

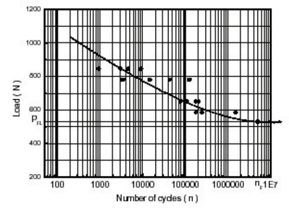
Fatigue Strength

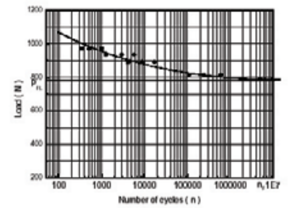
Groups	Fatigue Strength(N)
BJS	360
BJC	300
CJT	530
CJC	780

[1)]Implant R&D Center, OSSTEM Implant Co. Ltd., Busan, South Korea
[2)]The Dept. of Prosthodontics ,Pusan National University Hospital, Busan, South Korea


Curve for stress versus number of cycle(S-N) of BJS

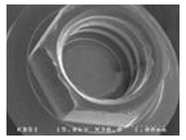

Curve for stress versus number of cycle(S-N) of BJC

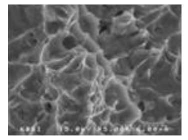

Curve for stress versus number of cycle(S-N) of CJT


Curve for stress versus number of cycle(S-N) of CJC

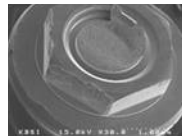
SEM examination(S-4200, Hitachi, Japan)

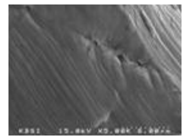
Compressive Strength


fractured abutment screw (original magnification X 30)


fractograph showing dimpled Surface (original magnificationX5.0k)

Fatigue Strength


fractured abutment screw (original magnification X 30)


fractograph showing dimpled Surface (original magnificationX5.0k)

Conclusions

Within the limits of this study ;

1.The fatigue endurance of internal conical was higher than that of external butt joint.

2. In butt joint, BJS with longer resistance arm showed higher fatigue strength than BJC.

3. CJC with internal conical joint had the strongest connection.

4. There was no direct correlation between fracture strength and fatigue strength.

GS System Biomechanics

The Effect of Tightening Torque on Reliability of Joint Stability

Tae-Gwan Eom[1)], Chang-Mo Jeong[2)*], Kwang-Hoon Kim[1)]

Introduction

A screw loosening has been considered as a problem in the component of implant. Although several comparative studies on static and dynamic tests of various implant parts have been reported, research about reliability of joint stability according to tightening torque(TT) has not been properly investigated.

The purpose of this study is to investigate the effect of TT on a screw loosening according to implant-abutment joint designs.

Materials and Methods

In this study, we used three OSSTEM(Korea) Implant assemblies, External Butt Joint-Safe Abutment System(BJS), 8˚ Internal Conical Joint-ComOcta Abutment(CJC) and 11˚ Internal Conical Joint-Transfer Abutment(CJT). Each assembly was divided equally five into 3 tightening torques, 20Ncm, 30Ncm and 40Ncm.

Implant-abutment Joint Design

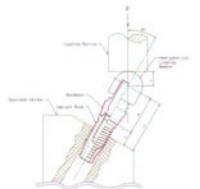
	Connection type	Materials
BJS	External Butt Joint Modified UCLA Abutment and Screw	Abutment - Ti Gr3 / Screw - Ti Gr5
BJC	8˚ internal Conical Joint Abutment and Screw	Abutment - Ti Gr3 / Screw - Ti Gr5
CJT	11˚ internal Conical Joint Abutment and Screw	Abutment - Ti Gr3 / Screw - Ti Gr5

BJS

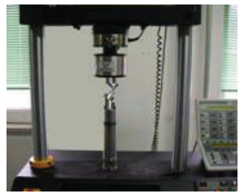
CJC

CJT

Cyclic Fatigue Loading



Schematic Diagram of Testing condition



Cyclic Loading System (8516, Instron corp, USA)

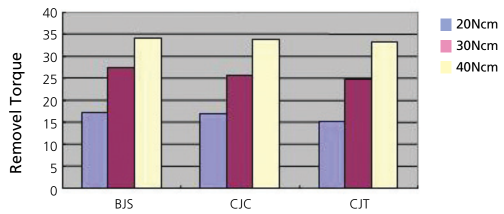
Each assembly was loaded with cyclic loading device(10~250N, 30˚, 2Hz). A target of 1.0E6 cycles was defined. Removal torque(RT) was recorded before and after loading. Loss RT/ initial RT was analyzed with two-way ANOVA test and Turkey test.

Results

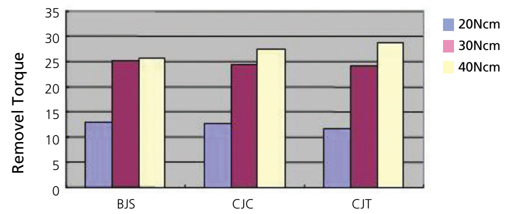
Mean and Standard Deviation of Removal Torque Values

Tightening Torque		20Ncm	30Ncm	40Ncm
BJS	Initial	17.2±0.85	27.5±0.69	34.1±1.08
	Postload	13±0.81	25.1±1.1	25.7±2.08
	Loss RT / Initial RT(%)	24.4	8.7	24.6
BJC	Initial	16.8±1.15	25.5±1.1	33.8±1.34
	Postload	12.7±1.0	24.3±1.7	27.4±1.5
	Loss RT / Initial RT(%)	24.4	4.7	18.9
CJT	Initial	15.3±0.9	24.7±1.49	33.1±1.16
	Postload	11.7±0.8	24.1±1.47	28.7±2.18
	Loss RT / Initial RT(%)	23.5	2.4	13.2

Tightening Torque VS Removel Torque at before loading



Tightening Torque VS Removel Torque at postload



1. Initial screw efficiencies(RT/TT) are RJS:87%, CJC:82% and CJT:80%. Amount of TT had little effect in all three assemblies. 30NcmTT showed the smallest change in removal torque after loading in all three assemblies. 30Ncm showed better stability than 20Ncm and 40Ncm.
2. After loading, 30Ncm TT showed the smallest change in removal torque in all three assemblies.

Conclusion

This study indicated that tightening torque may influence joint stability. Within the limit of this study, The joint stability was showed the best stable when abutments were tightened to 30Ncm in all implant-abutment connections. Therefore it is recommended that optimal TT values should be provided according to implant-abutment system used in clinic.

[1)]Implant R&D Center, OSSTEM Implant Co. Ltd., Busan, South Korea
[2)]The Dept. of Prosthodontics, Pusan National University Hospital, Busan, South Korea

GS System
Biomechanics

Study on the Adaptation to the Investment Water-Powder Ratio by the Abutment and Casting Crown

Tae-Hee Byun[1)*], Kwang-Hoon Kim[2)]

Introduction

Casting is a simple method for making dental restorations that require complicated, precise work for features such as inlay, crown & bridge, partial work, implants, and abutments. Nonetheless, it may also cause various casting defects such as deformation, bubble holes, shrinking, and imprecision. Casting shrinkage in particular occurs on most metals. Casting using wax of an original size makes the casting body different from the desired size. Unlike general casting, dental casting work requires expanding the investing material to let the mold expand alongside the shrinkage of the alloy during the melting and casting of alloy. This main dental feature is an important issue. This study seeks to examine the change of the fit depending on the water-mixing rate of the investing material among many other factors of casting defects and examine how the fit of an implant abutment and the casting body changes depending on the water-mixing rate of the investing material.

Methods

To examine the fit of an implant abutment and the casting body, an abutment 5.5㎜ high (GS Rigid Abutment: OSSTEM implant Co. Ltd., Korea) was connected to a plastic coping with the snap-on cut. The rotary angle was then measured (Fig 1. Rotary angle tester). The reason for the use of the plastic coping is to reduce errors during the creation of a super-structure and to ensure the same degree of shrinkage during casting. After the measurement of the rotary angle of the plastic coping, 16%, 18%, and 20% mixing rates were used for the phosphate investing material (CB30). Casting was done with ceramic gold alloy and Ni-Cr metal. Afterward, the rotary angles of the cast plastic coping was measured for the abutment whose rotary angle was first measured. The difference in the fit before and after casting was compared.

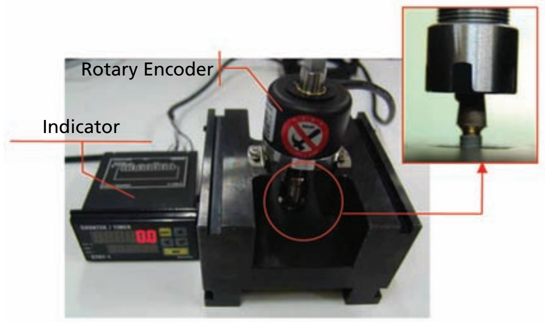


Fig 1. Rotary Angle Tester

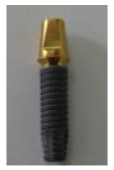


Fig 2. Rigid Abutment


Fig 3. Plastic Coping Before/ After Casting

Results

Using plastic copings with the snap-on area cut, the difference of the fit was compared based on the changes in rotary angles depending on the mixing rate of investing material.

1. When casting was done with Ni-Cr Metal and Ceramic Gold Alloy, and investing material was mixed at an 18% mixing rate (producer-guided), Ni-Cr shrank (2˚→1˚) and gold expanded (2.5˚→3.5˚).
2. When casting was done with Ni-Cr Metal and Ceramic Gold Alloy, and investing material was mixed at a 20% mixing rate, both Ni-Cr (2.2˚→1˚) and gold (3˚→2.8˚) shrank.
3. When casting was done with Ni-Cr Metal and Ceramic Gold Alloy, and investing material was mixed at a 16% mixing rate, Ni-Cr shrank (3˚→2.5˚). Gold expanded (2˚→3.2˚), however.

[1)] Implant R&D Center, OSSTEM Implant Co. Ltd., Busan, South Korea

Table 1. Changes in the rotary angle depending on the mixing rate of phosphate investing material (CB30)

Powder	100		100		100	
Liquid	16		18		20	
	Pre-casting	Pre-casting	Pre-casting	Pre-casting	Pre-casting	Pre-casting
Ni-Cr Metal	3˚	-0.5	2˚	-1	2.2˚	-1.2
Ceramic Gold	2˚	+1.2	2.5˚	+1	3˚	-0.2

Conclusions

Casting is a very useful method of creating a complicated, precise superstructure. Considering the possible various casting defects, however, careful use is required. In this study, a comparison was made by examining the difference of the fit in accordance with the mixture rate of the investing material as one of the factors of casting defects.

Table 2. Linear shrinkage rate of alloy and expansion rate of investing materials

Alloy Type	Linear Shrinkage Rate (%)
Gold alloy for coating deposition	1.40
Non-precious metal alloy for coating deposition	2.10
Expansion rate of phosphate investing material: 1.5-2%	

(*Table 2. Reference for the linear shrinkage rate of alloy and expansion rate of investing material)

1. When investing material was mixed at a water-mixing rate of 18%, the rotary angle shrank because it failed to compensate the shrinkage rate of Ni-Cr perfectly. The rotary angle also increased because the expansion rate of the investing material was higher than the shrinkage rate of ceramic Gold Alloy.
2. When investing material was mixed at a water-mixing rate of 16%, the change of rotary angle through the compensation of the shrinkage rate of Ni-Cr increased. Since the expansion rate of investing material was much higher than the shrinkage rate of ceramic gold alloy, the rotary angle became bigger than the 18% rate of investing material.
3. When investing material was mixed at a 20% rate, the rotary angle of Ni-Cr shrank since its expansion rate dropped by more than the 18% rate. Nonetheless, the shrinkage rate of ceramic gold alloy became equal to the expansion rate of the investing material. Consequently, there was almost no change of the rotary angle.0

This test result reveals that the water-mixing rate of the investing material affects the difference of the fit of a superstructure. For the creation of a dental superstructure, adhering to the water-mixing rate specified by the manufacturer is recommended. Note, however, that a user's precise knowledge of the shrinkage rate of casting metal and the expansion rate of the investing material will ensure the creation of a superstructure with a perfect fit.

A Retrospective Study on the Clinical Success Rate of OSSTEM® Implant

Sung-Moon Back[1)], Min-Suk Oh[1)], Su-Kwan Kim[1)*]

Purpose

It is important to analyze the causes of implant failure. Therefore, we examined the records of patients who received an OSSTEM® implant at the dental clinic at Chosun University, Korea, between January 2002 and December 2005. Implant success and cumulative survival rates were evaluated by assessing clinical examination results, medical records, and radiographs. The success rate was assessed according to gender, implant placement area, fixture diameter and length, and the presence or absence of maxillary sinus surgery.

Materials and Methods

The study was performed on 247 patients (144 male, 103 female) who received 479 OSSTEM® Implants (Seoul, Republic of Korea) at the dental clinic at Chosun University, Korea, between January 2002 and December 2005. The patients ranged in age from the teens to the 70s. The patients had no systemic diseases that would have been a contraindication for implant surgery. We compared patient gender and age, implant area (maxillary anterior tooth, maxillary premolar tooth, maxillary molar tooth, mandibular front tooth, mandibular premolar tooth, and mandibular molar tooth areas), implant diameter and length, and use of the maxillary sinus lifting technique. Based on the examination records, the following were analyzed: patient gender and age distribution, implant placement location, fixture diameter and length, presence or absence of maxillary sinus surgery, and cause of implant failure.

Results

Success rate according to patient gender and age distribution. The highest success rates occurred among those in the 40s age group (31%) for male patients and the 50s age group (28%) for female patients. In both male and female patients, the failure rate increased with increasing age.

Success rate according to implant placement location. In all age groups, implants were placed most frequently in the mandibular molar tooth area (41% of total) and maxillary molar tooth area (18% of total). The implant failure rate was highest in the maxillary molar tooth area (8/88, 9%) and mandibular molar tooth area (16/192, 8%). Among the maxillary molar tooth cases, maxillary sinus lifting was performed in 24 cases, and failure occurred in four of these.

Classification according to implant area and fixture diameter and length. The location and fixture size was determined for each of the 479 implants. The most frequently implanted areas were the mandibular molar tooth, maxillary molar tooth, and maxillary pre-molar tooth areas. The implant diameters were 3.3, 3.75, 4.1 and 5.1 mm, and the lengths ranged from 10 to 15 mm. The most frequently used implant had a diameter of 4.1 mm and a length of 13 mm.

Success rate following maxillary sinus lifting surgery (Table 1). Maxillary sinus lifting was performed during the placement of 24 implants, and four of these implants failed. Perforation developed during the placement of eight implants, and three of these failed.

Outcome	Perforation	Non-perforation
Success	5(20.83%)	15(62.5%)
Failure	3(10.25%)	1(4.1%)

Table 1. Success rate following maxillary sinus lifting (total, 24 cases).

Causes of implant failure (Table 2). Among the 479 implants, there were 28 failures. The most frequent causes of failure, in decreasing order, were poor bone quality, poor initial stability, and perforation in the maxillary sinus. In this study, maxillary sinus lifting was performed simultaneously with implantation in 24 patients, and bone union failed in four cases, for a success rate of 83%.

[1)]Dept. of Maxillofacial Surgery, College of Dentistry, Chosun University, South Korea

Causes	Implants (%)
Poor bone qualiy:	12(42.9%)
Cases implanted in natural bone	8
Cases with simultaneous maxillary sinus lifting surgery	4
Poor initial stability	8(28.5%)
Dehiscence formation	1(3.5%)
Perforation in the maxillary sinus	3(10.7%)
Erroneous implant direction	1(3.5%)
Exposure of the blocking menbrane	2(2.7%)
Reimplantation due to implant fracture	1(10.7%)
Total	28

Table 2. Causes of implant failure.

Discussion

Given that the implant failure rate increases with age, poor bone quality and consequent poor initial stability may have the greatest effect on implant failure. In particular, bone quality deteriorates rapidly following the onset of menopause in female patients, as bone remodeling accelerates due to estrogen deficiency or as osteoclast bone resorption activity becomes higher than osteoblast bone formation activity. In this study, the diameter and length of the implant were selected on the basis of residual bone volume, bone quality, and surgical area, among other factors.

The success rate was 93.8% in female patients and slightly higher (94.3%) in male patients. However, despite the overall success rate of 93.1% demonstrated in this study, maxillary sinus lifting remains a very difficult technique requiring great care.

Bone grafts, including those associated with maxillary sinus lifting, were performed in 181 cases, representing 37.8% of the 247 implanted patients. This implies that approximately half of the patients visiting general dental clinics require the simultaneous performance of a large or small bone grafting process. When counseling implant patients, it may be advisable to warn them in advance that a bone graft may be necessary during implant surgery.

Owing to the small size of the study, it was difficult to elucidate a correlation between perforation and failure, although it was considered that perforation did not necessarily induce failure. Further limitations of this study are that: (1) implantation was not performed by a single surgeon so that the ability of the surgeon could not be analyzed; (2) the follow-up period was only 4-years; and (3) various bone graft Material were used in mixtures so that the biocompatibility of each materialcould not be determined precisely.

Future studies on methods of improving the success rate of implantation in the maxillary molar tooth area are recommended and may lead to more predictable treatment.

SS System Clinic

Multicenter Retrospective Clinical Study of OSSTEM® SS II Implant System

Young-Kyun Kim[1)*], Hee-Kyun Oh[2)], Su-Gwan Kim[3)], Yong-Geun Choi[4)], Yong-Seok Cho[5)], Young-Hak Oh[6)]

Introduction

Introduced in 2003 as OSSTEM® SS II Implant System, it was straight body with internal 8° morse taper & octagonal connection type, based on one-stage surgery.(Fig 1.) The screw thread designed 0.8 pitch triangle shape increase implant initial stability and distribution of occlusal force, therefore this implant system is favorable for immediate loading. The fixture collar with machined surface exhibit 0.1 to 0.3㎛ roughness and it have a good effect on peri-implant tissue compatibility. Fixture body have Resorbable Blasting Media (RBM) surface using hydroxyapatite, exhibiting 1.2 to 1.8㎛ roughness.(Fig 2.) This surface roughness has been reported as an optimal level of osseointergration. But up to now, there are few clinical reports on this implant system. Thus the authors planned a multicenter retrospective study of OSSTEM® SS II implant system to evaluate the its clinical outcome.

Fig 1. OSSTEM® SS II Implant System

Table 1. Specification of OSSTEM® SS II Implant System (mm)

	Regular				Wide
Platform diameter (P)	4.8		4.8		6.0
Collar height (C)	1.8	2.8	1.8	2.8	2.0
Body length (L)	8.5, 10, 11.5, 13, 15				
Body diameter (D)	4.1		4.8		4.8

Objects and Methods

This study was approved by the Bioethics Committee of The Seoul National University Bundang Hospital.

■ **Implant system** : OSSTEM® SS II Implant System

■ **Clinical centers :**

1. Dept. of Oral & Maxillofacial Surgery, Seoul National University Bundang Hospital
2. Dept. of Oral & Maxillofacial Surgery, College of Dentistry, Chonnam University
3. Dept. of Oral & Maxillofacial Surgery, College of Dentistry, Chosun University
4. EB Dental Private Office
5. Apsun Dental Hospital
6. All Dental Private Office

■ **Objects**

- Implant placement at January 2003 to December 2004
- 128 patients, 396 implants
- Age : Mean 51.4 years (19 to 76 years)
- Sex : Male 68, Female 60

■ **Methods**

- The time of Follow-up : 31 months (19 to 40 months) after implant placement
- Exclusion criteria : Not applied
- Evaluation parameter :
  1. Patients general conditions
  2. Implant length & width
  3. Areas of implant placement
  4. Implant placement methods
  5. Primary & Secondary stability
  6. Prostheses types
  7. Complications
  8. Peri-implant soft tissue condition
  9. Crestal bone resorption
  10. Survival rate & Success rate

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[2)]Dept. of Oral & Maxillofacial Surgery, College of Dentistry, Chonnam University, South Korea
[3)]Dept. of Oral & Maxillofacial Surgery, College of Dentistry, Chosun University, South Korea
[4)]EB Dental Private Office, South Korea
[5)]Apsun Dental Hospital, South Korea
[6)]All Dental Private Office, South Korea

Results

1. Patients condition

Table 2. Distribution of Patient condition (Estimable patients, N=123)

	N	Percentage
Healthy patients	97	78.9
Cardiovascular disease	11	8.9
Diabetes Mellitus	9	7.3
Liver disease	2	1.6
Bronchial asthma	1	0.8
Psychological disorder	1	0.8
Others	2	1.6
Total	123	100

Table 3. Distribution of Smoking patients (Estimable patients, N=97)

	N	Percentage
Smoking*	25	25.8
Non-smoking	72	74.2
Total	97	100

*Smoking patients; more than 10 cigarette per day

Table 4. Distribution of Oral hygiene (Estimable patients, N=121)

Oral hygiene	N	Percentage
Good	25	20.7
Moderate	59	48.8
Poor	34	28.1
Very poor	3	2.5
Total	121	100

2. Implant length, width

Table 5. Distribution of implants by diameter and length (Implant, n=396)

		N	Percentage
Diameter	4.1	164	41.4
	4.8	232	58.6
Length	8.5	13	3.3
	10	44	11.1
	11.5	164	41.4
	13	158	39.9
	15	17	4.3

3. Area of implant placement

Table 6. Distribution of implant by area (Implant, n=396)

		n (%)	
Maxilla		**174 (43.9)**	
	Anterior		10 (2.5)
	Premolar		46 (11.6)
	Molar		118 (29.8)
Mandible		**222 (56.1)**	
	Anterior		32 (8.1)
	Premolar		47 (11.9)
	Molar		143 (36.1)
Total		**396 (100)**	

4. Surgery type

Table 7. Distribution of Surgery type (Implant, n=396)

		n	Percentage
Implant site preparation	Drilling	304	76.8
	Only Osteotome technique	23	5.8
	Mixed technique	69	17.4
	Total	396	100
Submerging	One-stage surgery	339	85.6
	Two-stage surgery	57	14.4
Total		396	100

Table 8. Distribution of Bone graft (Implant, n=396)

	n (%)	
Bone graft	**185 (46.7)**	
Sinus bone graft		91 (23.0)
Horizontal augmentation		31 (7.8)
Vertical augmentation		19 (4.8)
GBR		42 (10.6)
Nerve repositioning		1 (0.3)
Ridge splitting		1 (0.3)
No bone graft	**211 (53.3)**	
Total	**396 (100)**	

5. Primary stability & Secondary stability using Periotest®

Table 9. Variations of the mean Periotest® values

		Primary stability	Secondary stability
Maxilla	Anterior	1.04	-1.23
	Premolar	0.29	-4.1
	Molar	0.27	-2.85
Mandible	Anterior	-3.55	-*
	Premolar	-1.75	-2.33
	Molar	-2.62	-3.78
Mandible		-1.35	-3.26

* Valuable data is not exist. Estimable implants ; Primary stability, n=108. Secondary stability, n=52

6. Prosthesis type

Table 10. Distribution of prosthesis type (Implant, n=396)

Restoration	n	Percentage
Single	93	23.5
Fixed Partial	246	62.1
Fixed Complete	26	6.6
Overdenture	22	5.6
Others	9	2.3
Total	396	100

SS System
Clinic

7. Complication

Table 11. Distribution of complication of implant (Implant, n=396)

Complication	n	Percentage
Implant mobility	3	0.8
Abscess	1	0.3
Peri-implant lesion	8	2.0
Alveolar bone resorption	6	1.5
Prosthodontic problem	6	1.5
Paresthesia & Osteomyelitis	1	0.3
Psychological problem	2	0.5
Total	27	6.8

8. Peri-implant soft tissue condition

Table 12. Peri-implant soft tissue condition (Estimable implant, n=357)

Plaque index	0.69
Calculus index	0.13
Inflammation index	0.38
Width of Attached gingiva (mm)	2.4

9. Crestal bone resorption

Table 13. Crestal bone resorption (Estimable implants, n=347)

Crestal Bone resorption (mm)	n	
None	241	69.5
0 to 0.5	10	2.9
0.6 to 1.0	80	23.1
1.0 to 2.0	7	2.0
Above 2.0 (Max.8.0)	8	2.3
Total	347	100

10. Survival rate & Success rate

■ Survival rate : 99.0%, 392 implants among 396 implants

Table 14. Implant failure analysis

Age/Gender	Tooth No.	Diameter (mm)	Length (mm)	Possible cause	Others
64/F	17	4.8	13	abscess	Sinus graft
42/M	46	4.1	13	Osteomyelitis	GBR
66/F	26	4.8	11.5	Psychological	-
	27	4.8	11.5	Psychological	-

■ Success rate (Albrektsson,1988) : 95.2%, 377 implants among 396 implants

Conclusions

The results of this multicenter retrospective study of OSSTEM® SS II Implant System during the short and/or midterm observation period are as follows.

1. OSSTEM® SS II implant system exhibited low crestal bone resorption, high primary & secondary stability and healthy peri-implant soft tissue condition.

2. OSSTEM® SS II implant system exhibited the high survival and success rate.

In Conclusions, OSSTEM® SS II Implant System is a reliable device.

Comparative Prospective Study of Non-Submerged Dental Implant System with Different Tread Design and Surface Treatment

Jong-Chul Park[1)], Gang-Mi Pang[1)], Chul-Ho Shin[2)], Hyung-Tae Kim[2)], Seung-Ryuong Ha[2)], Jeong-Yeon Yoon[2)], Jai-Bong Lee[2)], Jong-Ho Lee[1)*]

Background and purpose of study

Non-submerged implant system has some advantage, compared with submerged implant systems. First, marginal bone loss around the fixture is reduced because the junction of abutment and fixture is located above the alveolar crest. Second, gingival attachment is still maintained after the prosthetic delivery. Third, Non-submerged implant system excludes fixture exposure operation which causes patient discomfort and elevates more treatment cost. So, recently many non-submerged type implant systems have been developed in Korea and good clinical result has been reported. But, till now, there has not been any prospective analysis about the clinical success of those systems. So, We compare the two types of nonsubmerged implant system commercialized in the market with different thread design, surface treatment method, and interconnection between the fixture and abutment.

Patients and Methods

With the 50 patients, the preliminary clinical study was performed from Apr. 2007 to Nov. 2007. We divided the patients into the control group(ITI) and the experimental group(SS II) by intention-to-treat analysis (N: experimental =30, control=20).

The difference of thread design of two system
Pitch length : 0.8mm Vs 1.25mm(exp Vs con)
External diameter : all 4.1mm
Internal diameter : 3.4mm Vs 3.5mm(exp Vs con)
Surface treatment : RBM Vs SLA(exp Vs con)

The difference of connection design
Morse taper : all 7degee
Location of octagonal structure: lower Vs middle(exp Vs con)
Size of octogonal structure : 2.9mm Vs 3.1mm(exp Vs con)

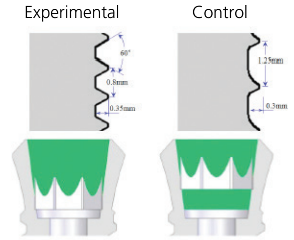

Fig 1. SS II Implant / ITI Implant

The criteria for the selection of patients

1. ipsilateral loss of mandibulr molar tooth(one or two missing tooth) without maxillary tooth missing
2. buccolingual bone width above 6mm
3. innterocclusal clearance more than 6mm from the lower mucosa
4. available alveolar bone height above 12mm
5. no temporomandibular joint discomfort
6. above 18 years old

The diameter and length of fixture : unified as 4.1mm x 10mm
Implant installation is performed with the protocol of each system and cast is cemented with the solid abutment after 3 month.
At the installation, the ISQ(implant stability quotient), PTV(periotest value), and insertion torque were compared. ISQ was evaulated by Ostell Mentor®(Intergation Diagnostic AB, Sweden) and PTV by Periotest® (Siemens, Germany). After installation, ISQ, PVT, radiographic marginal bone loss are investigated at a interval of 1 month. After delivery, occlusal contact evaluation, PTV, radiographic marginal bone loss are investigated at 1month, 2month interval.
For radiographic examination of marginal bone change, we used the XCP tray and butty for exact localization and direction of x-ray tube. At each visit, radiographic image taking was done by PACS(πViewSTAT™, Infinitt, Korea) for marginal bone loss evaluation according to marginal bone height at the insertion for assessing its change over the time.

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2)Dept. of Prosthodontics, College of Dentistry, Seoul National University, South Korea

Results

Of the 61 fixtures installed in 50 patients, 2 implants were removed before loading. After completion of prosthetic treatment, there has been no further fixture removal. Until Nov. 2007, final prosthetics was delivered in 28 fixtures. Failed 2 fixtures are included in the control group. These fixture was removed at the post op 1month for severe marginal bone loss with inflammation. Initial torque, ISQ, PTV at installation were all not eventful.

Table 1. Fixture distribution by the patients sex

	Male	Female	Total
EXP	26	7	33
Con	17	11	28

Exp : experimental group
Con : control group

Fig 2.

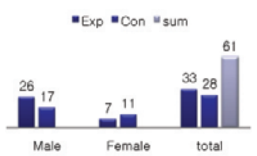
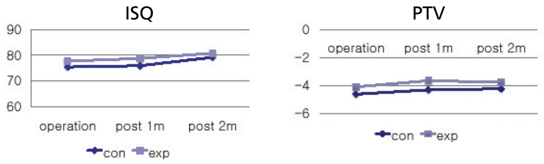


Table 2. Data summary of ISQ and PTV at each visit

group	N for ISQ	ISQ(avg)	N for PTV	PTV(avg)	ISQ(SD)	PTV(SD)
Con op	21	75.43	11	-4.64	6.18	1.21
Exp op	31	77.71	19	-4.11	5.53	1.61
Con 1m	15	75.93	9	-4.33	5.91	1.35
Exp 1m	27	78.76	18	-3.67	6.83	1.64
Con 2m	19	79.21	20	-4.25	3.34	1.14
Exp 2m	24	80.79	23	-3.78	5.07	1.86

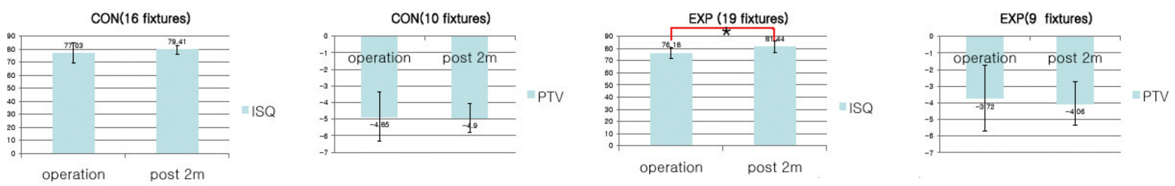
v2 : data at the installation v4 : data after 1month installation v5 : data after 2month installation
Avg : average SD : standard deviation
N for ISQ : the number of fixtures evaluated with OstellMentor®
N for PTV : the number of fixtures evaluated with Periotest®

Fig 3. Comparision of ISQ and PTV at each visit



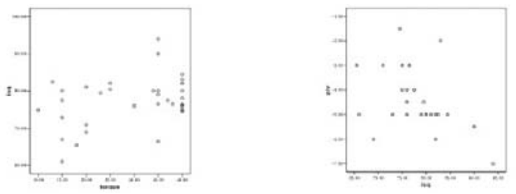
No statistical significance(independant sample T-test) between control group and experimental group about the data of ISQ and PTV at each visit.
The fixtures compared at the each visit is same as above table.

Fig 4. Comparison of ISQ and PTV between at operation and at 2 months later



No statistical significance(paired T-test) about the data of ISQ and PTV ofcontrol group between at operation and at post 2 months.

Fig 5. Correlation anaylsis between variables at operation



Correlation is significant between torque and ISQ, ISQ and PTV at implant installation($p<0.05$). Pearson correlation between torque and ISQ = 0.344. Pearson correlation between ISQ and PTV = -0.415. There is no correlation between insertion torque and PTV(figure and data not listed)

Table 3. Comparison of radiographic marginal bone loss during 2 months

		proxi	distal
CON	AVG	-0.47	-0.25
	N	15.00	15.00
	SD	0.43	0.53
EXP	AVG	-0.30	-0.11
	N	19.00	19.00
	SD	0.58	0.54

No statistical significant(independent sample T-test) Experimental group Vs control group of the marginal bone loss during 2 months.

Discussion

This study aims to compare the two types of non-submerged implant system. To date, this study does not show any clinical difference between 2 groups. But this is the preliminary study during only 8 months. Although we installed 61 fixtures in 50 patients, the number of fixture available for statistical comparison is limited. In addition, the period for statistical comparison is short.

But, this study is designed to report the comparative evaluation between two implants systems in at least 80 fixtures for 1 year follow up period by the Apr. 2009.

After that, this study will show the first prospective comparison data of two implant system in republic of Korea.

Conclusions

Until 8 months evaluation period, This result shows the experimental group is not inferior to the control group, but the long term follow up may be needed.

(Supported by the Korea Health R&D Project, Ministry ofHealth & Welfare, Republic of Korea, A062480V)

Retrospective Study of Immediately Loaded Implants among Elderly Patients with Diabetes Mellitus

Tae-Sung Kim[1)], Jong-Jin Kwon[1)*]

Purpose

- To analyze the differences in the success rates of implants installed in healthy and diabetic patients aged 60 years and above
- To evaluate the change in the implant marginal alveolar bone in healthy and diabetic patients under different conditions such as implant type and number, immediate implantation, immediate loading, bone graft, installation site, and single or multiple splint

Materials and Methods

☞ Patients

- 62 patients aged 60 years and up and who visited Korea University's Ahn-am medical center dental department for implant treatment between 2004 and 2005 and went back for follow-up for 2 years
- 40 healthy patients
- 22 diabetic patients (controlled DM)

☞ Implants

Table 1.

Implants		Healthy	Diabetic	Total	Spec.
ITI standard		88	58	146	sandblasted, large grit, acid-etched (Institute Straumann, Waldenburg, Switzerland)
SS II		44	22	66	Restorable Blasted Media (RBM) surface OSSTEM® Co., Korea)

☞ Implant installation

Conventional protocol

Bone graft: Autogenous bone, Bio-oss, BBP

Immediate loading: Solid abutment/ Self-curing resin

Immediate implantation, Immediate loading: Immediate installation on the extraction socket following extraction and Immediate loading

☞ Evaluation of the implant marginal bone

X-ray taking 6, 12, and 24 months after the op

Long-cone paralleling technique

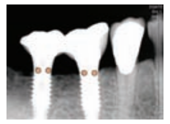


Fig 1.

The criteria for bone level were determined based on the radiolucent area formed on the internal screw of the implant and neck area as a reference point.

☞ Evaluation of implant success and survival rate

Smith and Zarb's criteria (Toronto, 1986')

☞ Statistical Analysis

Single-variant ANOVA, post hoc study Tukey HSD (SPSS software version 11, SPSS, Chicago, IL) p<.05

Results

☞ Success rate by group

Healthy patient : 2 failures among 132 implants (98.48%)
1 each of ITI, OSSTEM®

Diabetic patient : 2 failures among 80 implants (97.5%)
1 each of ITI, OSSTEM®

☞ Change in the alveolar marginal bone according to the arch

The same tendency can be observed in the maxilla and mandible for both ITI and OSSTEM®.

Large volume of bone resorption can be seen in the maxillary premolar and molar regions.

Table 2. Jaw with DM

	Jaw	Installation	After 6 month	After 12 month	After 24 month
ITI	Mx	1.17	1.36	0.13	0.82
	Mn	1.57	1.23	0.2	0.11
OSSTEM®	Mx	0.98	0.98	0.3	0.08
	Mn	1.3	1.32	0.13	0.13

Table 3. Jaw without DM

	Jaw	Installation	After 6 month	After 12 month	After 24 month
ITI	Mx	1.69	1.33	0.18	0.1
	Mn	1.57	1.23	0.2	0.11
OSSTEM®	Mx	1.08	1.22	0.15	0.1
	Mn	0.75	1.2	0.12	0.07

Table 4. Position with DM

	Position	Installation		After 6 month		After 12 month		After 24 month	
		Mesial	Distal	Mesial	Distal	Mesial	Distal	Mesial	Distal
ITI	Mx Anterior	1.42	1.43	1.1	1.1	0.56	0.56	0.2	0.2
	Mx premolar	1.07	1.93	1.31	1.4	0.15	1.03	0.03	0.33
	Mx molar	1.13	1.04	1.6	1.66	0.16	0.1	0.08	0.08
	Mn Anterior	1.59	1.46	1.19	1.17	0.16	0.16	0.16	0.1
	Mn premolar	1.71	1.61	1.29	1.21	0.4	0.21	0.1	0.1
	Mn molar	1.51	1.54	1.26	1.28	0.13	0.12	0.09	0.09
OSSTEM®	Mx Anterior	0	0	0	0	0	0	0	0
	Mx premolar	1	1.75	1.37	1.55	0.1	0.9	0.1	0.1
	Mx molar	1.94	1.19	1.57	1.41	0.56	0.23	0.1	0.2
	Mn Anterior	2	1.75	1.1	1.1	0.1	0.1	0.1	0.1
	Mn premolar	1.03	1.15	1.32	1.36	0.17	0.15	0.19	0.17
	Mn molar	1.5	1.4	1.95	1.08	0.15	0.1	0.1	0.1

Table 5. position without DM

	Position	Installation		After 6 month		After 12 month		After 24 month	
		Mesial	Distal	Mesial	Distal	Mesial	Distal	Mesial	Distal
ITI	Mx Anterior	1.8	1.24	1.28	0.28	0.24	0.22	0.1	0.1
	Mx premolar	1.86	1.73	1.29	0.32	0.18	0.13	0.1	0.1
	Mx molar	1.82	1.66	1.41	0.41	0.15	0.19	0.09	0.09
	Mn Anterior	1.59	1.46	1.19	0.17	0.16	0.16	0.16	0.1
	Mn premolar	1.71	1.61	1.29	0.21	0.4	0.21	0.1	0.1
	Mn molar	1.51	1.54	1.26	0.28	0.13	0.12	0.09	0.09
OSSTEM®	Mx Anterior	1.02	1.12	1.12	0.12	0.18	0.18	0.1	0.1
	Mx premolar	1.13	1.03	1.14	0.21	0.15	0.09	0.09	0.09
	Mx molar	1.07	1.75	1.39	0.35	0.17	0.12	0.13	0.32
	Mn Anterior	1	1	1.2	0.2	0.1	0.1	0.1	0.1
	Mn premolar	1.15	1.23	1.28	0.28	0.13	0.1	0.08	0.08
	Mn molar	1.07	1.07	1.13	0.13	0.17	0.1	0.03	0.03

[1)]Implant Major, Korea University, Anam Hospital, South Korea

☞ Change in the alveolar marginal bone by length
The volume of bone resorption increases as the length decreases.

Table 6. Length with DM

	Length	Installation		After 6 month		After 12 month		After 24 month	
		Mesial	Distal	Mesial	Distal	Mesial	Distal	Mesial	Distal
ITI	8mm	1.85	1.35	1.15	1.15	0.15	0.15	0.05	0.05
	10mm	1.48	1.41	1.31	1.32	0.19	0.27	0.12	0.11
	12mm	1.05	1.2	1.95	1.07	0.1	0.15	0.1	0.1
	14mm	1.8	1.8	1.2	1.5	0.11	0.12	0.1	0.1
OSSTEM®	10mm	1.54	1.16	1.64	1.41	0.41	0.5	0.1	0.1
	11.5mm	1	1.5	1	1.8	0.1	0.56	0.1	0.45
	13mm	1.47	1.27	1.35	.38	0.23	0.27	0.12	0.13

Table 7. Length without DM

	Length	Installation		After 6 month		After 12 month		After 24 month	
		Mesial	Distal	Mesial	Distal	Mesial	Distal	Mesial	Distal
ITI	8mm	1.05	1	1.13	0.13	0.1	0.1	0.1	0.1
	10mm	1.52	1.43	1.26	0.28	0.13	0.15	0.09	0.1
	12mm	1.95	1.75	1.36	0.4	0.24	0.21	0.13	0.12
	14mm	1.39	1.35	1.33	0.28	0.14	0.14	0.1	0.11
OSSTEM®	10mm	1.39	1.39	1.43	0.5	0.15	0.09	0.4	0.4
	11.5mm	1.64	1.31	1.3	0.16	0.21	0.12	0.21	0.25
	13mm	1.24	1.09	1.2	0.13	0.13	0.12	0.12	0.1

☞ Change in the alveolar marginal bone according to the upper prosthesis
The volume of bone resorption is greater for 1-unit ITI at 12 and 24 months.

Table 8. Prosthesis with DM

	Prosthesis	Installation		After 6 month		After 12 month		After 24 month	
		Mesial	Distal	Mesial	Distal	Mesial	Distal	Mesial	Distal
ITI	1 - unit	1.8	1.8	1.5	1.5	1.8	0.1	0.1	0.1
	2 - unit	1.23	1.25	1.45	1.38	0.07	0.07	0.07	0.07
	3 - unit	1.36	1.31	1.36	1.4	0.15	0.26	0.11	0.11
	4 - unit	1.9	1.74	1.27	1.27	0.39	0.39	0.18	0.14
OSSTEM®	1 - unit	1.27	1.27	1.7	1.6	0.37	0.1	0.1	0.1
	2 - unit	1.42	1.25	1.32	1.36	0.24	0.15	0.14	0.14
	3 - unit	1.03	1	1.3	1.3	0.57	0.37	0.1	0.3
	4 - unit	1.25	1.25	1.72	1.55	0.1	0.85	0.1	0.1

Table 9. Prosthesis without DM

	Prosthesis	Installation		After 6 month		After 12 month		After 24 month	
		Mesial	Distal	Mesial	Distal	Mesial	Distal	Mesial	Distal
ITI	1 - unit	1.59	1.59	1.37	1.37	0.14	0.14	0.1	0.1
	2 - unit	1.15	1.1	1.1	1.12	0.12	0.19	0.08	0.1
	3 - unit	1.38	1.33	1.26	1.26	0.13	0.14	0.09	0.1
	4 - unit	1.82	1.66	1.41	1.45	0.16	0.11	0.1	0.1
	5 - unit	1.18	1.03	1.33	1.37	0.29	0.3	0.18	0.14
OSSTEM®	1 - unit	1.19	1.04	1.27	1.47	0.18	0.1	0.09	0.09
	2 - unit	1.5	1.25	1.4	1.05	0.1	0.05	0.1	0.25
	3 - unit	1.85	1.64	1.29	1.27	0.18	0.13	0.26	0.25
	4 - unit	1.1	1.1	1.13	1.11	0.1	0.1	0.1	0.1

☞ Change in the alveolar marginal bone according to loading

Table 10. Loading with DM

	Loading	Installation		After 6 month		After 12 month		After 24 month	
		Mesial	Distal	Mesial	Distal	Mesial	Distal	Mesial	Distal
ITI	Conventional loading	1.59	1.5	1.47	1.49	0.24	0.4	0.16	0.15
	Immediate loading	1.32	1.26	1.22	1.23	0.17	0.11	0.06	0.6
	Immediate-immediate loadingImmediate	1.13	1.13	1.6	1.6	0.3	0.27	0.23	0.23
	Immediate insertion	0	0	0	0	0	0	0	0
OSSTEM®	Conventional loading	1.54	1.36	1.07	1.63	0.28	0.73	0.1	0.22
	Immediate loading	1.01	1.04	1.53	1.46	0.32	0.18	0.15	0.15
	Immediate-immediate loadingImmediate	1.86	1.07	1.14	1.21	0.21	0.1	0.1	0.1
	Immediate insertion	0	0	0	0	0	0	0	0

Table 11. Loading without DM

	Loading	Installation		After 6 month		After 12 month		After 24 month	
		Mesial	Distal	Mesial	Distal	Mesial	Distal	Mesial	Distal
ITI	Conventional loading	1.97	1.8	0.19	0.22	0.22	0.22	0.13	0.1
	Immediate loading	1.37	1.29	0.29	0.32	0.14	0.15	0.09	0.1
	Immediate-immediate loadingImmediate	1.66	1.21	0.54	0.49	0.14	0.15	0.13	0.12
	Immediate insertion	1.8	1.8	0.36	0.33	0.16	0.16	0.12	0.11
OSSTEM®	Conventional loading	1.77	1.55	0.28	0.35	0.2	0.14	0.27	0.25
	Immediate loading	1.08	1.82	0.58	0.43	0.1	0.1	0.25	0.25
	Immediate-immediate loadingImmediate	1.2	1.09	0.19	0.09	0.11	0.09	0.08	0.12
	Immediate insertion	0	0	0	0	0	0	0	0

☞ Change in the alveolar marginal bone according to bone graft

Table 12. Graft with DM

	Graft	Installation		After 6 month		After 12 month		After 24 month	
		Mesial	Distal	Mesial	Distal	Mesial	Distal	Mesial	Distal
ITI	No graft	1.29	1.27	0.34	0.36	0.11	0.11	0.07	0.06
	Bone graft	1.77	1.64	0.39	0.39	0.37	0.47	0.19	0.18
OSSTEM®	No graft	1.41	1.16	0.47	0.42	0.25	0.33	0.12	0.16
	Bone graft	1.9	1.9	0.25	0.5	0.5	0.1	0.1	0.1

Table 13. Graft without DM

	Graft	Installation		After 6 month		After 12 month		After 24 month	
		Mesial	Distal	Mesial	Distal	Mesial	Distal	Mesial	Distal
ITI	No graft	0.46	0.32	0.225	0.26	0.14	0.15	0.08	0.08
	Bone graft	0.94	0.9	0.4	0.42	0.22	0.19	0.16	0.15
OSSTEM®	No graft	0.7	0.48	3	0.29	0.16	0.12	0.15	0.16
	Bone graft	0.25	0.25	0.21	0.2	0.16	0.09	0.44	0.44

Conclusions

- A similar tendency was observed in terms of the alveolar marginal bone change according to the arch between diabetic and healthy patients.

- In terms of alveolar marginal bone change according to the installation site, a larger volume of bone resorption was noted in the premolar and molar regions of diabetic patients possibly due to the higher rate of bone grafting.

- For the alveolar marginal bone change according to the implant length, there was less bone resorption in the case of longer ITI and OSSTEM® implants in both healthy and diabetic patients.

- In terms of alveolar marginal bone change according to the upper prosthesis, the volume of bone resorption was larger in the case of single restorations compared to other 2-, 3-, 4-, and 5-unit prostheses and in diabetic patients. In some cases, the volume of resorption was larger for long prosthesis such as 4 and 5 units; this may be attributed to the anatomical effect of the installation site.

- For the alveolar marginal bone change according to the installation method, a larger volume of bone resorption was noted in the case of Immediate-immediate loading for both healthy and diabetic patients compared to the other method; no major differences could be found.

- Similar results could be observed in the changes according to bone grafting for both healthy and diabetic patients.

- The volume of bone resorption is slightly larger in general for diabetic patients according to conditions such as arch, length, installation site, upper prosthesis, and installation method. Note, however, that this difference does not have statistical significance. The implant success rate and volume of alveolar marginal bone resorption fall within the normal range. The ITI and OSSTEM® implants show similar results.

For whom? Immediate Implant.
; The Factors for Successful Immediate Implant

Jong-Jin Kwon[1)*]

Background and purpose of study

For successful immediate implant loading, four factors have been suggested recently: operating, host, implant, and occlusal factors. Operating factors include early stability as one of the most important factors of immediate loading and outstanding operating skills. On the other hand, host factors include bone substance and bone quantity of the operating region and healing rate. Design, form, method of surface handling, and length of implants make up the implant factors, whereas occlusal factors include the quantity and quality of occlusal force and prosthesis design.
For the last 10 years, serial experiments as following have been done to verify the possibility of immediate loading, even immediate-immediate loading.

- Crest bone level between maxilla and mandible was not significant (P>.05).
- The success rate and crest bone level of OSSTEM® SS II and ITI regular was not significant.(P>.05)

Materials and Methods

Patients
- Korea Univ. Hospital
  75visiting patients(M:38, F:37)
  Mean age : 51.5years(26~81years)

Implants
- ITI implant (SLA surface, Ø4.1mm)
  49 patients / 110 fixtures
- OSSTEM® implant (RBM surface, Ø4.1mm)
  26 patients / 61 fixtures

Follow up
- At least 1year / mean 1.65year


Fig 1. ITI implant


Fig 2. OSSTEM® implant

Installation & Provisional Restoration


Fig 3.


Fig 4.


Fig 5.


Fig 6.

Data analysis
Criteria of successful osseointegration-Smith & Zarb
- Marginal bone change of alveolar crest
(X-ray-the day of operation, 6months later and 6months later)

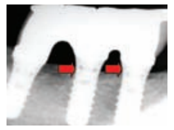


Fig 7.

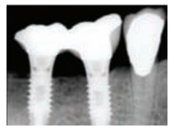


Fig 8.

Follow up data analysis


Fig 9. ITI post-op


Fig 10. post-op 6months

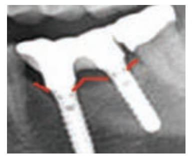


Fig 11. post-op 12months

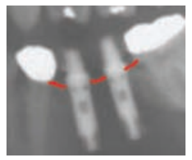


Fig 12. OSSTEM® post-op

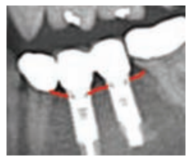


Fig 13. post-op 6months


Fig 14. post-op 12months

[1)] Implant Major, Korea University, Anam Hospital, South Korea

Results

Marginal bone changes(Maxilla Vs Mandible)

- In ITI implant : no significant diffrence(P〉.05)
- In OSSTEM® implant : significant diffrence(P〉.05) (Mx.〉Mn. / initial insertion depth)

Fig 15. Marginal bone level changes in Maxilla

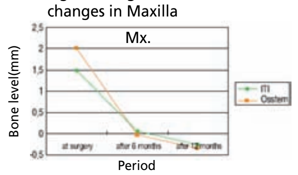
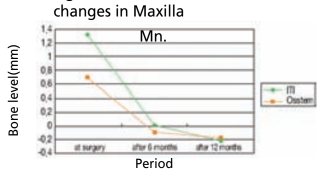


Fig 16. Crestal bone level changes in Maxilla



Marginal bone changes(Length)

- Long fixture showed more marginal bone loss
- Maybe those were installed at ant. Maxilla.

Fig 17.

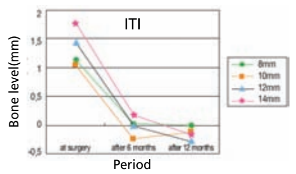
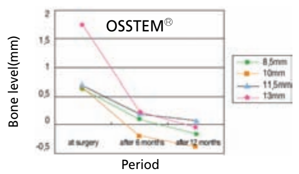


Fig 18.



Marginal bone changes(Kinds of Prosthesis)

- In ITI implant : significant diffrence(P〉.05)
  2-unit vs. 4-unit at operation ~ 6month
  single vs. 2-unit at 6month ~ 12month
- OSSTEM® implant : no significant diffrence (P〉.05)

Fig 19.

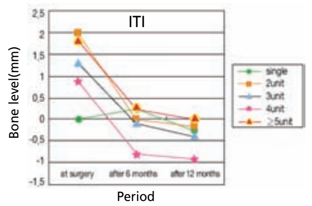
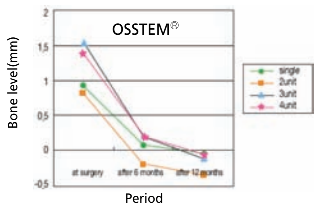


Fig 20.



Marginal bone changes(Implant position)

- In ITI implant : no significant diffrence(P〉.05)in Mx.
  significant diffrence(P〉.05)in Mn.
- In OSSTEM® implant : significant diffrence(P〉.05)in Mx.
  no significant diffrence(P〉.05)in Mn.
- Generally irregular relationship among implant position

• Marginal bone changes (Position / ITI)

Fig 21.

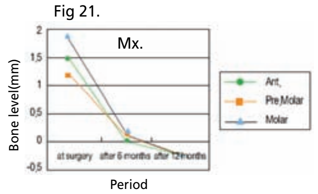
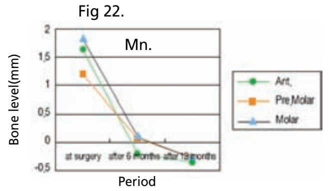


Fig 22.



• Marginal bone changes (Position / OSSTEM®)

Fig 23.

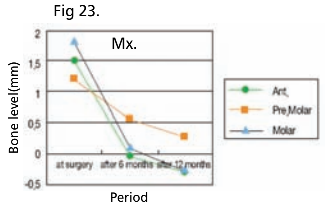
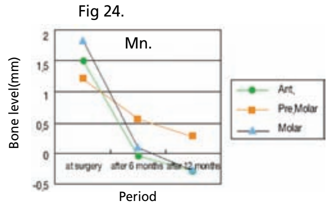


Fig 24.



Conclusions

Most of the marginal bone loss of the immediate-immediate loaded implant was observed within 6 month. And then marginal bone level was relative stabilized in immediate loaded implant.
Implant position, length, number, type of restoration, and bone graft or not, etc. did not show any significant changes to marginal bone loss both in OSSTEM® and ITI Implant patients. (P > 0.05)
Comparing to reported papers, even in old adult patient also showed satisfactory clinical result, if carefully treated.

Prospective Clinical Study of Two OSSTEM® SS II Implant Systems with Different Surfaces in Partially Edentulous Patients

Min-Seok Oh[1] , Su-Gwan Kim[1)*], Hak-kyun Kim[1], Seong-Yong Moon[1]

Purpose

Non-inferiority clinical trial comparing "SS II RBM Fixture" and "SS II CMP Fixture" implants for patients missing natural teeth to evaluate the effectiveness and safety of SS II CMP Fixture

Materials and Methods

- **Calcium metaphosphate (CMP)**
  Microstructure
  - Analysis method: Surface observation using scanning electron microscopy (SEM, JSM-6480LV, JEOL)
  - Analysis Results The RBM surface configuration is made slightly smoother after the CMP coating.

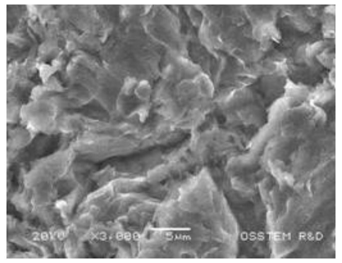


Fig 1. RBM surface (Ra=1.332㎛)

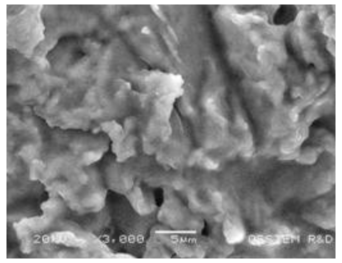


Fig 2. CMP-coated surface on RBM (Ra=1.140㎛)

- **Prospective, open, non-inferiority trial**
  - Experimental group: SS II CMP Fixture implant
  - Control group: SS II RBM Fixture implant
- **Subject**
  - Patients aged 18 years or older and with completed jaw bone growth
  - Patients with missing natural teeth
  - Patients with sufficient vertical, mesiodistal, and bucco-lingual bone
- **Clinical trial period**
  - April 1, 2006 ~ October 31, 2007
  - 24 months following the approval of clinical trial plan by the director of the Korea Food and Drug Administration
  - Subject recruitment period: About 4 months
  - Effectiveness observation period: About 12 months
  - Statistical analysis period: About 2 months
  - Report preparation period: About 2 months

Table 1.

Visit Date	Observation Period
Visit1	-4 weeks~0 day
Visit2	0 day (baseline date)
Visit3	2weeks±1week
Visit4	13weeks±2weeks (maxilla) 7weeks±2weeks (mandible)
Visit5	26weeks±2weeks (maxilla) 14weeks±2weeks (mandible)
Visit6	27weeks±2weeks (maxilla) 15weeks±2weeks (mandible)
Visit7	28weeks±2weeks (maxilla) 16weeks±2weeks (mandible)
Visit8	9months±4weeks (maxilla) 6months±4weeks (mandible)
Visit8'	9months±4weeks (mandible)
Visit9	12months±4weeks (maxilla) 12months±4weeks (mandible)

Dept. of Oral and Maxillofacial Surgery, College of Dentistry, Chosun University, South Korea

- **Observation and examination items**
  - · Measurement of clinical index of surgery site
  - · Surgery site: Record by dental formula (example: #16)
    - Implant diameter and length: Record of the implant used
  - · Mobility measurement
    - Mean value of three measurements with Periotest [PTVs]
  - · Grant subject identification code (CRF-00)
  - · Random grouping into experimental or control group
  - · Evaluating the volume of bone loss
    - Evaluate the volume of vertical and horizontal bone loss by scanning the periapical x-rays taken based on the parallel method.
  - · Evaluating occlusion following prosthesis setting
    - Evaluate on visit 7 made right after setting the implant upper structure (prosthesis) using articulating paper (about 20~35㎛ thick) and shim stock (about 8㎛ thick)

Results

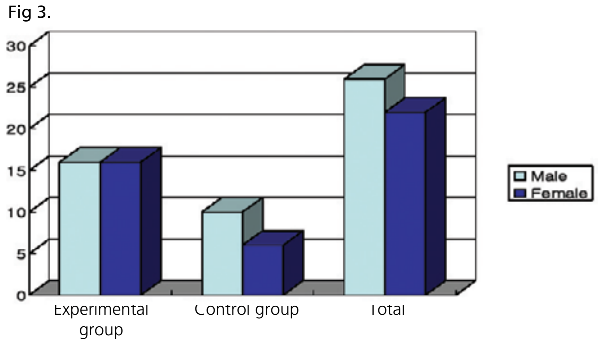
- **Classification according to implant length and diameter**
  - Experimental group (CMP coating): 32 persons - 38 fixtures
  - Control group (RBM surface): 16 persons -18 fixtures
  - 2 dropouts during the clinical trial (withdrawal of consent)

Table 2.

L / D	8.5mm SS II CMP	8.5mm SS II RBM	10.0mm SS II CMP	10.0mm SS II RBM	11.5mm SS II CMP	11.5mm SS II RBM	13mm SS II CMP	13mm SS II RBM	15.0mm SS II CMP	15.0mm SS II RBM
4.1mm			7	3	6	6	5	2		
4.8mm	2		6		6	3	5		2	1

- **Classification according to age and gender**

Fig 3.



Mean Age: 41.2 years | Mean Age: 34.1 years | Mean Age: 38.8 years

- **Classification according to the installation site**

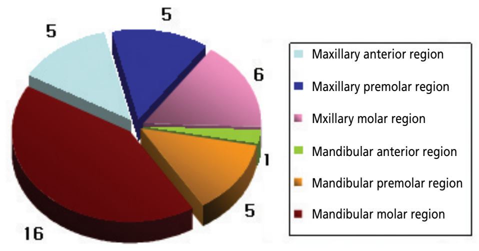


Fig 4. Experimental group (CMP): 38 fixtures

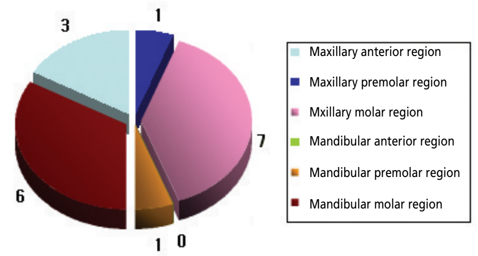


Fig 5. Control group (RBM): 18 fixtures

- **Classification according to the accompanying surgery**

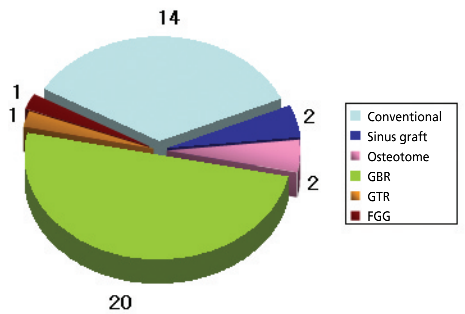


Fig 6. Experimental group (CMP): 38 fixtures

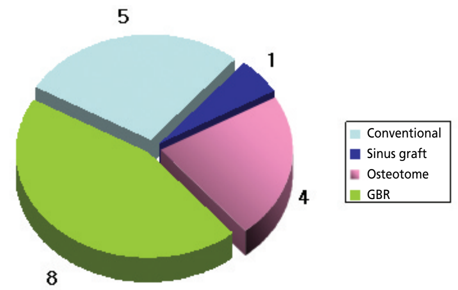


Fig 7. Control group (RBM): 18 fixtures

- **Evaluation of the volume of bone loss**
  - Distortion: Compensation by calculating the implant expansion rate
  - Baseline: First thread line of the implant
  - Bone resorption level: Mean value after evaluating the mesiodistal bone level of the fixture at the baseline

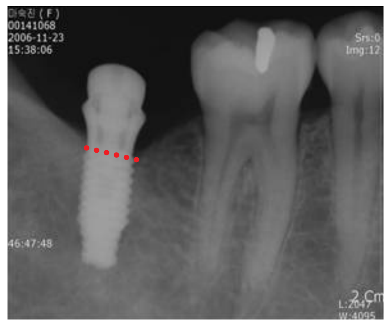


Fig 8.

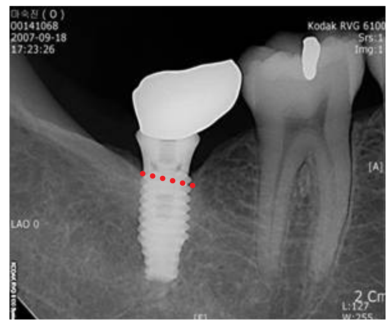


Fig 9.

SS System Clinic

SS System Clinic

- **Results of evaluation of bone loss volume**
  - Experimental group (CMP coating): 32 persons - 38 fixtures
  - Control group (RBM surface): 16 persons -18 fixtures
  - 2 dropouts during the clinical trial (withdrawal of consent)

Table 3.

	Group	V3 Volume of Bone Loss	V5 Volume of Bone Loss	V8 Volume of Bone Loss	V8' Volume of Bone Loss	V9 Volume of Bone Loss
Total	Experimental group (M±SD)	.021±.0528 (n=38)	. 141±. 1771 (n=37)	.103±.1689 (n=35)	. 139±.2033 (n=18)	124±. 1809 (n=25)
	Control group (M±D)	.056±.0784 (n=18)	. 167±. 2058 (n=18)	.167±.1496 (n=15)	. 171±.1799 (n=07)	.182±. 1401 (n=11)
	p-value	.103	.628	.212	.715	.354
Mandible	Experimental group	.032±.0646 (n=22)	. 123±. 1412 (n=22)	.114±.1931 (n=21)	. 147±. 2065 (n=17)	. 146±. 2187 (n=13)
	Control group	.088±.0991 (n=8)	.163±. 1685 (n=8)	.186±.1676 (n=07)	.171±. 1799 (n=07)	.200±. 1633 (n=04)
	p-value	.172	.522	.391	.788	.658
Maxilla	Experimental group	.006±.0250 (n=16)	.167±.2225 (n=15)	. 086±. 1292 (n=14)		.100±. 1348 (n=12)
	Control group	.030±.0483 (n=10)	.170±.2406 (n=10)	.150±. 1414 (n= 08)		.171±. 1380 (n= 07)
	p-value	.176	.972	.291		.285

Statistical analysis Results
By observation period, there was no significant difference (p>0.05) in bone loss between the experimental and control groups.
The volume of bone loss increases for both groups as the observation period changes.

- **Results of the mobility analysis**

Table 4.

	Group	V2Mobility	V4Mobility	V7Mobility	V8Mobility	V8'Mobility	V9Mobility
Total	Experimental group (M±SD)	-1.055±.9078 (n=38)	-3.561±3.5931 (n=38)	-2.740±2.5058 (n=35)	-2.043±2.8440 (n=35)	-1.576±2.3023 (n=17)	-1.628±2.3341 (n=25)
	Control group (M±D)	1.606±9.4437 (n=18)	-2.811±3.3715 (n=18)	-1.369±3.4869 (n=16)	-.973±3.2587 (n=154)	-1.143±2.2963 (n=07)	-1.270±2.4340 (n=10)
	p-value	.364	.461	.116	.249	.679	.688
Mandible	Experimental group	-2.309±3.3001 (n=22)	-4.550±3.1356 (n=22)	-3.082±2.5959 (n=22)	-1.943±3.0214 (n=21)	-1.576±2.3023 (n=17)	-1.523±2.2234 (n=13)
	Control group	-.413±10.8791 (n=08)	-3.650±3.2859 (n=08)	-1.188±3.2140 (n=08)	-.314±2.5823 (n=07)	-1.143±2.2293 (n=07)	-2.233±.6807 (n=03)
	p-value	.642	.498	.108	.213	.679	.351
Maxilla	Experimental group	.669±4.1164 (n=16)	-2.200±3.8301 (n=16)	-2.162±2.3283 (n=13)	-2.193±2.6589 (n=14)		-1.742±2.5429 (n=12)
	Control group	3.220±8.3599 (n=10)	-2.140±3.4565 (n=10)	-1.550±3.8352 (n=08)	-1.550±3.8352 (n=08)		-.857±2.8407 (n=07)
	p-value	.307	.968	.659	.647		.493

Statistical analysis Results
By observation period, there was no significant difference (p>0.05) in mobility between the experimental and control groups.

- **Types of complications and treatments**
  - · Complications occurring in a total of 4 cases
  - · Damage of the inferior alveolar nerve: 1 case
    - Cause: Excessive traction of the flap and heat production during drilling - neuropraxia
    - Treatment: TENS and soft laser
  - · Loss of bone graft material and intervention of granulomatous tissue: 2 cases
    - Cause: Early exposure of the non-absorbable membrane
    - Treatment: After removing the exposed membrane, conduct debriment and autogenous bone graft.
  - · Proliferative gingivitis around the implant: 1 case
    - Cause: Insufficient volume of keratinized gingiva
    - Treatment: Free gingival graft following gingival curettage and topical antibiotic (tetracyclin) application

- **Evaluation of periodontal tissue [Visit 9]**
  - · Plaque index
    - 0: No plaque accumulation [T:24/38] [C:11/18]
    - 1: Detected upon probing following the gingival margin [T:11/38] [C:5/18]
    - 2: Can be seen by the naked eye [T:3/38] [C:2/18]
    - 3: Abundant
  - · Calculus index
    - 0: No calculus accumulation[T:37/38] [C:17/18]
    - 1: Slight calculus accumulation with early calcification[T:1/38] [C:1/18]
    - 2: Calculus accumulation 1/2mm wide on the cervical area of the lingual surface
    - 3: Calculus accumulation 2mm wide on the cervical area of the lingual surface and buildup in the interproximal area
  - · Gingival index
    - 0: No impression of inflammation, discoloration and bleeding, etc. [T:35/38] [C:16/18]
    - 1: Slight discoloration and inflammation, but no bleeding [T:3/38] [C:2/18]
    - 2: Moderate inflammation, redness, swelling, and bleeding upon probing
    - 3: Severe inflammation, redness, swelling, and spontaneous bleeding

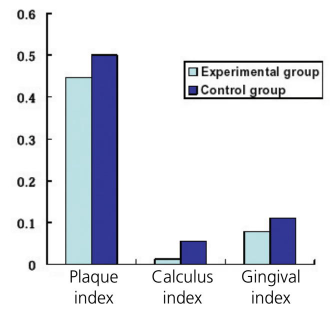


Fig 10.

Conclusions

Calcium metaphospate coated group (experimental group) was not inferior than resorbable blasting media group (control group) in prospective clinical evaluation and stastical examination.

Analysis of Clinical Application of OSSTEM®(KOREA) Implant System for 6 Years

Young-Kyun Kim[1)*], Pil-Young Yun[1)], Dae-Il Son[1)], Bum-Soo Kim[1)], Jung-Won Hwang[2)]

Purpose

We evaluated various applications and clinical outcomes of OSSTEM® implants installed by an oral and maxillofacial surgeon from January 2000 to December 2005 retrospectively.

Material and Methods

1. Total 534 fixtures of OSSTEM® implant system were installed to 133 patients.
2. The patients ranged from 20 to 95 years in age (mean 51.5). There were 72 male and 61 female patients.
3. From the 534 fixtures, 305 fixtures were installed in mandible and 229 fixtures in maxilla.

Results

1. The major operating method was guided bone regeneration with implant fixture installation (66 patients), followed by osteotome technique (32), simple technique without supplementary procedure (28), and others.
2. From the 534 fixtures in 133 patients, early failure of implant was found in 13 fixtures (2.4%) from 10 patients (7.5%). From the 318 fixtures in 98 patients who have functioned for more than 1 year after prosthesis delivery, there were two failures and 97.6% 6-year cumulative survival rate. One case failed after 2.5 years, and the other case after 4 years.
3. Major causes of early failure were detected as lack of initial stability (4 patients).

Table 1. Surgery distribution

Surgery	Number
Simple placement	28
GBR	66
Sinus bone graft	22 (simultaneous: 20 delayed: 2)
Extraction and Immediate placement	20
Osteotome Tq.	32
Redge splitting	7
Inferior nerve Repositioning	4
Distraction osteogenesis	3
Segmental osteotomy	4
etc	17

Table 3. Early failure according to surgery

Types of surgery	No. of patient	No of fixtures
Ext. and immediate implant, GBR	2	3
Simple placement	3	4
BAOSFE	1	1
Sinus graft and simultaneous placement	3	4
Sinus graft and delayed placement	1	1

Table 2. 6-year cumulative survival rate

Period(F/U) (year)	Number Of Implants	survival	failure	Failure rate (%)	Drop-out	Survival rate(%)
Placement ~ 1	534	521	13	2.4		97.6
1-2	308	318	0	0	216	97.6
2-3	129	128	1	0.8	189	96.8
3-4	101	100	1	1	28	95.8
4-5	81	81	0	0	20	95.8
5-6	81	81	0	0	0	95.8

Conclusions

From the results of our mid-term and short-term follow-up study, OSSTEM® implant system showed good clinical outcomes and high success rate. Furthermore, in spite of extensive surgical procedure, excellent final clinical results were obtained.

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Retrospective Study of OSSTEM® Dental Implants; Clinical and Radiographic Results of 2.5 Years

Sun-Hee Oh[1)], Taek-Ga Kwon[1)], Young-Kyun Kim[2)], Jung-Won Hwang[1)*]

Introduction

Over the last years, domestic implant systems have been growing in dental implant market of South Korea, and growing attention has been paid to the several domestic implant systems. This study presents results of a clinical trial of OSSTEM® (Seoul. Korea) implants followed up to 30months.

Materials and Methods

Three hundred seventy-one OSSTEM® implants were investigated which were placed in 87 patients between June 2003 and December 2005. The average follow-up period from implant placement was 15.4months (SD8.1 months) and mean loading period was 10.6months (SD7.1months). Survival rate of implants was evaluated. For the evaluation of marginal bone changes, only the implants in function more than 12 months were considered. Crestal bone loss of 115 implants(mean loading period of 17.1±3.9months) was analyzed using linear radiographic measurements.

Table 1. Distribution of patients according to sex and age.

Age	Male	Femate	Total	%
20-29	0	2	2	2
30-39	4	1	5	6
40-49	13	9	22	25
50-59	12	12	24	28
60-69	12	12	24	28
70-79	4	4	8	9
80-89	0	2	2	2
Total	45	42	87	100

Table 2. Distribution of implants according to position.

Position		No. of implants	%
Upper	Anterior	41	11
	Premolar	37	10
	Molar	55	15
Lower	Anterior	60	16
	Premolar	55	15
	Molar	128	33
	Total	371	100

Table 3. Distribution of implant types.

Fixture type		No. of implants			%
Submerged	US II	159	170	43	46
	US III	6		2	
	GS II	5		1	
Non-Submerged	SS II	5	201	1	54
	SS II	196		53	
	Total	371	371	100	100

Table 4. Distribution of implant according to length and diameter.

Diameter (mm)	Length(mm) 8.5	10	11.5	12	13	15	Total	%
3.3	0	2	16	0	15	1	34	9
3.75	5	1	6	0	10	2	24	6
4	12	14	34	0	28	7	95	26
4.1	6	1	57	0	30	11	115	31
4.5	0	2	2	0	0	0	4	1
4.8	1	14	50	2	19	0	86	23
5	0	5	7	0	1	0	13	4
Total	24	49	172	2	103	21	371	100
%	6	13	46	1	28	6	100	

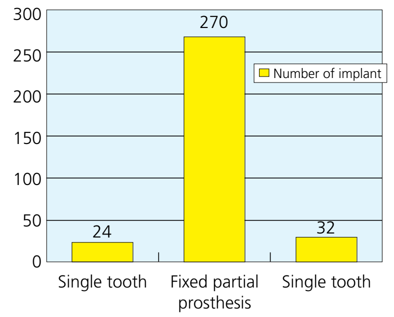

Fig 1. Distribution of implants according to type of prosthetic restoration

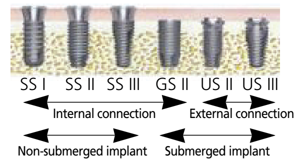

Fig 2. Fixture types

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• **Clinical Evaluation**

The average follow-up period from implant placement was 15.4 months (SD 8.1, n=371) and mean loading period was 10.6 months (SD 7.1, n=326).

> **Implant survival criteria**
> - Buser D, Quintessence Int., 1994.-
> • Absence of any complaints such as pain, dysesthesia, or paresthesia at the implanted area
> • Absence of recurring peri-implant infection and/or suppuration
> • no perceptible mobility
> • no radiolucencies at the implant-bone junction.

• **Radiographic Evaluation**

For the evaluation of marginal bone changes, only the implants in function more than 12 months were considered. The crestal bone loss of 115 implants (mean loading period of 17.1±3.9 months) was analyzed using linear radiographic measurements. (standardized parallel periapical view technique).

Fig 3. Reference point of each implant for radiographic evaluation

Table 5.

Implant type	Thread pitch
US II	0.6mm
SS II	1.25mm
SS II GS II US III	0.8mm

Results

• **Clinical Outcomes**

There were 9 implants failed in six patients. One male patient had failure of four implants. All of the nine implants were early failed before prosthetic treatment and the failures occurred in the maxilla where sinus or nasal cavity bone graft procedures were applied (Table V). The short-term survival rate of OSSTEM® implant was 97.6%. There were only 2 cases of mechanical problem (screw loosening) of implant components among the prosthetic complications (Table VI).

• **Radiographic Outcomes**

The marginal bone level from the reference point at the beginning and 1 year after functional loading was 0.52mm (SD 0.71) and 0.71mm (SD 0.86), respectively. The mean marginal bone loss during mean mean loading period (17.1±3.9months) was 0.21mm (SD 0.34)(n=115) (Table VII). Submerged implants (US II) showed significantly more marginal bone loss than non-submerged implants (SS I and SS II) (P<0.001).

Table 6. Failures of implants.

Patient	Sex/Age	Fixture type	Site	GBR	Timing of failure (month)
1	F/45	submerged(US II)	#16	Sinus elevation *(window opening)	1.5
2	M/42	Non-submerged(SS II)	#46	Thin ridge *(buccal GBR)	1.5
3	F/64	Non-submerged(SS II)	#17	Sinus elevation *(window opening)	2.5
4	M/48	Non-submerged(SS II)	#15	Sinus elevation *(window opening)	3.0
5	M/40	Non-submerged(SS II)	#16	Sinus elevation **(window opening)	4.5
6	M/56	submerged(US II)	#11,15,22,24	Lefort I and iliac bone graft *	2.0

* Delayed implantation ** Simultaneous implantation

Table 7. Prosthetic complications.

Type of prosthesis	Complication	No. of patient
Single crown	Screw loosening	1
Fixed partial prosthesis	Artificial tooth fx.	2
	Metal framework fx.	1
Overdenture	Screw loosening (2 implants, one time)	1
	Artificial tooth fx.	1
	O-ring change (three times)	2
	Bar clip change	2
Total		10

Table 8. Marginal bone loss according to the fixture type.

	No. of Implants	Mean (SD) (mm)
US II	64	0.31(0.36)
SS I	5	0.00 (0.00)
SS II	46	0.07 (0.26)
Total	115	0.21(0.34)

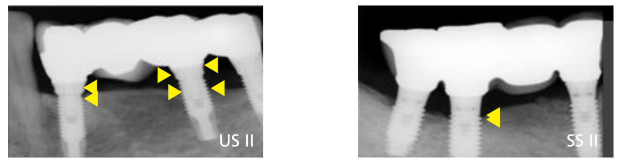

Fig 4. Radiographic finding of marginal bone resorption

Conclusions

The results obtained in this short-term retrospective study population revealed an excellent survival rate and marginal bone response for OSSTEM® Implants.

Multicentric Prospective Clinical Study of Korean Implant System; Early Stability Measured by Periotest®

Young-Kyun Kim[1)*], Jung-Won Hwang[2)], Pil-Young Yun[1)],
Su-Gwan Kim[3)], Chae-Heon Chung[4)], Yong-Gun Choi[5)], Sung-Il Song[6)]

Purpose

A number of dental implant systems have been developed worldwide. And, on the base of experimental and clinical studies, considerable technical improvement and production of qualified dental implant system was accomplished. As a member of Korean implant system, OSSTEM® implant system has relatively long-term accumulated clinical data. Though there were many studies on the OSSTEM® implant system, multicentric prospective study has not been tried. The authors tried to evaluate the early stability using Periotst® value preliminarily.

Materials and Methods

The patients who had been operated from Jun 2003 to May 2004 in the Seoul National University Bundang Hospital, Chosun University Dental Hospital, Bundang Jesaeng General Hospital respectively were included. To evaluate factors associated with early stability, patients were classified according to gender, age, area of surgery, bone quality, width of alveolar ridge, type of implant, diameter and length of implant. Primary stability and secondary stability was measured by Periotest® device.

Results

Periotest® value at the time of implant placement was -1.7 in one-stage group. This value was significantly higher than that of two-stage group(+1.5). Diameter of implant was closely related with primary stability(p=0.001). Primary stability was fine(under the +3) in 73.1%(95/130) of implants and 96.2%(125/130) of implants showed fine secondary stability. There was significant difference between primary stability and secondary stability.

Table 1. Numeric variables

	minimum	maximum	mean(SD)
Age (years)	21	83	54.7(11.8)
Width of alveolar ridge (mm)	3.0	13.0	6.4(1.6)
Exposure of fixture thread (mm)	0	10	1.5(2.5)
Primary stability	-7.0	28.0	0.7(6.7)
Secondary stability	-6.0	15.0	-2.76(3.2)

Table 2. Clinical factors Vs. Primary and secondary stability

		Fixture number(※)	Primary stability	Secondary stability
Gender	Male	51(39.2)	1.0±7.0	−2.5±3.4
	Female	79(60.8)	0.5±6.6	−2.9±3.0
Age	〈55	63(48.5)	0.3±7.2	−3.1±2.9
	≥55	67(51.5)	1.1±6.2	−2.4±3.4

Table 3. Anatomic factors Vs. Primary and secondary stability

		Fixture number(※)	Primary stability	Secondary stability
Age	Mx. anterior	6(4.6)	2.5±8.4	−2.3±3.3
	Mx. premolar	14(10.8)	1.2±5.3	−2.7±2.8
	Mx. molar	22(16.9)	2.8±7.8	−1.8±2.3
	Mx. anterior	14(10.8)	5.7±9.2	−3.0±3.1
	Mx. premolar	17(13.1)	1.2±7.9	−2.6±4.9
	Mx. molar	57(43.8)	−1.8±4.0	−3.2±3.0
Bone quality	Type 1	32(24.6)	2.2±9.0	−2.5±4.7
	Type 2	64(49.2)	−1.5±4.5	−3.6±2.1
	Type 3	15(11.6)	0.7±4.2	−2.9±2.0
	Type 4	19(14.6)	5.7±7.3	−0.3±2.7
Width of aveolar rdge (mm)	≥6.0	75(57.7)	1.2±6.7	−2.2±3.6
	〉6.0	55(42.3)	0.0±6.7	−3.6±2.2

Table 4. Fixture factors Vs. Primary and secondary stability

		Fixture number(※)	Primary stability	Secondary stability
Fixture type	1 Stage	34(26.2)	−1.7±4.4	−2.7±4.7
	2 Stage	96(73.8)	1.5±7.2	−2.8±2.5
Age	≤4.0	85(65.4)	2.1±7.4	−2.7±2.4
	〉4.0	45(34.6)	−1.9±4.3	−2.8±4.3
Fixture length(mm)	≤11.5	75(57.7)	−0.5±6.0	−2.9±3.1
	〉11.5	55(42.3)	2.3±7.4	−2.6±3.3

Table 5. Surgical Vs. Primary and secondary stability

		Fixture number(※)	Primary stability	Secondary stability
Surgical type	Immediate	13(10.0)	10.2±9.8	−3.5±3.4
	Major GBR	27(20.8)	2.0±7.2	−1.8±2.5
	Simple	90(69.2)	−1.1±4.5	−2.9±3.3


Fig 1. Immediate

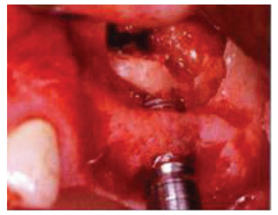
Fig 2. Major GBR


Fig 3. Simple

Table 6. Primary and secondary stability

		Fixture number(※)
Primary stability	≤0.0	83(63.8)
	〉0.0, ≤3.0	12(9.3)
	〉5.0	35(26.9)
Secondary stability	≤0.0	115(88.5)
	〉0.0, ≤3.0	10(7.7)
	〉5.0	5(3.8)

Table 7. Paired t-test: Primary stability Vs. Secondary stability

	t	dt	Sig.(2-tailed)
Primary stability-Secondary stability	5.989	129	.000

Table 8. The resuits of Pearson correlation test

Age	pearson Correlation
	Sig.(2-talled)
	N
Width of alveolar ridge	pearson Correlation
	Sig.(2-talled)
	N
Fixture diameter	pearson Correlation
	Sig.(2-talled)
	N
Fixture length	pearson Correlation
	Sig.(2-talled)
	N
Exposure of implant thread	pearson Correlation
	Sig.(2-talled)
	N
Primary stability	pearson Correlation
	Sig.(2-talled)
	N
Secondary stability	pearson Correlation
	Sig.(2-talled)
	N

*. Correlation is signiticant at the 0.05 level (2-telled)
**. Correlation is signiticant at the 0.01 level (2-telled)

Conclusions

From the analysis of preliminary data, satisfactory result was on the whole achieved. More reliable data for the additional radiographic and histomorphometric evaluation will be followed later from this multicentric prospective study.
Ultimately, this study will contribute to develop more adaptable and compatible to the Korean people specifically and to suggest a clinical evidences that many clinicians could select domestic implant system with confidence.

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Vertical Alveolar Ridge Augmentation Using Autogenous Bone Grafts and Platelet-Enriched Fibrin Glue with Simultaneous Implant Placement

Hyeon-Jung Lee[1)], Byung-Ho Choi[1)*], Jae-Hyung Jung[1)], Shi-Jiang Zhu[2)], Seoung-Ho Lee[3)], Jin-Young Huh[1)], Tae-Min You[1)], and Jingxu Li[2)]

Purpose

The aim of this study was to evaluate the combined use of autogenous bone and platelet-enriched fibrin glue as grafting material for vertical alveolar ridge augmentation with simultaneous implant placement in a canine alveolar ridge defect model.

Materials and Methods

In 6 mongrel dogs, bilateral vertical alveolar ridge defects were created in the mandible. After 3 months of healing, 2 dental implants were placed in each defect of the mandible, creating 6-mm supra-alveolar peri-implant defects. The 2 implants per defect were subjected to surgical treatments involving either a combination of autogenous bone grafts and platelet-enriched fibrin glue, or a conventional flap procedure only (control).

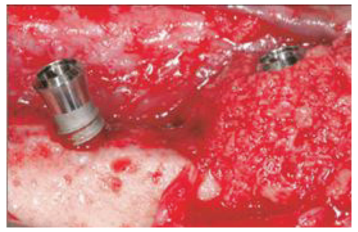

Fig 1. View of the implant and bone grafts immediately after placement in the alveolar ridge defects.

After a healing period of 6 months, the dogs were humanely killed for histological and histometric analyses.

Results

Clinical healing was uneventful following the defect induction and ridge augmentation. No adverse reactions or infection occurred.

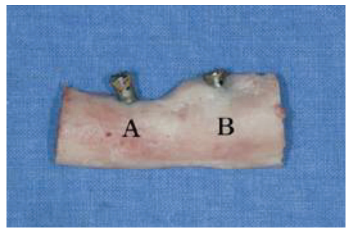

Fig 2. Photograph of the mandible showing the augmented area and the implant: A is the control side, B the fibrin glue side.

All animals exhibited a completely reconstructed alveolar ridge at the sites receiving autogenous bone grafts and platelet-enriched fibrin glue, and limited alveolar augmentation at the control sites.

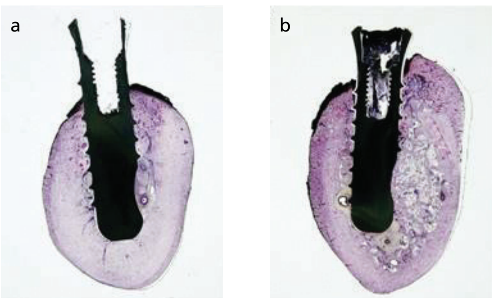

Fig 3. View of the specimen showing the augmented area and the implant. a, Control side. b, Fibrin glue side.

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Table 1. Primary and secondary stability

	Fibrin glue	Control	P values
Defect height (mm)	6.7 ± 0.4	6.5 ± 0.3	NS
New bone height (mm)	4.2 ± 1.0	0.6 ± 0.4	<.05
New bone-implant contact (%)	40.5 ± 17.3	34.3 ± 14.5	NS
Resident bone-implant contact (%)	48.4 ± 10.7	53.8 ± 7.9	NS

NS, not significant.

Implant placement alone produced limited vertical alveolar height (0.6±0.4 mm). However, alveolar augmentation including a combination of autogenous bone grafts and platelet-enriched fibrin glue with simultaneous implant placement resulted in alveolar ridge augmentation amounting to 4.2±1.0 mm, comprising 63% of the defect height. New bone-implant contact was 40.5% in the defects treated with combined autogenous bone grafts and platelet-enriched fibrin glue, and was 48.4% in the resident bone; this difference was not statistically significant.

Conclusions

The present study demonstrates that vertical alveolar ridge augmentation using autogenous bone grafts and platelet-enriched fibrin glue with simultaneous implant placement might effectively increase vertical alveolar ridge height and allow for an acceptable level of osseointegration.

SS System Biology

Flapless Implant Surgery: An Experimental Study

Seung-Mi Jeong[1)], Byung-Ho Choi[2)*], Jingxu Li[1)], Han-Sung Kim[3)], Chang-Yong Ko[3)], Jae-Hyung Jung[2)], Hyeon-Jung Lee [2)], Seoung-Ho Lee[4)], and Wilfried Engelke[5)]

Purpose

The purpose of this study was to examine the effect of flapless implant surgery on crestal bone loss and osseointegration in a canine mandible model.

Materials and Methods

In 6 mongrel dogs, bilateral, edentulated, flat alveolar ridges were created in the mandible. After 3 months of healing, 2 implants in each side were placed by either flap or flapless procedures. After a healing period of 8 weeks, microcomputerized tomography at the implantation site was performed. Osseointegration was calculated as percentage of implant surface in contact with bone. Additionally, bone height was measured in the peri-implant bone.

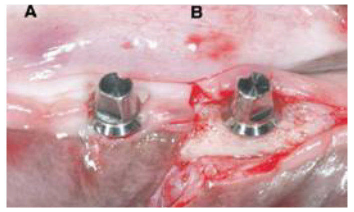

Fig 1. Clinical feature after implant placement.
A, Implant placed without a flap.
B, Implant placed with a flap.

Results

Healing after implant placement was uneventful in all animals. Upon gross examination, the bone around the implants was more abundant at flapless sites than at flap sites.

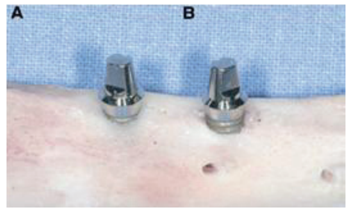

Fig 2. Photograph of the mandible showing bone loss around the implants.
A, Flapless site; B, Flap site.

The mean osseointegration was greater at flapless sites (70.4%) than at sites with flaps (59.5%) (P<.05). The mean peri-implant bone height was greater at flapless sites (10.1 mm) than at sites with flaps (9.0 mm) (P<.05).

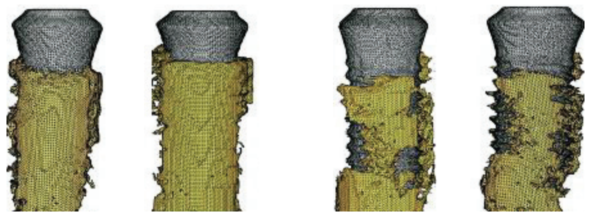

Fig 3. Three-dimensional microCT showing the bone (yellow) around the implants (gray).

Fig 4. Three-dimensional microCT overview of the bone-to implant contact area (red) around the implant surface (gray).

Table 1. Parameters of bone-to-implant contact and bone height around dental implants when placed either without or with a flap

	Flapless group	Flap group
Bone-implant contact (%)	70.4 ± 6.3	59.5 ± 6.3
Bone height (mm)	10.1 ± 0.5	9.0 ± 0.7

Conclusion

Flapless surgery can achieve results superior to surgery with reflected flaps. The specific improvements of this technique include enhanced osseointegration of dental implants and increased bone height.

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Maxillary Sinus Floor Augmentation Using Autogenous Bone Grafts and Platelet-Enriched Fibrin Glue with Simultaneous Implant Placement

Hyeon-Jung Lee[1)], Byung-Ho Choi[1)*], Jae-Hyung Jung[1)], Shi-Jiang Zhu[2)], Seoung-Ho Lee[3)], Jin-Young Huh[1)], Tae-Min You[1)], Jingxu Li[2)]

Purpose

The aim of this study was to evaluate the use of autogenous bone in combination with platelet-enriched fibrin glue as a grafting material for maxillary sinus augmentation with simultaneous implant placement in dogs.

Materials and Methods

The mucous membranes of 12 sinuses in 6 dogs were elevated bilaterally. In the right sinus, autogenous bone mixed with platelet-enriched fibrin glue was grafted into the space between the membrane and the sinus wall. In the left sinus, autogenous bone alone was grafted as a control. At the same time, 2 dental implants were inserted into the grafting material through the maxillary sinus floor. The animals were killed 6 months after surgery.
A morphometric study using an image analysis system (IBAS, Contron, Erching, Germany) was performed to quantify the newly formed bone around the implants.

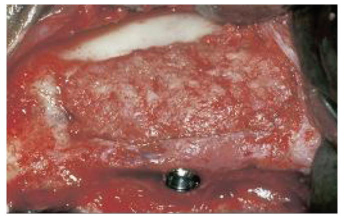
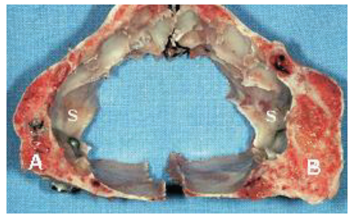


Fig 1. View of the implant and autogenous bone mixed with platelet-enriched fibrin glue immediately after placement in the space between the sinus membrane and the sinus floor.

Results

All animals recovered rapidly from surgery and were healthy throughout the follow-up, with no indication of infection or other complications. On gross examination of both sinuses, the sinus membrane was intact and flush with the apical implant surface and the original graft volume was clearly reduced. The newly formed bone was more abundant on the fibrin glue side than on the control side.



A, Control side. B, Fibrin glue side.

Fig 2. Photograph of the maxillary sinuses showing the augmented area and the implant; S, maxillary sinus cavity.

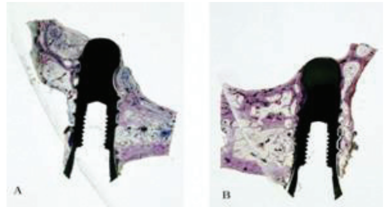


Fig 3. View of the histologic sections of the specimen showing the augmented area and the implant. A, Control side. B, Fibrin glue side.

Table 1. Parameters of BIC and bone formation 6 months after sinus augmentation with autogenous bone combined with platelet-rich fibrin glue and primary insertion of a titanium implant

	Fibrin glue (Autogenous bone + autofibrin)	Control (Autogenous bone)
Bone-implant contact (%)	40.5 ± 14.4	32.3 ± 12.0
Height of newly formed bone in the augmented area (mm)	12.0 ± 1.0	10.7 ± 1.0

The mean bone-implant contact was 40.5% on the fibrin glue side and 32.3% on the control side ($P < .05$).
The mean height of newly formed bone in the augmented area was 12.2 mm on the fibrin glue side and 10.7 mm on the control side ($P < .05$).

Conclusion

The results indicate that the use of autogenous bone mixed with platelet-enriched fibrin glue can achieve results superior to those for grafts of autogenous bone alone. The specific improvements of this technique include enhanced osseointegration of dental implants and increased height of new bone.

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Treatment of Experimental Peri-implantitis Using Autogenous Bone Grafts and Platelet-Enriched Fibrin Glue in Dogs

Tae-Min You[1], Byung-Ho Choi[1]*, Shi-Jiang Zhu[2], Jae-Hyung Jung[1], Seoung-Ho Lee[3], Jin-Young Huh[1], Hyun-Jung Lee[1], and Jingxu Li[2]

Purpose

The purpose of this study was to evaluate the effects of autogenous bone grafts and platelet-enriched fibrin glue in the treatment of peri-implantitis.

Materials and Methods

Thirty-six screw-type commercially pure titanium implants with rough acid-etched surfaces were inserted into 6 mongrel dogs 3 months after extraction of mandibular premolars. After 3 months of healing, periimplantitis was induced by placing gauze and wire around the implants. Once peri-implantitis was created, surgical treatments involving a combination of autogenous bone grafts and platelet-enriched fibrin glue, autogenous bone grafts alone, or a conventional flap procedure only (control) were carried out. Six months later, biopsies of the implant sites were taken and prepared for ground sectioning and analysis.

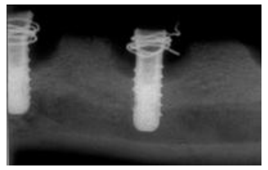

Fig 1. Radiographic appearance of the bone loss around the implants 2 months after placing the gauze and wire.

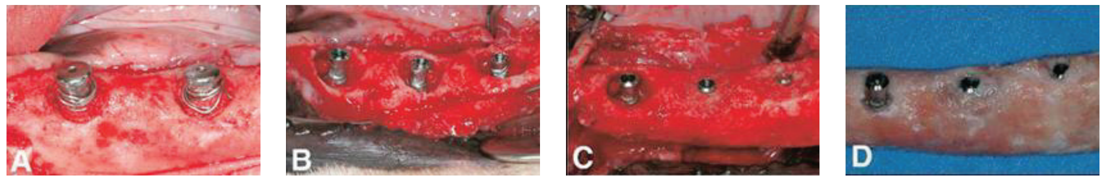

Fig 2. Clinical features after ligature placement (A), after elevation of full mucoperiosteal flaps and granulation tissue removal (B), after treatment (C) and after animal was killed (D).

Results

In the control group, a thin connective tissue capsule was found to separate all implant surfaces from the newly formed bone. In the bone and fibrin glue groups, both regenerated bone in close contact with the implant surface and thin connective tissue were found within all defects, but their amounts varied considerably between the groups.

Fig 3. Histologic features of the implants with the adjacent peri-implant tissues. A, Implant treated with a conventional flap procedure only. B, Implant treated with autogenous particulate bone. C, Implant treated with autogenous particulate bone mixed with platelet-enriched fibrin glue. Toluidine blue staining, original magnification X25.

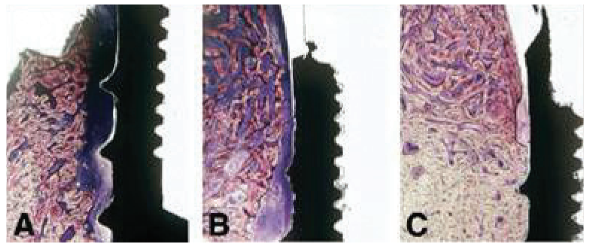

Fig 4. Higher magnificatioin of the implants with the adjacent peri-implant tissues. A, Implant treated with a conventional flap procedure only. B, Implant treated with autogenous particulate bone. C, Implant treated with autogenous particulate bone mixed with platelet-enriched fibrin glue. Toluidine blue staining, original magnification X100.

The amount of reosseointegration was significantly higher in peri-implantitis defects treated with combined autogenous bone grafts and platelet-enriched fibrin glue as compared with the other 2 treatment procedures. A mean bone-to-implant contact of 50.1% was obtained in the peri-implantitis lesions treated with combined autogenous bone grafts and platelet-enriched fibrin glue. The corresponding values for the autogenous bone grafts and control groups were 19.3% and 6.5%, respectively.

Conclusion

The present study demonstrates that surgical treatment involving the combined use of autogenous bone grafts and platelet-enriched fibrin glue might effectively promote reosseointegration in lesions resulting from periimplantitis.

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SS System Biology

Influence of Implant Fixture Design on Implant Primary Stability

Gap-Yong Oh[1)], Sung-Hwa Park[1)], Seok-Gyu Kim[1)*]

Statement of Problem

Current tendencies of the implant macrodesign are tapered shapes for improved primary stability, but there are lack of studies regarding the relationship between the implant macrodesign and primary stability.

Purpose

The purpose is to investigate the effect of implant macrodesign on the implant primary stability by way of resonance frequency analysis in the bovine rib bones with different kinds of quality.

Methods

Fifty implants of 6 different kinds from two Korean implant systems were used for the test. Bovine rib bones were cut into one hundred pieces with the length of 5 cm.

Among them forty pieces of rib bones with similar qualities were again selected. For the experimental group 1, the thickness of cortical part was measured and 20 pieces of rib bones with the mean thickness of 1.0mm were selected for implant placement. For the experimental group 2, the cortical parts of the remaining 20 pieces of rib bones were totally removed and then implants were placed on the pure cancellous bone according to the surgical manual. After placement of all implants, the implant stability quotient(ISQ) was measured by three times, and its statistical analysis was done.

Fig 1. Aluminum block for stabilizing bone specimen.

Fig 2. Bone specimen fixed in aluminum block.

Fig 3. Tapered(TH:left) and straight(SH:right) implants in Oneplant system.

Fig 4. SS III, US III, US II, GS II in OSSTEM System

Table 1. Implant types used in this stuty

Implant type	Number	Size	System	Characteristics
Tapered hexplant(TH)	5	4.3×10	Oneplant	tapered, submerged
Straight hexplant(SH)	5	4.3×10	Oneplant	straight, submerged
US II	10	4.0×10	OSSTEM	straight, submerged
US III	10	4.0×10	OSSTEM	tapered, submerged
GS II	10	4.0×10	OSSTEM	straight, submerged
SS III	10	4.0×10	OSSTEM	tapered, non-submerged

Table 2. Surgical manual of OSSTEM Implant System

(US II, US III, SS III : D3 bone)
(1) guide drill, (2) Ø2.0 twist drill, (3) depth gauge, (4) parallel pin, (5) Ø2.0/3.0 pilot drill, (6) Ø3.0 twist drill, (7) Ø4.0 implant
(US II : D1 bone)
(1)~(6) ⇒ (7) Ø3.3 marking drill, (8) countersink, (9) Ø4.0 tap drill, (10) Ø4.0 implant
(US III, SS III : D1 bone)
(1)~(6) ⇒ (7) shaping drill, (8) tapered drill (9) Ø4.0 implant
(GS II : D3 bone)
(1)~(6) ⇒ (7) Ø3.3 marking drill, (8) Ø4.0 implant
(GS II : D1 bone)
(1)~(6) ⇒ (7) Ø3.6 marking drill, (8) Ø3.8 step drill (9) Ø4.0 implant

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Table 3. Surgical manual of Oneplant Implant System

(TH : soft bone)
(1) point drill, (2) Ø2.0 twist drill, (3) depth probe, (4) Ø3.3 step drill, (5) Ø4.3 implant
(TH : hard bone)
(1)~(4) ⇒ (5) Ø4.3 conical drill, (6) Ø4.3 tap drill, (7) Ø4.3 implant
(SH : soft bone)
(1)~(3) ⇒ (4) Ø2.0/3.0pilot drill, (5) Ø3.0 twist drill, (6) Ø4.3(4.1)implant
(SH : hard bone)
(1)~(3) ⇒ (4) Ø2.0/3.0 pilot drill, (5) Ø3.0 twist drill, (6) Ø3.5twist drill, (7) Ø4.1 cortical drill, (8) Ø4.1 tap drill (9) Ø4.3(4.1) implant

Results

There are statistically significant differences in ISQ values among 4 different kinds of OSSTEM system implants in the experimental group 2. For the experimental group 1, OSSTEM system implants showed significantly different ISQ values, but when differences in the thickness of cortical parts were statistically considered, did not show any significant differences in ISQ values. Among Oneplant system implants, there are no significant differences in ISQ values for the experimental group 2 as well as for the experimental group 1.

Table 4. Mean ISQ values in the experimental group 1

Implant	N	Mean	SD
TH	5	54.30	11.73
SH	5	58.83	7.52
US II	10	64.83	8.88
US III	10	65.00	5.47
GS II	10	57.70	5.89
SS III	10	60.30	9.45

Table 5. Mean ISQ values in the experimental group 2

Implant	N	Mean	SD
TH	5	53.73	9.38
SH	5	59.80	11.46
US II	10	47.27	11.09
US III	10	50.63	11.85
GS II	10	45.17	9.65
SS III	10	55.97	11.72

Table 6. Mean thickness of cortical bone in the experimental group 1

Implant	N	Mean	SD
TH, SH	10	0.9	0.3
US II, US III, GS II, SS III	10	1.25	0.5

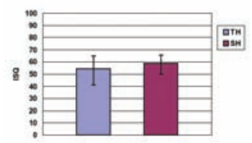

Fig 5. Mean ISQ values of Oneplant implants in the experimental group 1.

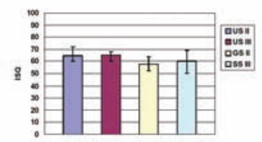

Fig 6. Mean ISQ values of OSSTEM implants in the experimental group 1.

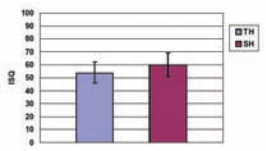

Fig 7. Mean ISQ values of Oneplant implants in the experimental group 2.

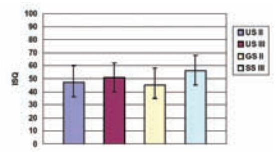

Fig 8. Mean ISQ values of OSSTEM implants in the experimental group 2.

Conclusion

Within the limits of this study, bone quality and implant design have some influences on the primary stability of implants. Especially in the bone of poor quality, tapered shape of implants are more favorable for the primary stability of implants.

SS System
Biomechanics

The Comparative Study of Thermal Inductive Effect Between Internal Connection and External Connection Implant in Abutment Preparation

Jung-Bo Huh[1)] , Suk- Min Ko[1)*]

Statement of Problem

The cement-type abutment would be needed for the reduction of its body in order to correct the axis and to assure occlusal clearance. In the case of intraoral preparation, there is a potential risk that generated heat could be transmitted into the bone-implant interface, where it can cause deterioration of tissues around the implant and failed osseointegration.

Purpose

The purpose of this study was to assess the difference of the heat transmitting effect on external and internal connection implant types under various conditions.

Methods

For evaluating the effects of alternating temperature, the thermocoupling wires were attached on 3 areas of the implant fixture surface corresponding to the cervical, middle, and apex. The abutments were removed 1㎜ in depth horizontally with diamond burs and were polished for 30 seconds at low speed with silicone points using pressure as applied in routine clinical practice. Obtained data were analyzed using Mann-Whitney rank-sum test and Wilcoxon / Kruskal-Wallis Tests.

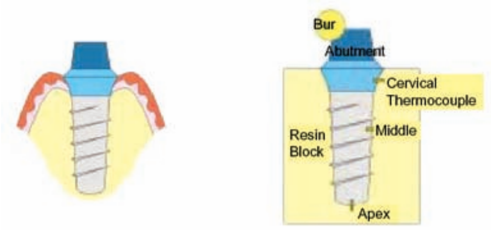

Fig 1. Experimental setup in this study. Cervical thermoelement was located in the middle of the machined surface of fixture which would correspond clinically to the level of the connective tissue, Middle thermoelement was located in the middle of fixture, Apex thermoelement was located at the lowest tip of fixture. The change in temperature were measured while reduce

Table 1. Each experimental groups

	Abutment	handpiece	coolant
1	Cemented	high speed	air & water
2			nothing
3		low speed	air & water
4			nothing
5	ComOcta	high speed	air & water
6			nothing
7		low speed	air & water
8			nothing

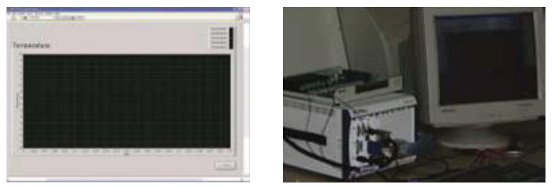

Fig 2. Temperature measuring equipment and Program.
The LabView(National Instrument, Texas, US) was used as the software in the monitoring system, PXI6259(National instrument, Texas, US) was used as the hardware

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Results

Increased temperature on bone-implant interface was evident without air-water spray coolant both at high speed reduction and low speed polishing (p<.05). But, the difference between connection types was not shown.

Table 2. Mean temperature and statistical significance of temperature for external connection type abutment

Abutment type	Handpiece type	Position	Coolant	Mean temperature	Statistical significant difference of temperature (p-value)
Cemented	High	Apical	yes No	36.9 52.1	0.009
Cemented	High	Cervical	yes No	37.1 52.9	0.009
Cemented	High	Middle	yes No	37.9 52.2	0.009
Cemented	Low	Apical	yes No	36.4 40.2	0.009
Cemented	Low	Cervical	yes No	36.4 59.3	0.009
Cemented	Low	Middle	yes No	36.6 40.1	0.009

Table 3. Mean temperature and statistical significance of temperature for internal connection abutment

Abutment type	Handpiece type	Position	Coolant	Mean temperature	Statistical significant difference of temperature (p-value)
Octa	High	Apical	yes No	37.4 40.1	0.009
Octa	High	Cervical	yes No	37.6 56.8	0.009
Octa	High	Middle	yes No	37.4 42.1	0.009
Octa	Low	Apical	yes No	37 38.9	0.0086
Octa	Low	Cervical	yes No	36.3 54.1	0.009
Octa	Low	Middle	yes No	37.1 41.1	0.009

Table 4. P-value among Cemented Abutment vs. ComOcta Abutment: Wilcoxon/Kruskal-Wallis Tests was used to compare significance differences, P<0.05 has statistic significance

	Cervical	Middle	Apex
HWC	0.25	0.35	0.17
HWOC	0.12	0.75	0.60
LWC	0.40	0.75	0.40
LWOC	0.08	0.46	0.12

- HWC : high speed preparation with coolant
- HWOC : high spped preparation without coolant
- LWC : low speed preparation with coolant
- LWOC : low speed preparation without coolant

Conclusion

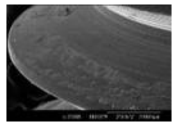
The reduction procedure of abutment without using proper coolant leads to serious damage of oral tissues around the implant irrespective of external and internal connection type.

Influence of Tungsten Carbide/Carbon on the Preload of Implant Abutment Screws

Jin-Uk Choi[1)], Chang-Mo Jeong[1)*], Young-Chan Jeon[1)], Jang-Seop Lim[1)], Hee-Chan Jeong[1)], Tae-Gwan Eom[1)]

Statement of Problem

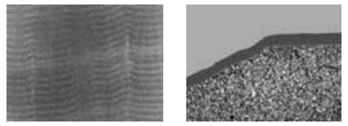
Recently, in order to increase preload with reducing the friction coefficient, abutment screws coated with pure gold and Teflon as dry lubricant coatings have been introduced. But the reported data indicate that if screw repeated tightening and loosening cycle, an efficiency of increasing preload was decreased by screw surface wearing off.



Robb TT, Porter SS. J Dent Res 1998;77(special issue):837 [abstract 1641, 1642]
Vigolo P. Int J Oral Maxillofac Implants 2004;19:260-265
Martin WC, Woody RD, Miller BH, Miller AW. J Prosthet Dent 2001;86:24-32

Purpose

This study was to evaluate the influence of tungsten carbide/carbon coating, which has the low friction coefficient and the high wear resistance, on the preload of abutment screws and the stability of coating surface after repeated closures.



Armorphous metal carbon coating
Multilamellar structure

Low Coefficient of Friction
Good Wear Resistance
High Load - Bearing Capacity

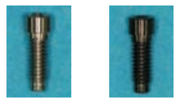
Materials

Features of Experimental Implant Abutment Systems (OSSTEM Implant, Korea)

Implant system	Implant Ø mm	Abutment / implant interface	Abutment	Abutment screw
US II	4.1	External butt joint (external hexagon)	Cemented	Ta, WC/CTa
SS II	4.8	8° Morse taper (internal octagon)	ComOcta	Ta, WC/CTa
GS II	4.5	11° Morse taper (internal hexagon)	Transfer	Ta, WC/CTa

Ta = titanium alloy; WC/CTa = tungsten carbide/carbon-coated titanium alloy.

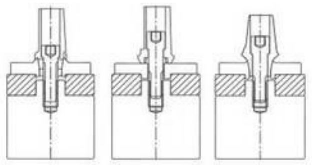
US II SS II GS II
Implant fixture



Ta WC/CTa
Abutment screw

Preload Test

To evaluate the influence of WC/C coating on the preload of implant abutment screws, each assembly (n=5) was tightened to 30Ncm and compressive force between abutment and fixture were measured in implant systems with three different joint connections, one external butt joint and two internal cones.



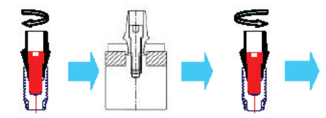
US II system SS II system GS II system
Schematic Diagram of Measurement Apparatus

Force sensor connection

Digital indicator for measuring compressive force

Consecutive Trial Test

To evaluate the stability and the alteration of coating screw, GS system assemblies (n=5) were examined by comparison of the compressive force and the removable torque values during 10 consecutive trials, and the surface change were observed.



Tightening (30Ncm) → Compressive Force Measurement → Removable torque value Measurement → 10 Consecutive Closure / Opening Trials

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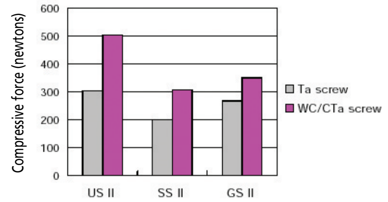
[2)]Implant R&D Center, OSSTEM Implant Co. Ltd., Busan, South Korea

Preload Test Results

Application of coating on implant abutment screw resulted in significant increase of compressive force in all implant systems (P<.05). The increasing rate of compressive force by coating in external butt joint was greater than those in internal cones (P<.05).

Mean Values±SDs of Compressive Force (N)

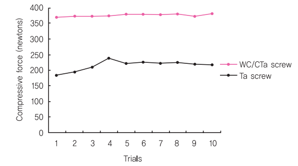
Implant system	Ta screw	WC/CTa screw	Percentage of increased compressive force
US II	303.8±12.7[c]	503.8° ±13.9[e]	65.8
SS II	199.6±7.8[a]	306.4±8.6[c]	53.5
GS II	266.6±11.0[b]	350.0±15.0[d]	31.3

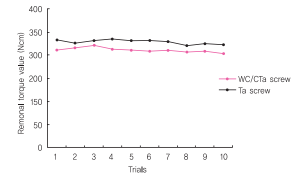


Consecutive Trial Test Results

Coated screw showed insignificant variations in the compressive forces during 10 consecutive trials (P<.05).
Removable torque values were greater with non-coated screw than that with coated screw (P<.05).

Trials	Compressive force (N)		Removable torque (Ncm)	
	Ta screw	WC/CTa screw	Ta screw	WC/CTa screw
1	180.4±10.1[a]	367.8±15.9	23.3±1.8	21.2±0.9[a,b]
2	192.6±11.3[a,b]	372.0±5.4	22.6±1.7	21.6±0.7[b,c]
3	209.4±23.6[b,c]	372.0±4.4	23.0±1.7	22.1±0.8[c]
4	233.4±25.6[c]	370.8±5.5	23.6±1.1	21.4±0.2[b,c]
5	221.4±13.6[c]	378.2±6.4	23.1±0.7	21.2±0.6[a,b]
6	222.6±15.7[c]	378.8±7.8	23.1±0.7	20.9±0.6[a,b]
7	219.8±19.9[c]	375.8±11.1	22.9±0.8	21.1±0.5[a,b]
8	222.0±22.4[c]	378.2±11.6	22.1±0.9	20.8±0.6[a,b]
9	217.8±17.3[b,c]	374.8±11.8	22.4±0.7	20.8±0.6[a,b]
10	216.6±16.8[b,c]	379.8±11.7	22.2±0.7	20.5±0.5[a]
Mean	213.6±15.7	374.8±4.0	22.8±0.5	21.2±0.5

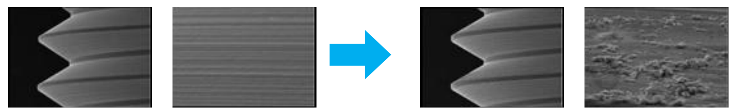




SEM Photomicrograph Results

Titanium alloy screw

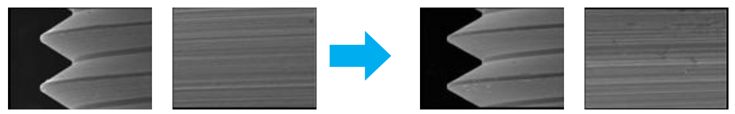
Pre-test Screws → Worn Screws



Magnification×100 Magnification×1,000 Magnification×100 Magnification×1,000

WC/C- coated titanium alloy screw

Pre-test Screws → Worn Screws



Magnification×100 Magnification×1,000 Magnification×100 Magnification×1,000

Conclusion

Tungsten carbide/carbon coating of implant abutment screw was effective in the increasing of preload and with favorable wear resistance.

The Effect of Internal Implant-Abutmnnt Connection and Diameter on Screw Loosening

Chun-Yeo Ha[1)], Chang-Whe Kim[1)],Young-Jun Lim[1)], Kyung-Soo Jang[1)*]

Statement of Problem

One of the common problems of dental implant prosthesis is the loosening of the screw that connects each component, and .this problem is more common in single implant-supported prostheses with external connection, and in molars.

Purpose

The purposes of this study were:

(1) to compare the initial abutment screw de torque values of the six different implant-abutment interface designs, (2) to compare the detorque values of the six different implant-abutment interface designs after cyclic loading, (3) to compare the detorque values of regular and wide diameter implants and (4) to compare the initial detorque values with the detorque values after cyclic loading.

Methods

Six different implant-abutment connection systems were used. The cement retained abutment and titanium screw of each system were assembled and tightened to 32Ncm with digital torque gauge. After 10 minutes, initial detorque values were measured. The custom titanium crown were cemented temporarily and a cyclic sine curve load(20 to 320N, 14Hz) was applied. The detorque values were measured after cyclic loading of one million times by loading machine. One-way ANOVA test, scheffe's test and Mann-Whitney U test were used.

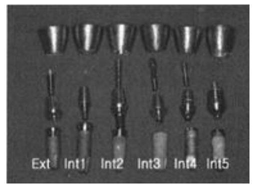


Fig 1. Regular diameter implants, abutments, abutment screws and titanium crowns.

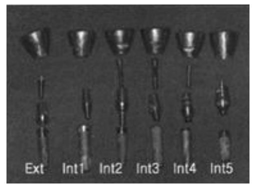


Fig 2. Wide diameter implants, abutments, abutment screws and titanium crowns.

Table 1. List of Components

Group	Brand name	Types of cemented abutments
Ext(R)	OSSTEM US II Selftapping Implant	Hexed, collar 1m, height 5.5m
Ext(W)		Hexed, collar 1m, height 5.5m
Int1(R)	OSSTEM SS II Implant	non-octa, height 5.5m
Int1(W)		non-octa, height 5.5m
Int2(R)	Camlog®	trivam, gingival collar 1.5m
Int2(W)		trivam, gingival collar 1.5m
Int3(R)	Implantium®	non-hex, gingival collar 1.0m
Int3(W)		non-hex, gingival collar 1.0m
Int4(R)	MIS®	hexed, gingival collar 2.0m
Int4(W)		hexed, gingival collar 2.0m
Int5(R)	Tapered Screw Vent®	hexed, 5.5m wide profile
Int5(W)		hexed, 5.5m wide profile

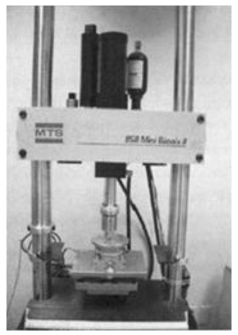


Fig 3. Loading machine

Fig 4. Customized jig

Fig 5. Digital torque gauge

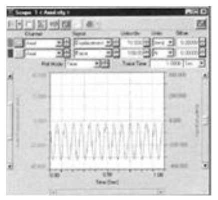


Fig 6. Loading pattern

[1)]Dept. of Prosthodontics, Graduate School, Seoul National University, South Korea

Results

The results were as follows:

1. The initial detorque values of six different implant-abutment connections were not significantly different($p > 0.05$).
2. The detorque values after one million dynamic cyclic loading were significantly different ($p < 0.05$).
3. The SS II regular and wide implant both recorded the higher detorque values than oth?er groups after cyclic loading($p < 0.05$).
4. Of the wide the initial detorque values of OSSTEM Self Tapping Implant, MIS and Tapered Screw and the detorque values of MIS implant after cyclic loading were higher than their regular counterparts($p < 0.05$).
5. After cyclic loading, SS II regular and wide implants showed higher de torque values than before($p < 0.05$).

Table 2. Results of initial detorque values of regular diameter implants after 32Ncm tightening(unit:Ncm)

	1st*	2nd*	3rd*	4th*	5th*	Mean	SD	Rate(%)
Ext(R)	27.5	24.0	27.1	23.6	28.2	26.1	2.12	81.5
Int1(R)	30.4	27.1	23.9	32.5	28.4	28.5	3.27	88.9
Int2(R)	28.7	26.2	28.5	28.8	28.7	28.2	0.50	88.1
Int3(R)	26.8	32.9	25.6	26.3	25.2	27.4	1.41	85.5
Int4(R)	28.0	28.3	26.1	27.3	27.7	27.5	0.38	85.0
Int5(R)	27.3	24.4	24.0	25.6	27.6	25.8	0.73	80.5

*1st, 2nd, 3rd, 4th, 5th:the number of measurement times

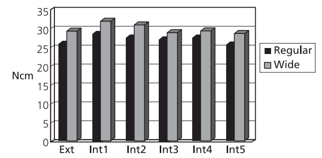


Fig 7. Mean initial detorque value

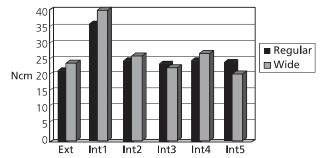


Fig 8. Mean detorque values after cyclic loading

Table 3. Results of initial detorque values of wide diameter implants after 32Ncm tightening(unit:Ncm)

	1st*	2nd*	3rd*	4th*	5th*	Mean	SD	Rate(%)
Ext(W)	29.3	29.4	30.3	28.1	30.2	29.5	0.88	92.1
Int1(W)	33.8	34.8	30.6	30.3	31.7	32.2	1.98	100.8
Int2(W)	31.7	32.2	32.8	27.0	31.6	31.1	2.32	97.1
Int3(W)	29.6	29.8	28.7	31.8	26.3	29.2	2.00	91.4
Int4(W)	28.0	29.3	31.3	30.0	29.6	29.6	1.19	92.6
Int5(W)	28.5	30.6	26.0	30.2	29.0	28.9	1.81	90.2

*1st, 2nd, 3rd, 4th, 5th:the number of measurement times

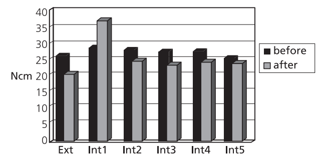


Fig 9. Mean detorque values of regular diameter implants

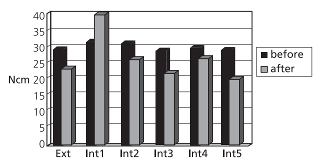


Fig 10. Mean detorque values of wide diameter implants

Table 4. Results of initial detorque values of regular diameter implants after cyclic loading(unit:Ncm)

	1st*	2nd*	3rd*	4th*	5th*	Mean	SD	Rate(%)
Ext(R)	19.2	23.4	22.0	19.0	21.9	21.1	1.92	66.0
Int1(R)	27.8	36.0	39.9	39.2	36.5	35.9	4.82	112.2
Int2(R)	24.9	24.2	24.6	24.7	24.6	24.6	0.25	76.9
Int3(R)	21.2	22.7	24.4	24.0	25.0	23.5	1.52	73.1
Int4(R)	26.1	25.7	23.7	22.0	25.4	24.6	1.70	76.8
Int5(R)	24.2	22.2	25.5	24.8	23.5	24.0	1.27	75.2

*1st, 2nd, 3rd, 4th, 5th:the number of measurement times

Table 5. Results of initial detorque values of wide diameter implants after cyclic loading(unit:Ncm)

	1st*	2nd*	3rd*	4th*	5th*	Mean	SD	Rate(%)
Ext(W)	25.4	24.9	21.6	22.8	22.8	23.5	1.59	73.5
Int1(W)	38.7	39.0	37.7	42.0	42.0	39.9	1.99	124.7
Int2(W)	28.8	26.6	22.9	25.0	26.0	25.9	2.16	80.9
Int3(W)	22.0	20.6	24.0	23.2	22.7	22.5	1.29	70.3
Int4(W)	24.5	26.4	27.5	27.9	27.8	26.8	1.43	83.8
Int5(W)	22.9	25.2	17.7	15.2	20.2	20.2	3.99	63.3

*1st, 2nd, 3rd, 4th, 5th:the number of measurement times

Conclusion

Within the limitations of this study, the following conclusions were drawn. Till ninth reuse of Smartpeg™, the ISQ measurement stability did not be affected. After twice autoclave sterilization of Smartpeg™, the ISQ measurement stability was affected.

SS System
Biomechanics

Effect of Joint Design on Static and Dynamic Strength

Ji-Hoon Yoon[1)], Chang-Mo Jeong[2)*], Tae-Gwan Eom[1)], Mi-Hyun Cheon[2)]

Introduction

Mechanical failures of component loosening and fracture of implant system have been concerned. These clinical failures may result from overload or fatigue. Although several comparatives studies on static fracture strength of different implant-abutment joint designs have been reported, the fatigue endurance of these joints has not been fully investigated.

The purpose of this study is to evaluate compressive and fatigue strength of different joint designs.

Materials and Methods

In this study four OSSTEM(Korea) implants assemblies were used, External Butt Joint-Safe Abutment(BJS), External Butt Joint-Cemented Abutment(BJC), 11° Internal Conical Joint-Transfer Abutment(CJT) and 11° Internal Conical Joint-Convertible Abutment(CJC).

Implant-abutment Joint Design

	Connection type	Materials
BJS	External Butt Joint Modified Abutment + Screw	Abutment -Ti Gr3 / Screw - Ti Gr5
BJC	External Butt Joint Abutment + Screw	Abutment - Ti Gr3 / Screw - Ti Gr5
CJT	11° internal Conical Joint Abutment + Screw	Abutment - Ti Gr3 / Screw - Ti Gr5
CJC	11° Internal Conical JointAbutment + Cylinder + Screw	Abutment - Ti Gr5 / Cylinder - Ti Gr3 / Screw - Ti Gr5

Compressive and fatigue strength of four groups were evaluated according to specified test(ISO/FDIS-14801). Tightening torque of each assembly was 30Ncm. The result of compressive strength was verified by one-way ANOVA and Turkey test. Fatigue test was started at 80% of fracture strength and failure was defined as material yielding, permanent deformation or fracture of any component. Test had been continued until three specimens reached the specified number of cycles with no failures. The failure modes were identified by SEM.(S-4200; Hitachi, Japan)

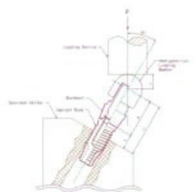

BJS


BJC


CJT


CJC

Compressive bending and Cyclic fatigue loading


Schematic Diagram of Test Condition


Cyclic Loading System (8516, Instron corp, USA)

Results

Compressive Strength

Implant-abutment Joint Design

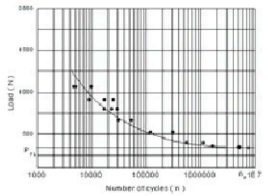
Groups(n=5)	mean
BJS	1392.1±52.6
BJC	1153.2±39.0
CJT	1016.2±116.4
CJC	968.3±86.0

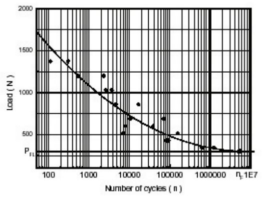
* Groups with the same letters are not significantly different. (P<0.05),

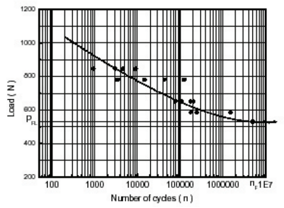
Fatigue Strength

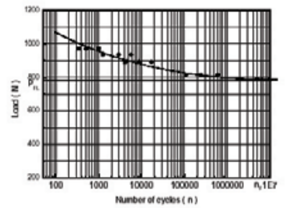
Groups	Fatigue Strength(N)
BJS	360
BJC	300
CJT	530
CJC	780

[1)]Implant R&D Center, OSSTEM Implant Co. Ltd., Busan, South Korea
[2)]The Dept. of Prosthodontics ,Pusan National University Hospital, Busan, South Korea


Curve for stress versus number of cycle(S-N) of BJS

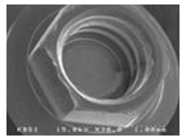

Curve for stress versus number of cycle(S-N) of BJC

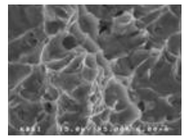

Curve for stress versus number of cycle(S-N) of CJT


Curve for stress versus number of cycle(S-N) of CJC

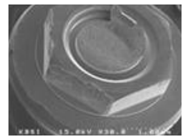
SEM examination(S-4200, Hitachi, Japan)

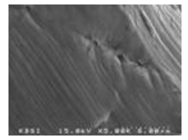
Compressive Strength


fractured abutment screw (original magnification X 30)


fractograph showing dimpled Surface (original magnificationX5.0k)

Fatigue Strength


fractured abutment screw (original magnification X 30)


fractograph showing dimpled Surface (original magnificationX5.0k)

Conclusions

Within the limits of this study ;

1.The fatigue endurance of internal conical was higher than that of external butt joint.

2. In butt joint, BJS with longer resistance arm showed higher fatigue strength than BJC.

3. CJC with internal conical joint had the strongest connection.

4. There was no direct correlation between fracture strength and fatigue strength.

A Retrospective Study on the Clinical Success Rate of OSSTEM® Implant

Sung-Moon Back[1)], Min-Suk Oh[1)], Su-Kwan Kim[1)*]

Purpose

It is important to analyze the causes of implant failure. Therefore, we examined the records of patients who received an OSSTEM® implant at the dental clinic at Chosun University, Korea, between January 2002 and December 2005. Implant success and cumulative survival rates were evaluated by assessing clinical examination results, medical records, and radiographs. The success rate was assessed according to gender, implant placement area, fixture diameter and length, and the presence or absence of maxillary sinus surgery.

Materials and Methods

The study was performed on 247 patients (144 male, 103 female) who received 479 OSSTEM® Implants (Seoul, Republic of Korea) at the dental clinic at Chosun University, Korea, between January 2002 and December 2005. The patients ranged in age from the teens to the 70s. The patients had no systemic diseases that would have been a contraindication for implant surgery. We compared patient gender and age, implant area (maxillary anterior tooth, maxillary premolar tooth, maxillary molar tooth, mandibular front tooth, mandibular premolar tooth, and mandibular molar tooth areas), implant diameter and length, and use of the maxillary sinus lifting technique. Based on the examination records, the following were analyzed: patient gender and age distribution, implant placement location, fixture diameter and length, presence or absence of maxillary sinus surgery, and cause of implant failure.

Results

Success rate according to patient gender and age distribution. The highest success rates occurred among those in the 40s age group (31%) for male patients and the 50s age group (28%) for female patients. In both male and female patients, the failure rate increased with increasing age.

Success rate according to implant placement location. In all age groups, implants were placed most frequently in the mandibular molar tooth area (41% of total) and maxillary molar tooth area (18% of total). The implant failure rate was highest in the maxillary molar tooth area (8/88, 9%) and mandibular molar tooth area (16/192, 8%). Among the maxillary molar tooth cases, maxillary sinus lifting was performed in 24 cases, and failure occurred in four of these.

Classification according to implant area and fixture diameter and length. The location and fixture size was determined for each of the 479 implants. The most frequently implanted areas were the mandibular molar tooth, maxillary molar tooth, and maxillary pre-molar tooth areas. The implant diameters were 3.3, 3.75, 4.1 and 5.1 mm, and the lengths ranged from 10 to 15 mm. The most frequently used implant had a diameter of 4.1 mm and a length of 13 mm.

Success rate following maxillary sinus lifting surgery (Table 1). Maxillary sinus lifting was performed during the placement of 24 implants, and four of these implants failed. Perforation developed during the placement of eight implants, and three of these failed.

Outcome	Perforation	Non-perforation
Success	5(20.83%)	15(62.5%)
Failure	3(10.25%)	1(4.1%)

Table 1. Success rate following maxillary sinus lifting (total, 24 cases).

Causes of implant failure (Table 2). Among the 479 implants, there were 28 failures. The most frequent causes of failure, in decreasing order, were poor bone quality, poor initial stability, and perforation in the maxillary sinus. In this study, maxillary sinus lifting was performed simultaneously with implantation in 24 patients, and bone union failed in four cases, for a success rate of 83%.

[1)]Dept. of Maxillofacial Surgery, College of Dentistry, Chosun University, South Korea

Causes	Implants (%)
Poor bone qualiy: Cases implanted in natural bone Cases with simultaneous maxillary sinus lifting surgery	12(42.9%) 8 4
Poor initial stability	8(28.5%)
Dehiscence formation	1(3.5%)
Perforation in the maxillary sinus	3(10.7%)
Erroneous implant direction	1(3.5%)
Exposure of the blocking menbrane	2(2.7%)
Reimplantation due to implant fracture	1(10.7%)
Total	28

Table 2. Causes of implant failure.

Discussion

Given that the implant failure rate increases with age, poor bone quality and consequent poor initial stability may have the greatest effect on implant failure. In particular, bone quality deteriorates rapidly following the onset of menopause in female patients, as bone remodeling accelerates due to estrogen deficiency or as osteoclast bone resorption activity becomes higher than osteoblast bone formation activity. In this study, the diameter and length of the implant were selected on the basis of residual bone volume, bone quality, and surgical area, among other factors.

The success rate was 93.8% in female patients and slightly higher (94.3%) in male patients. However, despite the overall success rate of 93.1% demonstrated in this study, maxillary sinus lifting remains a very difficult technique requiring great care.

Bone grafts, including those associated with maxillary sinus lifting, were performed in 181 cases, representing 37.8% of the 247 implanted patients. This implies that approximately half of the patients visiting general dental clinics require the simultaneous performance of a large or small bone grafting process. When counseling implant patients, it may be advisable to warn them in advance that a bone graft may be necessary during implant surgery.

Owing to the small size of the study, it was difficult to elucidate a correlation between perforation and failure, although it was considered that perforation did not necessarily induce failure. Further limitations of this study are that: (1) implantation was not performed by a single surgeon so that the ability of the surgeon could not be analyzed; (2) the follow-up period was only 4-years; and (3) various bone graft Material were used in mixtures so that the biocompatibility of each materialcould not be determined precisely.

Future studies on methods of improving the success rate of implantation in the maxillary molar tooth area are recommended and may lead to more predictable treatment.

Multicenter Retrospective Clinical Study of OSSTEM® US II Implant System in Type IV Bone

Su-Gwan Kim[1)*], Chul-Min Pack[1)], Young-Kyun Kim[2)], Hee-Kyun Oh[3)], Gab-Lim Choi[4)], Young-Hak Oh[5)]

Purpose

The purpose of this study is to evaluate the success rate of the Osstem® US II (Osstem,Co.Ltd. Seoul Korea) placed in the edentulous area of type 4 bone quality.

Materials and Methods

178 US II implants that had been inserted between 1997 and 2005 were followed up for mean 29.4 months. With medical records and radiographs we analysis the distribution of patients' age and gender, position of implant, the kind of surgical technique, the type of prostheses, amount of bone resorption survival rate and success rate of implants. From these analysis we got the following results.

Results

In the distribution of implants by site, 167 implants were placed on maxilla and only 11 implants on mandible. And the resorption of crestal bone more than 1mm was measured at only 5 implants. The mean plaque, gingival inflammatory and calculus index were measured 0.56, 0.31, 0.01. The survival rate was 100% and success rate was 98.8% during 29.4 months of mean following up period.

Table 1. Distribution of implants by site

	Maxilla	Mandible
Incisor	5	2
Premolar	32	1
Molar	130	8
Total	167	11

Table 2. Distribution of implants by length and diameter

		Maxilla	Mandible
Length		8.5	2
		10	5
		11.5	13
		13	9
		15	27
		18	14
		20	105
Diameter		3.75	7
		4.0	101
		4.5	2
		5.0	21
		5.5	47

Table 3. Distribution of operation methods

Operation methods	Mandible
Conventioonal methods	54
SL via lateral window	114
SL via osteotome technique	9
GBR	1

SL:sinus litting, GBR:guided bone regeneration

Table 4. Distribution of implants by type of prostheses

Prostheses	No.of implants
Single	3
Fixed partial	136
Fixed complete	33
Others	6

Table 5. Distribution of implants by bone resorption

Amount of bone resorption(mm)	No.of implants
None	165
0~0.9	2
1.0~2.0	5
〉2.0	0

Conclusions

As a result, we got the excellent clinical results of US II implant system at bone quality of type 4.

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[2)] Dept. of Oral & Maxillofacial Surgery, Seoul National University Bundang Hospital, South Korea
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Multicenter Retrospective Clinical Study of OSSTEM® US II Implant System in Complete Edentulous Patients

Su-Gwan Kim[1)*], Min-Suk Oh[1)], Young-Kyun Kim[2)], Hee-Kyun Oh[3)], Gab-Lim Choi[4)], Young-Hak Oh[5)]

Purpose

In this study, we analyzed data for edentulous patients from multiple centers after installation of the OSSTEM® US II system in a retrospective study of patient gender, age, implant area, additional surgery, type of prosthesis, and the implant survival and success rates. We then analyzed the success rate after prosthetic restoration using implants in completely edentulous patients to validate the usefulness of the US II system.

Materials and Methods

Between 1997 and 2005, of the patients who visited regional dental clinics and private clinics nationwide (Department of Oral and Maxillofacial Surgery, Chosun University Dental College; Department of Oral and Maxillofacial Surgery and dental clinics, Seoul National University Bundang Hospital; Department of Oral and Maxillofacial Surgery, Chonnam University Dental School; dental clinics, Daedong Hospital; All Dental Private Office) and underwent the OSSTEM® US II system implant procedure, our multicenter retrospective study examined 44 completely edentulous patients (meanage 63.3 years) who received 276 implants. The following results were obtained.

Results

1. Eight of the 44 patients had systemic diseases, including 3 patients with diabetes, 2 patients with cardiovascular disease, and 1 patient each with cerebral infarction, hypertension, bronchial asthma, and Parkinson's disease.
2. The oral hygiene of the 44 patients was classified as good in 36 patients, somewhat poor in 7 patients, moderately poor in 1 patient, and very poor in 0 patient.
3. Of the implants installed, 80 were 20 mm long, 65 were 11.5 mm long, 64 were 13 mm long, and 37 were 15mm long; 175, 52, and 23 implants had diameters of 4.0, 3.75, and 3.3 mm, respectively.
4. When opposing teeth were encountered, 60 were natural teeth, 13 were porcelain, 40 had gold crowns, 7 were resin teeth, 90 were total dentures, and 66 were implant-repaired opposing teeth.
5. After implant installation, no bone resorption of the alveolar crest occurred in 181 cases, and more than 1 mm of bone loss took place in 44 cases.
6. The mean calculus index for the soft tissues near the implants in 215 cases was 0.11, and the gum inflammation index assessed in 226 cases averaged 0.34. The plaque index measured in 225 cases averaged 0.55, and the width of the attached gingiva measured in 222 cases averaged 2.05 mm.
7. For implant surgery, no additional surgery was performed in 161 cases (58.3%); maxillary sinus elevation via a lateral window was performed in 45 cases (16.3%); guided bone regeneration (GBR) was performed in 42 cases (15.2%); simultaneous maxillary sinus elevation and GBR were performed in 6 cases (2.1%); and veneer grafting was performed in 10 cases (3.6%).
8. According to the implant method, two implants installed with sinus lifting via a lateral window failed, for a survival rate of 95.55% (43/45). Temporary complications developed with the other procedures, but were resolved in all cases, giving good results.
9. Of the 276 implants installed, two failed and were removed for a final survival rate of 99.27%.

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Table 1. Distribution of implants by site

	Maxilla	Mandible
Incisor	73	60
Premolar	55	34
Molar	44	10
Total	172	104

Table 2. Distribution of implants by length and diameter

		Maxilla	Mandible
Length	8.5	3	
	10	5	
	11.5	65	
	13	64	
	15	37	
	18	22	
	20	80	
Diameter	3	1	
	3.3	23	
	3.75	52	
	4.0	175	
	4.5	3	
	5.0	9	
	5.5	13	

Table 3. Distribution of opposite prostheses

condition	No.of implants
Complete denture	90
Implant prosthesis	66
Natural tooth	60
Gold crown tooth	40
Ceramic tooth	13
Acrylic resin tooth	7

Table 4. Distribution of implants by bone resorption(I)

Amount of bone resorption(mm)	No.of implants
0	181
0.3	1
0.4	1
0.5	2
0.7	1
0.8	1
1.0	25
1.5	1
2.0	9
3.0	9
None	45

Table 5. Distribution of implants by bone resorption(II)

Amount of bone resorption(mm)	No.of implants
None	181
0~0.9	6
1.0~2.0	35
〉2.0	9

Table 6. Distribution of surgical technique

operation methods	No.of implants
Conventioonal method	58.3%(161/276)
SL via lateral window	16.3%(45/276)
GBR	15.2%(42/276)
Veneer	3.63%(10/276)
SL via osteotome technique	2.1%(6/276)
DO	1.5%(4/276)
Split crest	1.5%(4/276)
Onlay	1.5%(4/276)

SL:sinus litt, GBR:guided bone regeneration, DO:distraction osteogenesis

Table 7. Survival rate according to surgical technique

operation methods	No.of implants
SL via lateral window	95.55%(43/45)
SL via osteotome technique	100%(6/6)
GBR	100%(42/42)
Veneer	100%(10/10)
Onlay	100%(4/4)
DO	100%(4/4)
Split crest	100%(4/4)
Conventioonal method	100%(161/161)

SL:sinus litt, GBR:guided bone regeneration, DO:distraction osteogenesis

Table 8. Survival rate on total implant

Implant statue	No.of implants
survival count	274
fail count	2
Total	276
survival(percentage)	99.27%

Conclusions

As a result, we got the excellent clinical results of US II implant system in complete edentulous patients.

Inferior Alveolar Nerve Repositioning and Implant Placement; Case Reports

Young-Kyun Kim[1)]

Four patients with mandibular posterior edentulous ridge visited for implant treatment. The available bone height from the alveolar crest to inferior alveolar canal was deficient absolutely. I performed the inferior alveolar nerve repositioning and simultaneous implant placement (OSSTEM® US II) and got the favorable results. Healing period from implant placement to second surgery was 2 to 3 months. Followup period after prosthodontic loading ranged from 8 to 17 months. Mean marginal bone resorption was 0.9 ㎜. All implants functioned well, however, some neurologic problems remained.

Table 1. Summary of cases

Case	Age	Gender	Anesthesia	Area
1	50	F	General	45~47
2	61	M	General	36~37
3	51	F	General	44~47, 34~37
4	32	M	General	43~45

Table 2. Summary of surgery

Case	Approach	Implant	Area
1	Anterior	#45:4D/15L #46:4D/15L #47:4D/13L	Autograft BioOss®
2	Posterior	#36:5D/15L #37:5D/15L	Autograft Regenaform®
3	Posterior	#44:3.3D/13L #46:4D/11.5L #47:4D/15L #34:3.3D/11.5L #35:3.3D/11.5L #36:4D/11.5L #37:4D/11.5L	Autograft Orthoblast II®
4	Anterior	#43:3.3D/11.5L #44:3.3D/11.5L #45:3.3D/11.5L	Autograft®

Table 3. Follow up resuits

Case	Healing period (mon)	Loading period (mon)	Marginal bone resorption(mm)	Complicaton	Obstacle of daily life
1	3	17	#45:0.5 #46:0.5 #47:0	Neuropathic pain	Yes
2	2.5	15	#36:0.5 #37:0.3	Paresthesia	No
3	2	8	#44:0.7 #46:0.7 #47:0.7 #34:0.7 #35:0 #36:2.1 #37:1.7	Paresthesia	No
4	3	16	#43:2.8 #44:1.7 #45:1	No	No

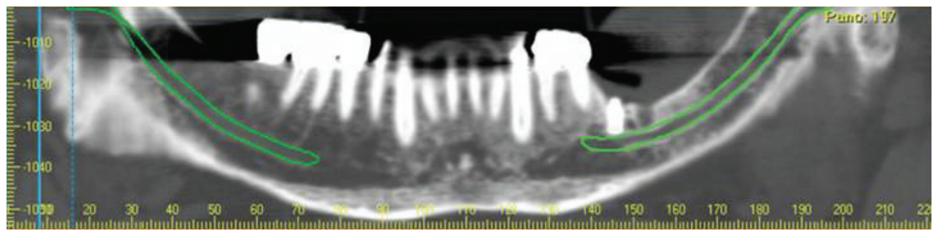

Fig 1. Pre-operative panorama

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Fig 2. Incision

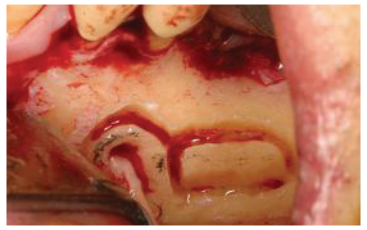


Fig 3. Posterior approach - bony window

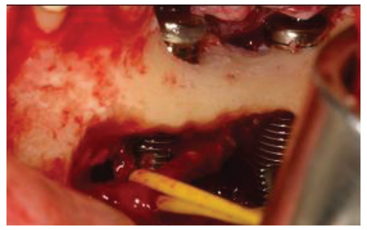


Fig 4. Elastic loop - implantation

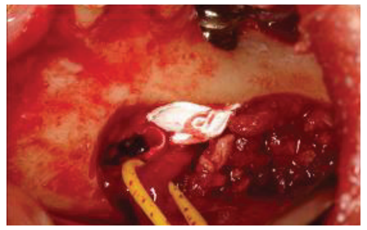


Fig 5. Bone graft with Biogide® membrane


Fig 6. Post-operative panorama

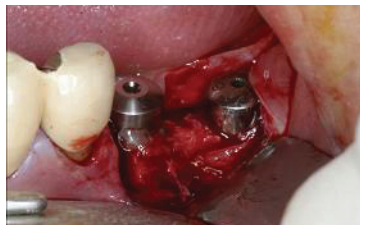
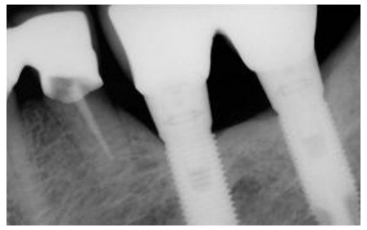


Fig 7. Post-operative 2.5 months


Fig 8. Final prosthesis fitted 1 year (paresthesia)



Aesthetic Implant Restoration through the Application of Zirconia Abutment

Hyun-Ju Kim[1)], Woon-Jung Noh[1)], Suk-Min Ko[1)*]

Introduction

The loss of teeth in the maxillary anterior is caused not only by periodontitis and dental caries but also by trauma; hence the high frequency among young people. The restoration of this area has conventionally been done using fixed bridges. Recently, however, an implant that enables preserving the adjacent teeth has been used. On the other hand, aesthetics is important for the anterior region. In certain cases, however, aesthetic restorations are hampered by the implant installation site, poor angulation, and metal exposure on the gingival margin. Considering its high light permeability, shade similarity to natural teeth, biocompatibility, hardness, aesthetics, and superior adaptability to the connecting part, Zirconia can be applied as abutment in the anterior region where aesthetics is a factor.

This study presents cases wherein aesthetic restorations were successfully done using zirconia abutment (ZioCera Abutment, OSSTEM®) and ceramic crowns in case of metal exposure, poor implant angulation, and low installation depth.

Case 1.

Thin gingiva (F/42)
CC #11, 21 root rest
Restoration area 11i, 21i
(Immediate implantation following extraction)


Fig 1.~6.

Case 2.

Implant location & angle (F/53)
CC #22 mob (+++)
Restoration area 22i
(Immediate implantation following extraction)

Fig 7.~12.

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Case 3.
High-level implant (F/56)
CC Severe periodontitis
Restoration area 12i, 11i, 21i, 22i

Fig 13.~18.

Conclusions

A beautiful smile requires the shape and shade of the maxillary incisor to be in harmony with the soft tissue. In the case of the maxillary anterior region, obtaining successful treatment results by simply restoring the masticatory function is impossible; the teeth, gingiva, and bone must be in harmony for aesthetic restoration. In this case, the use of Zirconia abutment addressed the problem of metal abutments and reconstructed the natural tooth shape and shade. Continuous long-term follow-up is necessary for the observation of the prognosis.

Restoration of the Mandibular Overdenture Using OSSTEM® Implants

Min-Seok Oh[1)], Su-Gwan Kim[1)*], Hak-Kyun Kim[1)], Seong-Yong Moon[1)]

This study was conducted to propose a clinical treatment protocol for implant installation for totally edentulous patient and evaluate the stability of the implant. We evaluated the bone quality, implant position and implant stability by periotest and osstel mento We installed OSSTEM® implant into lower full edentulous ridge. After using temporary implant prothesis, we conducte mobility using periotest and Osstell Mentor® We evaluated the stability of the OSSTEM® implant by periotest. The mobility result showed that the bone-implant stability decreases during the first month and increased after 2 months. The mandibular posterior showed relatively lower stability compared to the anterior.

Introduction

From the initial grafting performed by Gustav Dahl in 1942, the full edentulum, subperiosteal implant treatment has reached its current stage through technical progress to a simple and precise treatment and design evolution covering even occlusal distribution.

OSSTEM® Implants offer a straight-body US II with external hexagon connection, a double tapered-body US III with superior early bonding for vulnerable bone, and a one-stage method US IV with external connection. For internal connection, SS I, which has the same body and screw thread as ITI products, straight body SS II with internal 8" morse taper connection, and SS III with 8" morse taper connection as well as the same alveolar bone grafting area as US III are available. GS II and GS III employ internal 11" taper connection with grafting at the bone level and offer superior joint stability to help prevent bone loss.

This study sought to report the satisfactory case result of full subperiosteal implant grafting using direct bone impression as conducted for the case of early loss of maxillary and mandibular teeth caused by a periodontal ailment, mandibular bone recession, and failure to endure the load of the existing denture.

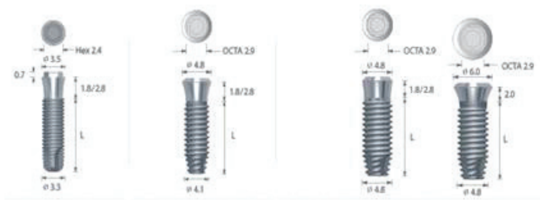


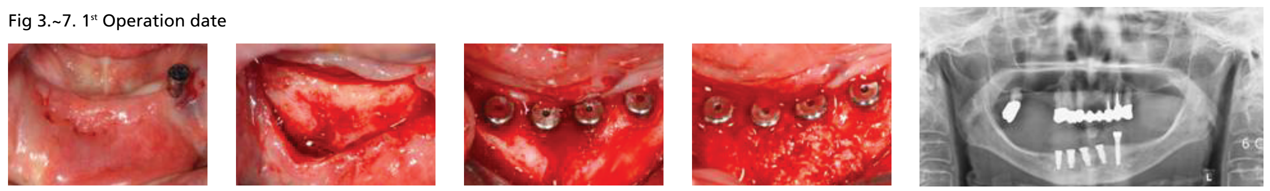
Fig 1. OSSTEM® SS System

Case Report

Patient Age/Sex: 77 years/Female
C/C: Needs rework of full denture
PMH: Non-specific
Tx plan
1. Implantation on #31,32,41,43
2. Prosthodontic reconstruction

Fig 2. 1st Visit, panoramic view

Fig 3.~7. 1st Operation date



Dept. of Oral and Maxillofacial Surgery, College of Dentistry, Chosun University, South Korea

US System Clinic

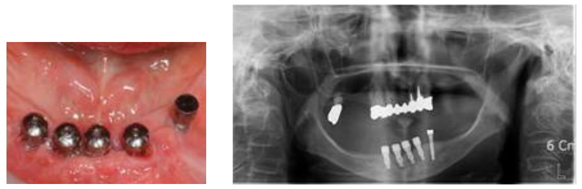


Fig 8.~9. 2nd operation date (post op, 4 months)

Fig 10. Post op (6 months)

Fig 11. Post op (10 months)

Fig 12. Post op (10 months, intra-oral view)

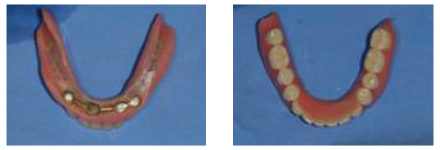


Fig 13. 14. Final complete denture

Patient Age/Sex: 46 years/Male
C/C: For consulting on implant surgery and prosthetic treatment
PMH: Non-specific
Tx plan
1. Upper = 4-implants and denture
2. Lower = 4-implants & 9 units of Cr & Br
*The use of stent is anticipated by duplicating the existing denture.

Fig 15. 1st visit, panoramic view

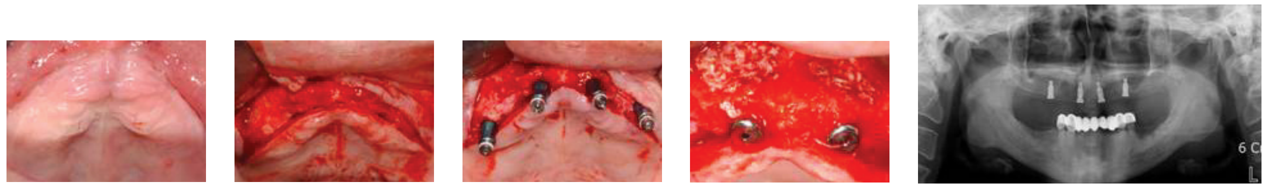


Fig 16.~20. 1st operation date

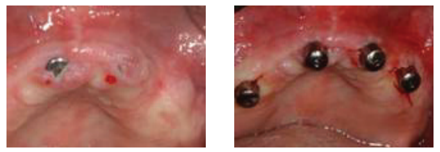


Fig 21. 22. 2nd operation date (post op, 8 months)

Fig 23. After the 2nd surgery implantation

Fig 24. Metal framework application

Fig 25. After the final prosthodontic treatment

Conclusions

The completely edentulous patient who underwent subperiosteal implant grafting recovered his maxillary and mandibular occlusal function and masticatory function with aesthetically good result. Further study is necessary for a prosthesis that enables the efficient distribution of occlusion force.

Retrospective Multicenter Cohort Study of the Clinical Performance of 2-stage Implants in South Korean Populations

Seok-Min Ko[1)*], Jeong-Keun Lee[2)], Steven E. Eckert[3)], Yong-Geun Choi[4)]

Purpose

To evaluate long-term follow-up clinical performance of dental implants in use in South Korean populations.

Materials and Methods

A retrospective multicenter cohort study design was used to col-lect long-term follow-up clinical data from dental records of 224 patients treated with 767 2-stage endosseous implants at Ajou University Medical Center and Bundang Jesaeng Hospital in South Korea from June 1996 through December 2003. Exposure variables such as gender, systemic disease, location, implant length, implant diameter, prosthesis type, opposing occlusion type, and date of implant placement were collected. Outcome variables such as date of implant failure were measured.

Table 1. Patient Characteristics

Characteristics	Women	Men
No. of implants	296	471
No. of patients	103	121
No. of patients having systemic diseases	8	13
Mean age (SD)	43.8(12.8)	46.7(12.7)
Range of age	18.8 to 70.7	17.1 to 71.7

Results

Patient ages ranged from 17 to 71.7 years old (mean age, 45.6 years old). Implants were more frequently placed in men than in women (61% versus 39%, or 471 men versus 296 women). Systemic disease was described by 9% of the patients. All implants had hydroxyapatite-blasted surfaces. Most of the implants were 3.75 mm in diameter. Implant lengths 10 mm, 11.5 mm, 13 mm, and 15 mm were used most often. Differences of implant survival among different implant locations were observed. Implants were used to support fixed partial dentures for the majority of the restorations. The opposing dentition was natural teeth for about 50% of the implants. A survival rate of 97.9% (751 of 767) was observed after 4.5 years (mean, 1.95±1.2 years).

Table 2. Implant Characteristics

		n	%
Length*	7mm	2	0.3
	8.5mm	24	3.6
	10mm	91	13.6
	11.5mm	130	19.4
	13mm	232	34.7
	15mm	157	23.5
	18mm	33	4.9
Diameter†	3.3mm	23	2.9
	3.75mm	604	84.0
	4.0mm	64	9.0
	5.0mm	26	4.0
	5.5mm	1	0.1

		n	%
Location	Maxilla		
	Anterior	105	13.7
	Premolar	58	7.6
	Molar	81	10.6
	Mandible		
	Anterior	67	8.7
	Premolar	116	15.2
	Molar	338	44.2

*Unspecified for 99 implants
†Unspecified for 49 implants

Table 3. Implant Failure by Anatomic Location

Implant location	No. of failures	Total no. of implants	%
Maxilla			
Anterior	3	105	2.85
Premolar	1	58	1.72
Molar	5	81	6.17
Mandible			
Anterior	0	67	0
Premolar	4	116	3.45
Molar	3	338	0.89

Table 4. Prosthesis Characteristics

		n	%
Prosthesis	Single	149	20.6
	Fixed partial denture	530	73.3
	Overdenture	44	6.1
Opposing occlusion	Partial/Fixed partial denture	248	33.7
	Crown	56	7.6
	Edentulous	23	3.0
	Natural tooth	363	49.3
	Removable denture	47	6.4

Table 5. Implant Failure and Survival by Year

Year	Implants at start of interval	Implants lost to follow-up	failures	% of total ailures	Cumulative survival(%)
1	767	754	13	81.3	98.3
2	754	752	2	12.5	98.0
3	752	751	1	6.2	97.9
4	751	751	0	0	97.9
4.5	751	751	0	0	97.9

Conclusions

Clinical performance of 2-stage dental implants demonstrated a high level of predictability. The results achieved with a South Korean population did not differ from results achieved with diverse ethnic groups. (Cohort Study)

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Analysis of clinical application of OSSTEM®(Korea) implant system for 6 Years

Young-Kyun Kim[1)*], Pil-Young Yun[1)], Dae-Il Son[1)], Bum-Soo Kim[1)], Jung-Won Hwang[2)]

Purpose

We evaluated various applications and clinical outcomes of OSSTEM® implants installed by an oral and maxillofacial surgeon from January 2000 to December 2005 retrospectively.

Material and Methods

1. Total 534 fixtures of OSSTEM® implant system were installed to 133 patients.
2. The patients ranged from 20 to 95 years in age (mean 51.5). There were 72 male and 61 female patients.
3. From the 534 fixtures, 305 fixtures were installed in mandible and 229 fixtures in maxilla.

Results

1. The major operating method was guided bone regeneration with implant fixture installation (66 patients), followed by osteotome technique (32), simple technique without supplementary procedure (28), and others.
2. From the 534 fixtures in 133 patients, early failure of implant was found in 13 fixtures (2.4%) from 10 patients (7.5%). From the 318 fixtures in 98 patients who have functioned for more than 1 year after prosthesis delivery, there were two failures and 97.6% 6-year cumulative survival rate. One case failed after 2.5 years, and the other case after 4 years.
3. Major causes of early failure were detected as lack of initial stability (4 patients).

Table 1. Surgery distribution

Surgery	Number
Simple placement	28
GBR	66
Sinus bone graft	22 (simultaneous: 20 delayed: 2)
Extraction and Immediate placement	20
Osteotome Tq.	32
Redge splitting	7
Inferior nerve Repositioning	4
Distraction osteogenesis	3
Segmental osteotomy	4
etc	17

Table 3. Early failure according to surgery

Types of surgery	No. of patient	No of fixtures
Ext. and immediate implant, GBR	2	3
Simple placement	3	4
BAOSFE	1	1
Sinus graft and simultaneous placement	3	4
Sinus graft and delayed placement	1	1

Table 2. 6-year cumulative survival rate

Period(F/U) (year)	Number Of Implants	survival	failure	Failure rate (%)	Drop-out	Survival rate(%)
Placement ~ 1	534	521	13	2.4		97.6
1-2	308	318	0	0	216	97.6
2-3	129	128	1	0.8	189	96.8
3-4	101	100	1	1	28	95.8
4-5	81	81	0	0	20	95.8
5-6	81	81	0	0	0	95.8

Conclusions

From the results of our mid-term and short-term follow-up study, OSSTEM® implant system showed good clinical outcomes and high success rate. Furthermore, in spite of extensive surgical procedure, excellent final clinical results were obtained.

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A Clinical Study of Implant Installation with Maxillary Sinus Augmentation by Lateral Window Technique; 4-Years Experience

Min-Suk Kook[1)], Jin-Suk An[1)], Hong-Ju Park[1)], Hee-Kyun Oh[1)*]

Introduction

Protocol of sinus augmentation procedure

- Chonnam National Univ.-

Residual bone height	Method	Timing of installation
10 mm	OSFE (0-2mm)	Simultaneous
10 - 7 mm	BAOSFE (2-4mm)	Simultaneous
7 - 3 mm	One-step lateral window	Simultaneous
< 3 mm	One-step with block bone	Simultaneous
	Two-step lateral window	4 - 5 mo later

Donor site for subantral bone graft

Ramus
- unilateral subantral graft

Chin
- bilateral subantral graft
- combined with other graft (onlay graft)

Ilium
- bilateral subantral graft
- combined with other graft (onlay graft)

Mx tuberosity
- residual bone height: > 6mm
- BAOSFE

Materials and Methods

Patients

- 87 patients (male: 53, female: 34) who were received sinus bone graft with lateral window technique from January, 2003 to January, 2007
- Mean age: 56.5 years (24-75 years in range)
- Mean follow-up periods: 28.2 months (2-48 months in range)

Lateral window technique


Fig 1. Preoperative state (#16,17)


Fig 2 . Trapdoor window by round bur


Fig 3. Tapping the trapdoor


Fig 4. Sinus membrane elevation by elevation curette


Fig 5. Sinus elevation curette


Fig 6. Bone harvesting

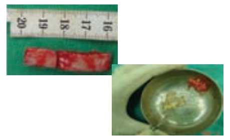

Fig 7. Chin block bone DFDB + particulated bone


Fig 8. Greenplast® application

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US System
Clinic

Results

Table 1. Distribution of patients according to ages

Age	Male		Female	
	N	%	N	%
21-30	1	1.9	0	0
31-40	3	5.7	4	11.8
41-50	10	18.9	9	26.5
51-60	25	47.2	15	44.1
61-70	12	22.6	6	17.6
71-	2	3.8	0	0
Total	53	100	34	100

Table 2. Types of graft Material

	Bone graft material	Total
Bilateral	Iliac bone + DFDB : 6	
	Iliac bone : 6	
	Chin bone + DFDB (Bio-oss) : 6 (1)	
	Ramal bone + DFDB (Bio-oss) : 3 (11)	36
	Chin bone + Ramal bone + DFDB : 1	
	Tuberosity bone + DFDB : 1	
	Chin bone + Ramal bone + Bio-oss : 1	
Unilateral	Iliac bone + DFDB : 1	
	Chin bone : 2	
	Chin bone + DFDB (Bio-oss) : 9 (3)	
	Ramal bone + DFDB (Bio-oss) : 6 (17)	51
	Ramal bone : 10	
	Chin bone + Ramal bone : 1	
	Tuberosity bone + Bio-oss : 1	
	Torus bone + DFDB : 1	

Table 3. Simultaneous vs delayed installation

	No. of sinus graft	No. of implants (mean number)	No. of failure
Simultaneous	89	249(2.8)	2
Delayed	44	141(3.2)	0
Total	123	390(3.2)	2

Table 4. Timing of implant installation

Residual bone height	Simultaneous installation	Delayed installation
>7mm	32	3
7-3mm	27	14
<3mm	2	6
Total	61	23

Table 5. Mean healing period of secondary uncovering surgery

Residual bone height	Mean healing period (months)
>7mm	7.1(5.8)
7-3mm	7.2(5.11)
<3mm	7.5(6.11)
Total	7.2(5.11)

Table 6. Average length of implants in sinus bone graft

Residual bone height	Simultaneous installation	Delayed installation
>7mm	13.3mm	13.0mm
7-3mm	13.2mm	13.1mm
<3mm	13.0mm	13.1mm

Table 7. Surface type of implants

Surface type	Simultaneous installation (%)	Delayed installation (%)	Total (%)
HA (Replace)	91 (23.3)	158 (40.5)	249(63.8)
RBM (OSSTEM®)	44 (11.3)	97 (24.9)	141 (36.2)
Total	135 (34.6)	255 (65.4)	390(100)

Table 8. Survival rate of implants

Simultaneous installation

Residual bone height	No. of fixture	No. of failure	Survival rate
>7mm	106	2	98.1%
7-3mm	132	0	100%
<3mm	11	0	100%
Total	249	2	99.2%

Delayed installation

Residual bone height	No. of fixture	No. of failure	Survival rate
>7mm	9	0	100%
7-3mm	48	0	100%
<3mm	84	0	100%
Total	141	0	100%

Table 9. Mean period of implant installation in delayed installation

Residual bone height	Timing of installation (months)
>7mm	6.0(5.7)
7-3mm	6.4(3.7)
<3mm	6.7(4.7)
Total	6.1(3.7)

Table 10. Complications of recipient site

Complication	Number of sinus (%)
Exposure of cover screw	8(6.5)
Infection of sinus	4(3.3)
Sinus membrane tearing	9(7.3)
Ecchymosis	42(34.1)
Swelling	102(82.9)

Summary

1. Protocol of sinus elevation procedure was determined by residual bone height and initial stability of implant.
2. Delayed implant installation was performed in case of Mx sinusitis, deficient residual bone, and combined onlay bone graft.
3. In delayed installation, mean healing period after subantral bone graft was 6.1 months (3-7months in range).
4. Autogenous bone or autogenous bone mixed with allografts or xenografts were used as graft material.
5. No membrane was used on the bony window and Greenplast® was applied to the grafted bone.
6. Temporary prosthetic restoration was used for 2-4 months before final restoration.

US System Clinic

Retrospective Study of OSSTEM® Dental Implants; Clinical and Radiographic Results of 2.5 Years

Sun-Hee Oh[1)], Taek-Ga Kwon[1)], Young-Kyun Kim[2)], Jung-Won Hwang[1)*]

Introduction

Over the last years, domestic implant systems have been growing in dental implant market of South Korea, and growing attention has been paid to the several domestic implant systems. This study presents results of a clinical trial of OSSTEM® (Seoul. Korea) implants followed up to 30months.

Materials and Methods

Three hundred seventy-one OSSTEM® implants were investigated which were placed in 87 patients between June 2003 and December 2005. The average follow-up period from implant placement was 15.4months (SD8.1 months) and mean loading period was 10.6months (SD7.1months). Survival rate of implants was evaluated. For the evaluation of marginal bone changes, only the implants in function more than 12 months were considered. Crestal bone loss of 115 implants(mean loading period of 17.1±3.9months) was analyzed using linear radiographic measurements.

Table 1. Distribution of patients according to sex and age

Age	Male	Femate	Total	%
20-29	0	2	2	2
30-39	4	1	5	6
40-49	13	9	22	25
50-59	12	12	24	28
60-69	12	12	24	28
70-79	4	4	8	9
80-89	0	2	2	2
Total	45	42	87	100

Table 2. Distribution of implants according to position

Position		No. of implants	%
Upper	Anterior	41	11
	Premolar	37	10
	Molar	55	15
Lower	Anterior	60	16
	Premolar	55	15
	Molar	128	33
	Total	371	100

Table 3. Distribution of implant types

Fixture type		No. of implants		%	
Submerged	US II	159	170	43	46
	US III	6		2	
	GS II	5		1	
Non-Submerged	SS II	5	201	1	54
	SS II	196		53	
	Total	371	371	100	100

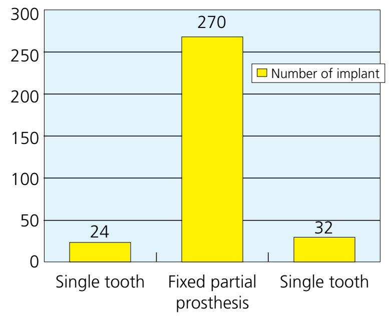

Fig 1. Distribution of implants according to type of prosthetic restoration

Table 4. Distribution of implant according to length and diameter

Diameter (mm)	Length(mm) 8.5	10	11.5	12	13	15	Total	%
3.3	0	2	16	0	15	1	34	9
3.75	5	1	6	0	10	2	24	6
4	12	14	34	0	28	7	95	26
4.1	6	1	57	0	30	11	115	31
4.5	0	2	2	0	0	0	4	1
4.8	1	14	50	2	19	0	86	23
5	0	5	7	0	1	0	13	4
Total	24	49	172	2	103	21	371	100
%	6	13	46	1	28	6	100	

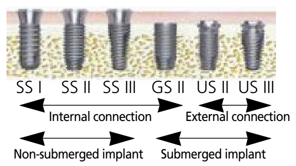

Fig 2. Fixture types

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[2)]Dept. of Prosthodontics, Seoul National University Bundang Hospital, South Korea

- **Clinical Evaluation**

The average follow-up period from implant placement was 15.4 months (SD 8.1, n=371) and mean loading period was 10.6 months (SD 7.1, n=326).

Implant survival criteria
- Buser D, Quintessence Int., 1994.-
- Absence of any complaints such as pain, dysesthesia, or paresthesia at the implanted area
- Absence of recurring peri-implant infection and/or suppuration
- no perceptible mobility
- no radiolucencies at the implant-bone junction.

- **Radiographic Evaluation**

For the evaluation of marginal bone changes, only the implants in function more than 12 months were considered. The crestal bone loss of 115 implants (mean loading period of 17.1±3.9 months) was analyzed using linear radiographic measurements. (standardized parallel periapical view technique).

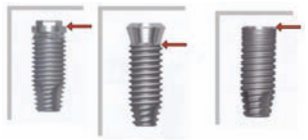

Fig 3. Reference point of each implant for radiographic evaluation

Table 5.

Implant type	Thread pitch
US II	0.6mm
SS II	1.25mm
SS II GS II US III	0.8mm

Results

- **Clinical Outcomes**

There were 9 implants failed in six patients. One male patient had failure of four implants. All of the nine implants were early failed before prosthetic treatment and the failures occurred in the maxilla where sinus or nasal cavity bone graft procedures were applied (Table V). The short-term survival rate of OSSTEM® implant was 97.6%. There were only 2 cases of mechanical problem (screw loosening) of implant components among the prosthetic complications (Table VI).

- **Radiographic Outcomes**

The marginal bone level from the reference point at the beginning and 1 year after functional loading was 0.52mm (SD 0.71) and 0.71mm (SD 0.86), respectively. The mean marginal bone loss during mean mean loading period (17.1±3.9months) was 0.21mm (SD 0.34)(n=115) (Table VII). Submerged implants (US II) showed significantly more marginal bone loss than non-submerged implants (SS I and SS II) (P<0.001).

Table 6. Failures of implants

Patient	Sex/Age	Fixture type	Site	GBR	Timing of failure (month)
1	F/45	submerged(US II)	#16	Sinus elevation *(window opening)	1.5
2	M/42	Non-submerged(SS II)	#46	Thin ridge *(buccal GBR)	1.5
3	F/64	Non-submerged(SS II)	#17	Sinus elevation *(window opening)	2.5
4	M/48	Non-submerged(SS II)	#15	Sinus elevation *(window opening)	3.0
5	M/40	Non-submerged(SS II)	#16	Sinus elevation **(window opening)	4.5
6	M/56	submerged(US II)	#11,15,22,24	Lefort I and iliac bone graft *	2.0

* Delayed implantation ** Simultaneous implantation

Table 7. Prosthetic complications.

Type of prosthesis	Complication	No. of patient
Single crown	Screw loosening	1
Fixed partial prosthesis	Artificial tooth fx.	2
	Metal framework fx.	1
Overdenture	Screw loosening (2 implants, one time)	1
	Artificial tooth fx.	1
	O-ring change (three times)	2
	Bar clip change	2
Total		10

Table 8. Marginal bone loss according to the fixture type.

	No. of Implants	Mean (SD) (mm)
US II	64	0.31(0.36)
SS I	5	0.00 (0.00)
SS II	46	0.07 (0.26)
Total	115	0.21(0.34)

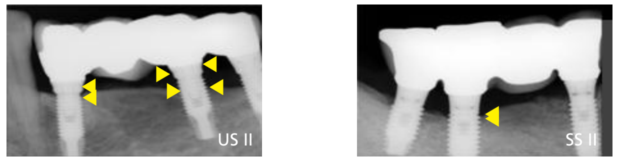

Fig 4. Radiographic finding of marginal bone resorption

Conclusions

The results obtained in this short-term retrospective study population revealed an excellent survival rate and marginal bone response for OSSTEM® Implants.

US II Implantation Using SimPlant Software in a Maxillary Edentulous Patient; A Case Report

Ju-Rim Sun[1], Su-Gwan Kim[1]*, Hee-Yeon Choi[1], Jong-Woon Kim[1], Ho-Bin Lee[1], Jung-Yeop Park[1], No-Seung Park[1], Sang-Yeol Kim[1], Su-Kwon Kim[1], Ki-Pyo No[1], Young-Hoon Won[1]

The SimPlant software is a three-dimensional oral implant treatment-planning software that is used for treatment planning in patients, after converting a computed tomography image. The software ensures appropriate fixture placement, implant diameter and length, and the construction of an appropriate surgical template (SimPlant SurgiGuide). We report the case of a maxillary edentulous patient treated with the aid of SimPlant software.


Fig 1. Intra-oral view


Fig 2. Pre-operative cast

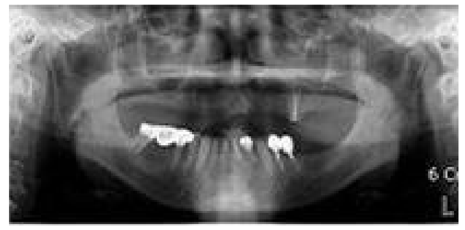
Fig 3. Pre-operative panorama


Fig 4. Axial view

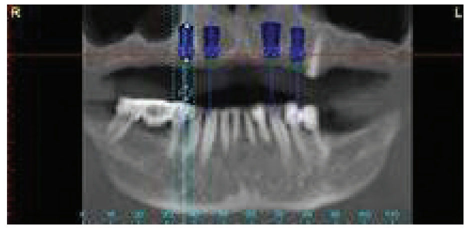
Fig 5. Panorama

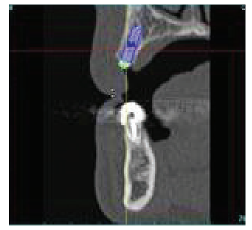
Fig 6. Cross section; #24

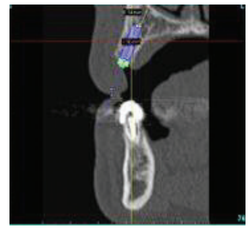
Fig 7. Measurement of distance

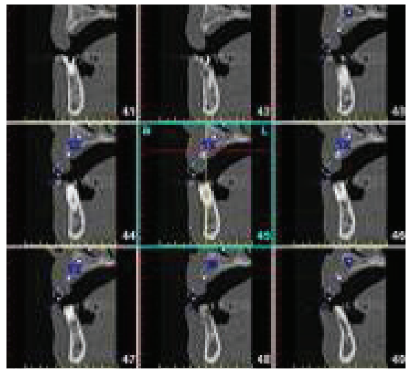
Fig 8. Cross section; #12

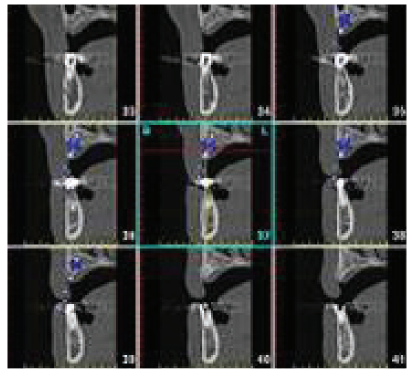
Fig 9. Cross section; #14

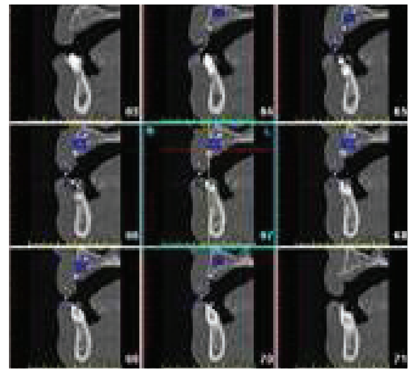
Fig 10. Cross section; #22


Fig 11. 3D (1)


Fig 12. 3D (2)

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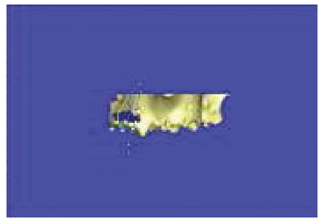
Fig 13. 3D (3)

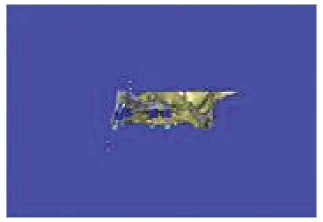
Fig 14. 3D (4)

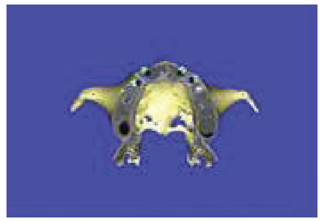
Fig 15. 3D (5)

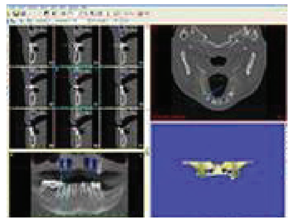
Fig 16. Final picture

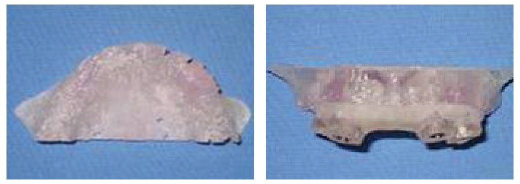
Fig 17. 18. Pre-operative anatomic model


Fig 19. surgical template


Fig 20. 21. Seat

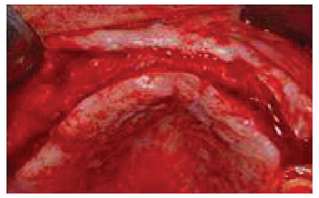
Fig 22. Incision

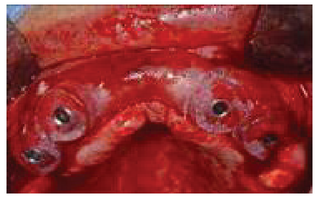
Fig 23. Seat

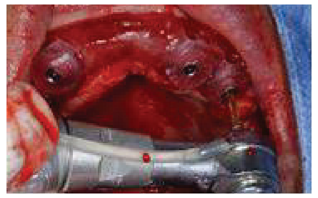
Fig 24. Drilling (1)

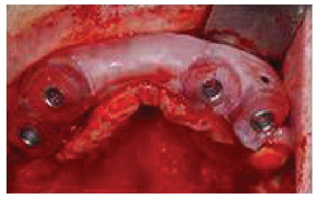
Fig 25. Drilling (2)

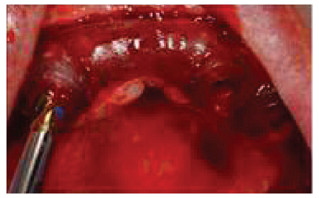
Fig 26. Drilling (3)

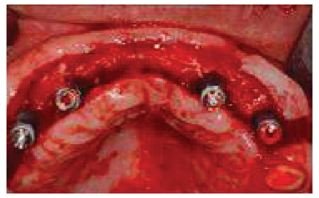
Fig 27. Fixation

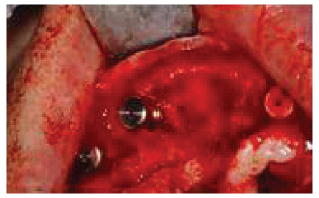
Fig 28. Defect


Fig 29. Graft

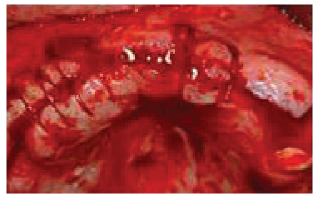
Fig 30. Suture

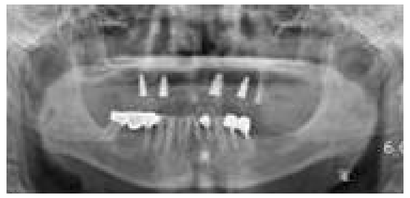
Fig 31. Post-operative panorama


Fig 32. Post-operative 3 weeks

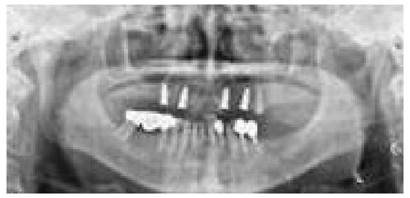
Fig 33. Post-operative 4 months

Vertical Ridge Augmentation and Implant Placement in Severe Bone Loss Area with Autogenous Bone and Bovine Bone

Jin-Hwan Kim[1)*], Dong-Uk Jung[1)]

Introduction

Severe bone loss may occur if a tooth used as abutment for a bridge is afflicted with advanced chronic periodontitis. For such area characterized by bone loss, a bone augmentation technique is required for implant placement. In this case, vertical alveolar bone augmentation surgery was performed on the area with bone defect and characterized by severe loss due to chronic periodontitis by placing an implant using the underlying residual bone and subsequently utilizing the implant (OSSTEM®, external-type fixture) as a tenting pole together with a combination of the absorbable membrane, autogenous bone, and xenograft. Free gingival graft was then performed on the upper jaw for the treatment of deficient soft tissue. Note that the survival of the free gingival graft was not

the main focus instead, the membrane was reduced as much as possible to prevent exposure during the healing process. Six months after the surgery, good osteogenesis was observed the satisfactory restoration of the molar area was also realized by inserting the final prosthesis in place.


Fig 1. Radiograph before the surgery


Fig 2. Occlusal view after the tooth extraction (severe bone loss)


Fig 3. Lateral view after the tooth extraction


Fig 4. Severe bone loss area


Fig 5. Collecting autogenous bone


Fig 6. Implant placement (OSSTEM® external type US II)


Fig 7. Autogenous bone and Bio-Oss


Fig 8. Absorbable membrane (fixing the membrane with cover screw)

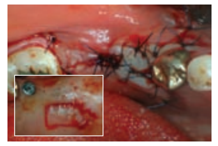
Fig 9. FGG and suture (filling in to make up for deficient soft tissue)


Fig 10. 10 days after the surgery (graft soughing)


Fig 11. Healing part 6 months after the surgery


Fig 12. Healing abutment after the second surgery


Fig 13. Occlusal surface of the final prosthesis in place


Fig 14. Lateral view of the final prosthesis in place (vertically augmented bone)

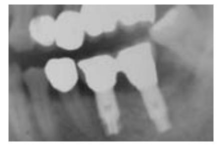
Fig 15. Radiograph after the insertion of the final prosthesis in place

Conclusions

Vertical bone augmentation was achieved in a single surgery to make up for deficient vertical bone. Osteogenesis was induced by minimizing the exposure of the absorbable membrane during the necrosis of the free gingiva thus contributing to implant success.

A risk-taking approach was taken instead of a step-by-step one for the patient's comfort, however, the frequency of surgery was reduced. Bone augmentation was also satisfactory.

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US System Clinic

Multicentric Prospective Clinical Study of Korean Implant System; Early Stability Measured by Periotest®

Young-Kyun Kim[1)*], Jung-Won Hwang[2)], Pil-Young Yun[1)],
Su-Gwan Kim[3)], Chae-Heon Chung[4)], Yong-Gun Choi[5)], Sung-Il Song[6)]

Purpose

A number of dental implant systems have been developed worldwide. And, on the base of experimental and clinical studies, considerable technical improvement and production of qualified dental implant system was accomplished. As a member of Korean implant system, OSSTEM® implant system has relatively long-term accumulated clinical data. Though there were many studies on the OSSTEM® implant system, multicentric prospective study has not been tried. The authors tried to evaluate the early stability using Periotst® value preliminarily.

Materials and Methods

The patients who had been operated from Jun 2003 to May 2004 in the Seoul National University Bundang Hospital, Chosun University Dental Hospital, Bundang Jesaeng General Hospital respectively were included. To evaluate factors associated with early stability, patients were classified according to gender, age, area of surgery, bone quality, width of alveolar ridge, type of implant, diameter and length of implant. Primary stability and secondary stability was measured by Periotest® device.

Results

Periotest® value at the time of implant placement was -1.7 in one-stage group. This value was significantly higher than that of two-stage group(+1.5). Diameter of implant was closely related with primary stability(p=0.001). Primary stability was fine(under the +3) in 73.1%(95/130) of implants and 96.2%(125/130) of implants showed fine secondary stability. There was significant difference between primary stability and secondary stability.

Table 1. Numeric variables

	minimum	maximum	mean(SD)
Age (years)	21	83	54.7(11.8)
Width of alveolar ridge (mm)	3.0	13.0	6.4(1.6)
Exposure of fixture thread (mm)	0	10	1.5(2.5)
Primary stability	-7.0	28.0	0.7(6.7)
Secondary stability	-6.0	15.0	-2.76(3.2)

Table 2. Clinical factors Vs. Primary and secondary stability

		Fixture number(※)	Primary stability	Secondary stability
Gender	Male	51(39.2)	1.0±7.0	−2.5±3.4
	Female	79(60.8)	0.5±6.6	−2.9±3.0
Age	〈55	63(48.5)	0.3±7.2	−3.1±2.9
	≥55	67(51.5)	1.1±6.2	−2.4±3.4

Table 3. Anatomic factors Vs. Primary and secondary stability

		Fixture number(※)	Primary stability	Secondary stability
Age	Mx. anterior	6(4.6)	2.5±8.4	−2.3±3.3
	Mx. premolar	14(10.8)	1.2±5.3	−2.7±2.8
	Mx. molar	22(16.9)	2.8±7.8	−1.8±2.3
	Mx. anterior	14(10.8)	5.7±9.2	−3.0±3.1
	Mx. premolar	17(13.1)	1.2±7.9	−2.6±4.9
	Mx. molar	57(43.8)	−1.8±4.0	−3.2±3.0
Bone quality	Type 1	32(24.6)	2.2±9.0	−2.5±4.7
	Type 2	64(49.2)	−1.5±4.5	−3.6±2.1
	Type 3	15(11.6)	0.7±4.2	−2.9±2.0
	Type 4	19(14.6)	5.7±7.3	−0.3±2.7
Width of aveolar rdge (mm)	≥6.0	75(57.7)	1.2±6.7	−2.2±3.6
	〉6.0	55(42.3)	0.0±6.7	−3.6±2.2

Table 4. Fixture factors Vs. Primary and secondary stability

		Fixture number(※)	Primary stability	Secondary stability
Fixture type	1 Stage	34(26.2)	−1.7±4.4	−2.7±4.7
	2 Stage	96(73.8)	1.5±7.2	−2.8±2.5
Age	≤4.0	85(65.4)	2.1±7.4	−2.7±2.4
	〉4.0	45(34.6)	−1.9±4.3	−2.8±4.3
Fixture length(mm)	≤11.5	75(57.7)	−0.5±6.0	−2.9±3.1
	〉11.5	55(42.3)	2.3±7.4	−2.6±3.3

Table 5. Surgical Vs. Primary and secondary stability

		Fixture number(※)	Primary stability	Secondary stability
Surgical type	Immediate	13(10.0)	10.2±9.8	−3.5±3.4
	Major GBR	27(20.8)	2.0±7.2	−1.8±2.5
	Simple	90(69.2)	−1.1±4.5	−2.9±3.3

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Fig 1. Immediate

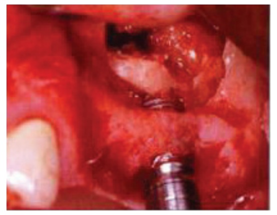
Fig 2. Major GBR


Fig 3. Simple

Table 6. Primary and secondary stability

		Fixture number(※)
Primary stability	≤0.0	83(63.8)
	〉0.0, ≤3.0	12(9.3)
	〉5.0	35(26.9)
Secondary stability	≤0.0	115(88.5)
	〉0.0, ≤3.0	10(7.7)
	〉5.0	5(3.8)

Table 7. Paired t-test: Primary stability Vs. Secondary stability

	t	dt	Sig.(2-tailed)
Primary stability-Secondary stability	5.989	129	.000

Table 8. The resuits of Pearson correlation test

Age	pearson Correlation
	Sig.(2-talled)
	N
Width of alveolar ridge	pearson Correlation
	Sig.(2-talled)
	N
Fixture diameter	pearson Correlation
	Sig.(2-talled)
	N
Fixture length	pearson Correlation
	Sig.(2-talled)
	N
Exposure of implant thread	pearson Correlation
	Sig.(2-talled)
	N
Primary stability	pearson Correlation
	Sig.(2-talled)
	N
Secondary stability	pearson Correlation
	Sig.(2-talled)
	N

*. Correlation is signiticant at the 0.05 level (2-telled)
**. Correlation is signiticant at the 0.01 level (2-telled)

Conclusions

From the analysis of preliminary data, satisfactory result was on the whole achieved. More reliable data for the additional radiographic and histomorphometric evaluation will be followed later from this multicentric prospective study.
Ultimately, this study will contribute to develop more adaptable and compatible to the Korean people specifically and to suggest a clinical evidences that many clinicians could select domestic implant system with confidence.

Retrospective Multicenter Study of OSSTEM® Endosseous Dental Implant

Jai-Bong Lee[1)*], Young-Soo Wang[1)], Kwang-Ho Shin[1)], Byung-Nam Hwang[1)]

Purpose

Osseointegrated dental implants have now become an accepted from of treatment for patients with a fully or partially missing dentition. The purpose of this study was to evaluate the performance of OSSTEM® implants in korea.

Materials and Methods

From December 1996 through October 1999, a total of 323 OSSTEM® implants were placed at 9 centers in the edentulous and partially edentulous jaws of 88 consecutive patients ranging in age from 18 to 79 years. The contents of questionnaires were the name of dental clinic and dentist, the issue year of dentist license, the history of OSSTEM® implant use, patient's name, gender, and age, anatomical 2 location of implant, diameter and length of implant, augmentation, first surgery date, second surgery date, prosthesis date, prosthesis type, abutment type, patient's satisfaction, any dissatisfaction and reasons, dentist's satisfaction, failure, failure date and reasons, and area of improvement.

Results

1. Both patients (94.4%) & doctors(93.5%) were satisfied with the results, in patient's aspect 'most satisfaction' cases were more common(52%).

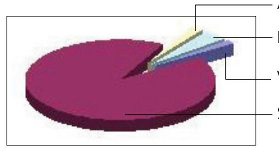

Fig 1. Doctor's satisfaction

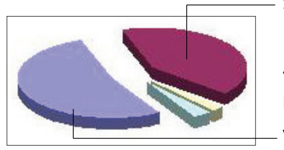

Fig 2. Patient's satisfaction

2. The length of fixture which was frequently used was 13㎜(142/319, 44.5%) followed by 15㎜ and 10㎜, and 3. 75㎜ diameter implant (239/319, 74.9%) was the most popularly used.
3. Mandibular posterior was the most common installation site (140/317, 43.8%).
4. A mean implant survival rate was 96.2%. That showed little difference which reported other paper. Cause of failure consisted of inflammation & infection-33.3%(4ea), fail of osseointegration-16.6%(2ea), pain during masticatory function-8.3%(1ea), improper prosthetic function & procedure-8.3%(1ea), implant mobility-8.3%(1ea).

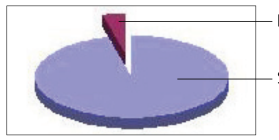

Fig 3. Success rate of the OSSTEM® implant

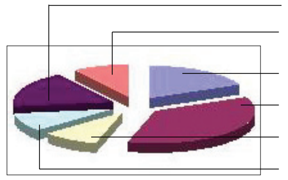

Fig 4. Cause of failure

5. The most popularly used types of abutment were the UCLA abutments(168/305, 55%).

Conclusions

Clinical performance of OSSTEM® implant prostheses at 9 dental clinics in South Korea demonstrated a high level of survival.

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The Effect of Surface Treatment of the Cervical Area of Implant on Bone Regeneration in Mini pigs

Jin-Yong Cho[1)*], Young-Jun Kim[1)], Min-Gi Yu[1)], Min-Suk Kook[1)], Hong-Ju Park[1)], Hee-Kyun Oh[1)]

Introduction

1) Immediate implant
- Schulte (1984): present the chance of success of immediate implant by using Tübingen implant (aluminium oxide)
- Krump and Barnett (1991): report the similar success rate between conventional implant and immediate implant

2) Advantage of immediate implant (Schwarts-Arad & Chaushu, 1997, Mayfield, 1999)
- Reduce the number of surgical procedures
- Preserve the dimensions of the alveolar ridge
- Reduce the interval between the removal of the tooth and the insertion of the implant supported restoration
- Establish proper implant position by using extraction socket

3) Healing of marginal bone defect after immediate implant
- Botticelli et al (2004): Marginal bone defects that occurred following immediate placement of implant after extraction were resolved by formation of hard tissue including optimal amounts of osseointegration.
- Akimoto et al (1999): At experiments in the dog in which implants with turned surface features were used, hard tissue defects failed to heal with proper osseointgration.

Purpose

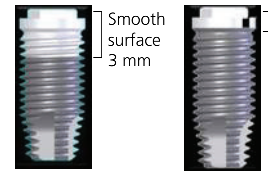
The present study was performed to evaluate the effect of surface treatment of the cervical area of implant on healing in fresh extraction socket following implant installation.

Materials and Methods

1) Materials

(1) Experimental animals: Four mini pigs, 18 months old and 30 kg weighted, were used.

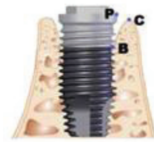
(2) Implant
- Control group: Thirty two US II implants (OSSTEM implant Co., Ltd., Korea) were installed in extraction socket. US II implant is hybrid implant which has machined surface at top and RBM surface at lower portion
- Experimental group: Thirty two US II Plus implants (OSSTEM implant Co., Ltd., Korea) which were treated with RBM over the surface were installed in extraction socket.



2) Methods

Under the general anesthesia, four premolars of the left side of the mandible and maxilla were extracted. US II implant and US II Plus implant were installed in the socket. Stability of implant was measured with Osstell™ (Model 6 Resonance Frequency Analyser: Integration Diagnostics Ltd., Sweden) at every 2 months. Animals were sacrificed at 4 months after experiment.

3) Evaluation
- **Macroscopic evaluation**: identify the healing state at experimental site
- **Histological evaluation**: H & E stained specimen using light microscope
- **Histomorphometric evaluation**: measuring the P-B distance under 40 HPF of light microscope
  P, platform of implant
  B, most coronal level of contact between bone and implant
- **Resonance frequency analysis**
- **Statistical analysis**: student t-test



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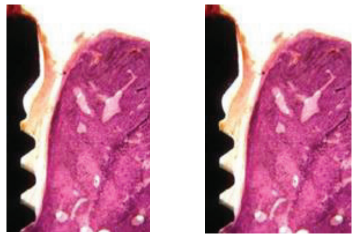
Results

1) Macroscopic findings

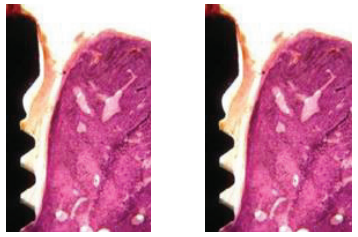
- Well healed soft tissue and no mobility of the implants were observed in both groups.

2) Histologic findings

- The ground sections illustrate the result of healing (X 40). In histologic findings, good osseointegration of implant was observed with RBM surface in both groups.
- In control group, the defect adjacent to coronal portion of control group separated from the implant surface by a layer connective tissue (A).
- The P-B distance ranged from 1.12 mm to 3.74 mm and from 0.99 mm to 3.75 mm after 2 months and 4 months of healing, respectively.
- In experimental group, the marginal defects exhibited substantial bone formation and high degree of osseointegration (B).
- The P-B distance ranged from 0.78 mm to 4.06 mm and from 0.39 mm to 2.64 after 2 months and 4 months of healing, respectively.



A. Control group



B. Experimental group

3) Histomorphometric analysis

The distance between implant platform (P) and the most coronal level of bone-to-implant contact (B)

Mean (SD)

	Control group		Experimental group
after 2 months	2.66(0.11)	*	1.80(0.13)
after 4 months	2.29(0.13)	*	1.25(0.10)

* p<0.05

The P-B distance were significantly decreased in implant which have RBM surface at cervical area. (p<0.05)

4) Resonance frequency analysis

RFA for US II and US II Plus after implantation, 2 months, and 4 months

Mean (SD)

	Control group		Experimental group
after implantation	64.67(1.39)		64.69(6.53)
after 2 months	67.83(1.48)		70.51(1.77)
after 4 months	69.60(0.97)	*	73.98(1.38)

* p<0.05

The stability of experimental group showed relatively higher RFA value than control group.

Conclusion

These results suggest that implant with rough surface at cervical area have an advantage in process of bone regeneration on defect around implant placed in a fresh extraction socket.

Histomorphometric Analysis of Different Type Immediate Loaded Implants in Human

Se-Hoon Kahm[1)*], Yong-Chul Bae[2)], Sung-Eun Yang[1)], Chang-Hyen Kim[1)], Je-Uk Park[1)]

Introduction

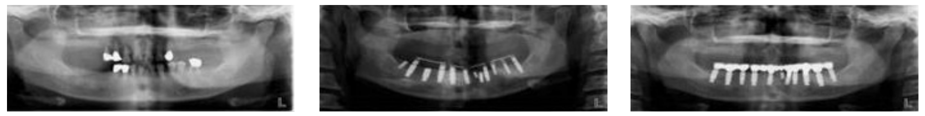
The immediate loading of implants appears to be a viable treatment option in the edentulous mandible. Some reports have shown favorable histologic results. Various designs of implant and prosthetic components are recommended by different manufacturers for immediate loading of implants. Various root form implants are successfully for immediate loading. Though histomorphometric studies in humans as well as in animals have been reported for some implant systems, a few showing remarkable results, it is not possible to extrapolate these results to other implant designs. The aim of this study was to perform a histologic and histomorphometric analysis of the peri-implant tissue reaction and bone-implant interface in 2 immediately loaded implants and 1 submerged implant from a patient after 4 months functional loading periods.

Materials and Methods

A 50-year-old patient with advanced periodontitis came in for restorative treatment. A complete denture and implant-fixed restoration were planned for the maxilla and the mandible, respectively. 12 implants were installed (10 GS II implants, 2 US II implants; 2 control: submerged D3.5 x L8.5mm GS II implant, 2 test: immediately loaded implants D3.3 x L8.5mm US II implant and D3.5 x L8.5mm GS II implant). 8 implants were immediately loaded including 1 US II implant and 1 GS II implant. 4 months later, 2 test implants (1 GS II implant, 1 US II implant) and 1 control implant(1 GS II implant) were retrieved with a trephine bur during second surgery. Histologic samples were prepared and examined by light microscope. Measured data were converted to digital images. The BIC (percentage of bone-to-implant surface contact, %), bone volume (proportion of mineralized bone within the limits of the three consecutive implant threads, %) of specimens were calculated with an image analysis software (Axiovision 4.1, Carl Zeiss, Germany). 2 additional implants (GS II implant, D5 x 13mm) were installed replacing test implants. After 2 months, the definitive prosthesis was delivered.

GS II Implant

US II Implant



Results

At low magnification, it was possible to observe that bone trabeculae was present around the implants. Areas of bone remodeling and haversian systems were present near the implant surface. In the control implant (GS II, submerged), the infiltration of inflammatory cells and retarded healing process were observed. However, compact, cortical and mature bone with well-formed osteons was present at the interface of the test implants (GS II, immediately loaded / US II, immediately loaded). BIC of control implant was 52.66±8.34% and bone volume of control implant was 12.63±7.17%. BICs of test implants were 82.96±15.60% in GS II immediate loaded implant, 70.02±2.99% in US II immediate loaded implant. Bone volumes of test implants were 65.63±5.79% in GS II immediate loaded implant, 67.73±2.35% in US II immediate loaded implant. Under light microscopy, it was possible to observe that the healing process and maturation of bone around the US II immediate loaded implant which was slightly better than GS II immediate loaded implant histologically.

GS II Submerged

X 50 magnification

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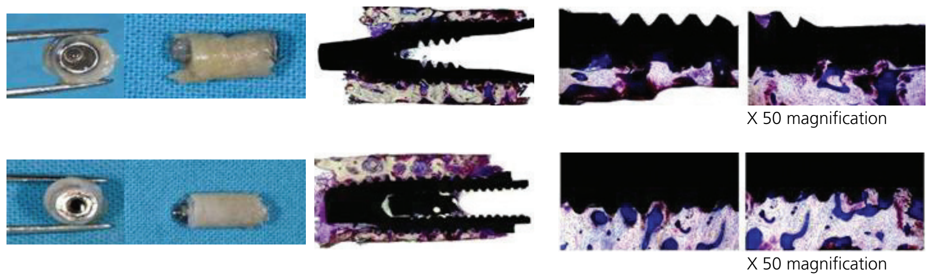
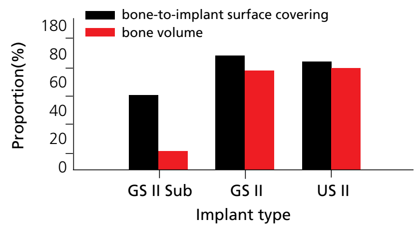
GS II Immediately loaded

US II Immediately loaded



	Percentage of bone-to-implant surface contact (BIC%)	Bone volume (%)
GS II Sub	52.66±8.34	12.63±7.17
GS II	82.96±15.60	65.63±5.79
US II	70.02±2.99	67.73±2.35



Discussion

2 immediately loaded implants showed higher BIC and bone volume values than 1 submerged implant. It seemed that the submerged implant had the initial problems such as overheating, poor stability, soft tissue invasion and so on. BIC and bone volume of 2 different implants were almost similar. Surface characteristics, thread designs, connection types, and inclusion of microthreads differ between US II implant and GS II implant. US II implant is hybrid type implant including main RBM surfaces and upper machined surfaces, traditional body designs, external connections. GS II implant is a dual-threaded internal connection type implant body with upper microthreads and CellNest surfaces (anodic oxidation treatment). Modification of implant designs, implant surface treatments, and connection types could contribute to more stable stress distribution, higher initial stability, enhanced biocompatibility to bone cells, and less micro gap. This study shows that BIC values of GS II implant were higher than US II implant's. However, this difference was not statistically significant. Due to the small sample size, statistical interpretation was not possible.

Conclusions

The histologic data showed that the osseointegration was achieved in immediately loaded implants surface treatments, micro-designs, connection types are all different in 2 tested implants. An implant design modification and an implant surface treatment can affect bone responses in immediate loading of implants. Maybe these developments could lead to favorable bone responses. However, more prospective studies and randomized controlled trials are needed.

Early and Immediately Loaded Implants in the Dog Mandible

Su-Gwan Kim[1)*]

Introduction

The recent study of Lekhdem and Testori reported the high, over 90% or 95% achievement rate of implantation. From the study of Branemark, there's necessity of immediate loading in partial and full edentulous patients for rapid, functional and esthetic recover, and it means a dramatic shortening of treatment time.

Shalak improved that the initial stability through mechanical anchorage is definitely important for immediately loaded implant.

Purpose

At this study, we implanted in the mandible of the dogs and gave early and immediate load by using provisional fixed bridges. Therefore, we consider the stability of early and immediately loaded implant as compared with peri-implant new bone formation rate.

Materials and Methods

For this experiment, we used the five, 10 to 15 kg weighed, 6-month-old dogs, and for implant products, the fifty US III RBM surface implants (OSSTEM implant Co., Ltd., Korea) of 4 mm diameter and 11mm length were used. Experimental group 1 is the one of early loading implant in the left mandible after 3 weeks installation. Experimental group 2 is the group of immediate loading implant in the right mandible. Each, the forefrontly installed, unloaded implant was established for control group.


US III Fixture

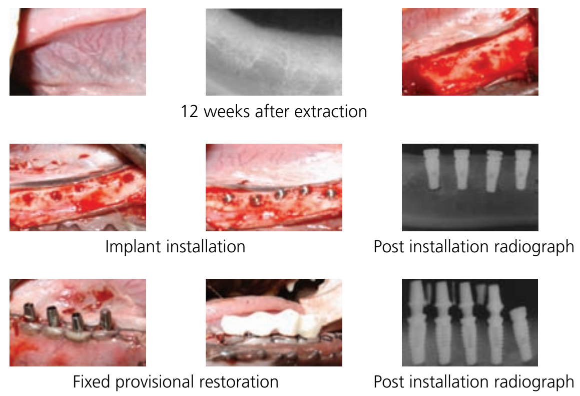
Experimental group 1	Early loading implant (post 3 weeks after installation) in the Left Mandible
Experimental group 2	Immediate loading implant in the Right Mandible
Control group	Submerged implant (Unloaded implant)

Three premolars and the first and second molars were removed from the left mandible under general anesthesia. 3 weeks later, the corresponding teeth were removed from the right mandible.

After the twelve weeks for healing, implantation and primary closure was operated in the left mandible.

The implant on right side were given a fixed provisional fixed bridge and immediately loaded, and at once, we connected abutments to the implants on left side, and the implants were also given a fixed provisional fixed bridge and immediately loaded.

Removal of PM1, 2, 3 and M1 of the Lt. Mandible
▼ 3 weeks
Removal of PM1, 2, 3 and M1 of the Rt. Mandible
▼ 9 weeks
Implant installation on left mandible and submerged
▼ 3 weeks
Implant installation on the right mandible and both fixed provisional restoration
▼
1st implant keeped submerging
▼ 16 weeks
Sacrifice of the animals



1)Dept. of Oral & Maxillofacial Surgery, College of Dentistry, Chosun University, Gwangju, South Korea

Results

1) Clinical examination
 (1) Three bridges in 3 dogs
 - Unilateral (left 2, right 1)
 - Partially lost at 8 weeks and 16 weeks
 (2) All implant - no mobile and no infection sign
 (3) Success & failure
 (4) Zablosky protocol (1980)
 - Implant stability
 - Retention of adequate bone level in X-ray
 - No infection sign

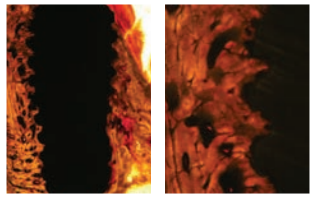
	N	Failed implant	Periotest (installation)	Periotest (16weeks)
Experimental group 1	20	0	-3.8(-6~-1)	-3.4(-6~+1)
Experimental group 2	20	0	-3.6(-5~-1)	-3.1(-6~+1)
Control group	10	0	-3.1(-5~-1)	-3.6(-6~-1)

2) Histologic examination

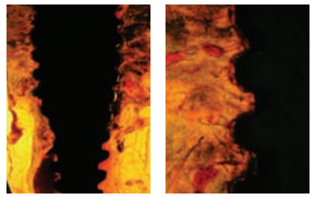
Experimental group 1 is the group of early loaded implants and shows that the bone was mature compared to the control group and the peri-implant bone had lamellar structure.

Experimental group 2 is the group of immediately loaded implants and histologic images are similar to group 1. Judging from density of lamellar structure, the bone was mature compared to the control group.

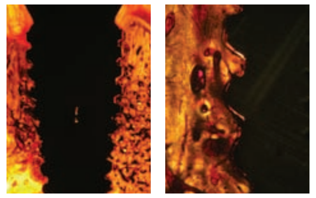
The bone of control was immature compared to the experimental groups. Histologic images of the control group and experimental group 1 and 2, showed fair bone contact between the implant and the bone, and there was seen no bone resorption.



Experimental Group 1



Experimental Group 2



Control Group

Distance between the implant top and the first implant-to-bone contact

	Mean	SD	Min	MAX
Experimental Group 1	0.79	0.61	0	2.1
Experimental Group 2	1.65	1.16	0.5	4.5
Control group	1.11	0.98	0	3

Conclusions

1. Clinical implant success rate
 - Control and experimental group: 100%
2. New Bone Formation rate
 - Significant difference between control and experimental group at 16 weeks
3. Distance between implant top and the first bone to implant contact
 - No significant difference between control and experimental group at 16weeks
4. Early and immediate loading in partially edentulous state
 - RBM surface implant
 - Good initial stability
 - Fixed provisional bridge → Expect good prognosis
5. Further evaluation
 - Long-term period

Surface Properties of Endosseous Dental Implant after Nd:YAG and CO_2 Laser Treatment at Various Energies

Su-Gwan Kim[1)*], Cheung-Yeoul Park[1)], Sun-Sik Park[1)], Myung-Duk Kim[2)], Tae-Gwan Eom[2)]

Introduction

Lasers have been used in dentistry since the 1960s to cut hard tissue. Following its development in the early 1960s, the carbon dioxide (CO_2) laser was rapidly introduced into medical research, every surgical specialty in medicine, and in dentistry. In dentisry, CO_2 laser was used mainly for the surgery of oral soft tissue. For some stomatologic lesions, surgery with CO_2 laser is the treatment of choice, while for other lesions the evidence for its use is still inadequate.

The purpose of this study was to compare the alterations of the titanium implant surface after using Nd:YAG and CO_2 lasers at various energies.

Materials and Methods

1) Dental laser: The Nd:YAG laser (SDL-3300EN, B&B Systems, Seoul) is wave length of 1.32 ㎛ and maximum power is 8 W, and pulse rate is 5-30 Hz. The CO_2 laser (Opelaser 03SII, Yoshida Dental Mfg. Co., Tokyo) beam is invisible, as it emit an infrared beam at a wave length of 10.6 ㎛ and emitting from 0.5 to 5 W.

2) Implants: This experiment used OSSTEM dental implants (OSSTEM implant, Korea). Ten smooth surface implants and 10 RBM surface implants were used. The composition of the implant is commercially pure titanium. Both types of implant were 11.5 mm long and 4.0 mm in diameter. The implants were submerged in an alginate mold with three threads of the implant exposed above the alginate. Two smooth surface implants and 2 RBM surface implants served as a control group that was not laser-treated. The remaining implants were treated using Nd:YAG and CO_2 lasers.

3) Laser treatment: The surface of each implant was treated for a period of 10 seconds on the 2nd and 3rd threads (Fig 1).

Fig 1. The surface was treated with CO_2 laser at the 2nd and 3rd threads.

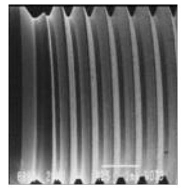


Fig 2. The control surface implant was very regular and smooth (original magnification X25).

The smooth surface implants (Group 1) were treated using a pulsed contact Nd:YAG laser at power settings of 1, 2, 3.5, and 5 W, which are commonly used for soft tissue surgery; the corresponding energy and frequency were 50 mJ and 20 Hz, 100 mJ and 20 Hz, 350 mJ and 10 Hz, and 250 mJ and 20 Hz, respectively. The Group 2 RBM implants were treated using a pulsed contact Nd:YAG laser. The Group 3 smooth surface implants were treated using a pulsed-wave non-contact CO_2 laser at 1, 2, 3.5, and 5 W, and the Group 4 RBM implants were treated using a pulsed-wave non-contact CO_2 laser.

Results

Under observation of SEM, the implant surface appeared smooth. An electron micrograph of the implant surface was created using machine processing. The surface was very regular and smooth. A SEM image of the surface with a micromachined groove is shown in Fig 2.

Table 1. Surface patterns of the test groups

Power settings	1 W	2 W	3 W	4 W
Group 1	Carbonization	Extensive melting with Holes	Extensive melting with Microfracture	Extensive melting with large and deep hole
Group 2	Carbonization	Extensive melting with Holes	Extensive melting with Microfracture	Extensive melting with large and deep hole
Group 3	No change	No change	Microfracture	Microfracture
Group 4	No change	No change	Microfracture	Microfracture

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[2)]Implant R&D Center, OSSTEM Implant Co., Busan, South Korea

US System
Biology

Abbreviations: Group 1, smooth surface implants were treated using a pulsed contact Nd:YAG laser; Group 2, RBM implants were treated using a pulsed contact Nd:YAG laser; Group 3, smooth surface implants were treated using a pulsed-wave non-contact CO_2 laser; Group 4, RBM implants were treated using a pulsed-wave non-contact CO_2 laser.

Table 2. Melting scores

Power settings	1 W	2 W	3 W	4 W
Group 1	1	2	3	3
Group 2	1	2	3	3
Group 3	0	0	1	1
Group 4	0	0	1	1

Abbreviations: Group 1, smooth surface implants were treated using a pulsed contact Nd:YAG laser; Group 2, RBM implants were treated using a pulsed contact Nd:YAG laser; Group 3, smooth surface implants were treated using a pulsed-wave non-contact CO_2 laser; Group 4, RBM implants were treated using a pulsed-wave non-contact CO_2 laser; Score 0, entire area no change; 1. predominantly no change (less than 50% no change); 2. predominantly change (50% < melting < 75%); 3, large hole and extensive melting (more than 75% melting).

Nd:YAG laser: After Nd:YAG laser treatment, the implant surface showed melting, loss of porosity, and extensive damage. The surface was relatively smooth because of the extensive melting independent of the power level. SEM showed alterations of all the surfaces tested. The amount of damage was proportional to the power (Figs 3 - 6). Damage was discernible at the lowest setting (1 W, 10 sec) used (Fig 3). A remarkable finding was the similarity of the lased areas on the smooth and RBM surfaces.

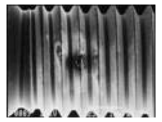


Fig 3.

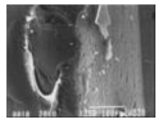


Fig 4.


Fig 5.


Fig 6.

CO_2 laser: The SEM examination showed that the pulsed mode of a non-contact (about 2 mm distance) CO_2 laser at power settings of 1.0 or 2.0 W did not alter the implant surface, regardless of implant type (smooth and RBM surfaces). At settings of 3.5 and 5 W, there was destruction of the micromachined groove (Fig 7). After treatment with a focused CO_2 laser beam, no discoloration of the titanium was observed. The structures of the smooth and RBM surfaces were not altered.

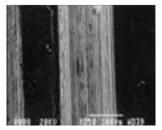


Fig 7.

Discussion

This study was done extraorally. However, the manipulation of the apparatus would be difficult within the actual oral environment. Being absorbed into intracellular protein, Nd:YAG laser would be more effective in the site where pigments such as melanin are present. Characteristically, CO_2 laser is absorbed to water 100%. Thus, more comprehensive and systematic studies are needed considering these characteristics of both types of laser.

We concluded that CO_2 lasers do not damage titanium surfaces. This should be of value when uncovering submerged implants and treating peri-implantitis. However, further investigations are required to determine the clinical efficacy of such treatment.

Based on the results of this in vitro experiment, we conclude that CO_2 laser treatment appears more useful than Nd:YAG laser treatment and CO_2 laser does not damage titanium implant surface, which should be of value when uncovering submerged implants and treating peri-implantitis.

The Accuracy of Impression Technique Using the New Impression Coping

Woon-Jung Noh[1)], Hyun-Joo Kim[1)], Sok-Min Ko[1)*]

Introduction and Purpose

The pick-up impression is most frequently used as conventional technique for implant. But it may result in inadequate working casts because using the self-curing acrylic resin for splinting impression copings may cause linear shrinkage. As the new impression technique using the flag type impression coping eliminates splinting procedures with self curing resin, it is more convenient and reduces errors of polymerizing contraction. Therefore, in this study, we are going to examine the availability of the new impression coping by comparing the accuracy of study models that were made from each impression technique.

Materials and Methods

① Implant System

Group	Implant Fixture	Implant coping	Method
Group I	ϕ 4.0mm x 13.0 (OSSTEM, ABFR413A)	Pick-up type (flag type) (OSSTEM, ICFR500N(+CSR150):non-hex)->#21,23,25,27 area (OSSTEM,ICFR500(+ CSR150) :hex)->#14 area	Non-Splinting
Group II	ϕ 4.0mm x 13.0 (OSSTEM, ABFR413A)	Pick-up type(conventional straight type) (OSSTEM, ICFR500N(+CSR150):non-hex)->#21,23,25,27 area (OSSTEM,ICFR500(+ CSR150):hex)->#14 area	Splinting
Group III	ϕ 4.0mm x 13.0 (OSSTEM, ABFR413A)	Pick-up type(conventional straight type) (OSSTEM, ICFR500N(+CSR150):non-hex)->#21,23,25,27 area (OSSTEM,ICFR500(+ CSR150):hex)->#14 area	Non-Splinting

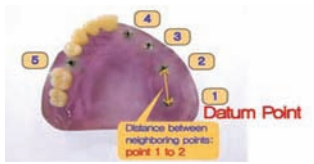
② Standard model

Maxillary left and #14 area edentulous simulator was made from clear resin. 5 fixtures were installed on #14, 21, 23, 25, 27 areas keeping parallelism between the fixtures with the parallelometer. That simulator with 5 fixtures was the standard model.

③ Apparatus

The '3-dimensional coordinates measuring equipment'(SIGMA-7106C) was used to measure the 3-dimensional relative position of each fixture. Metal circular cones that can be attachable to the fixtures were invented. As the relative position of each metal circular cone means the position of each fixture attached, we detected the relative position of each metal circular cone.


Measuring jig (metal circular cone) and the position of base point



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Group I


Group II


Group III

Results

1. In general, Group I and Group II were more accurate than Group III if the distance between 2 fixtures was not long spanned (e.g. fixture 1 to 5, 4 to 5), but there was no considerable difference of availability statically.
2. In single case, there was no considerable difference of availability statically.

Discussion and Conclusion

From the results, the impression technique using new flag type impression coping is proved to be fast, convenient and practically useful. Especially, in case of short span, if we attach the flag type impression coping towards nearest fixture, we assess that we are able to have more accurate impression taking than other impression techniques .

And this experiment is has a meaning that we get 3-dimensional result by using the '3-dimensional coordinates measuring equipment' '(SIGMA-7106C). The '3-dimensional coordinates measuring equipment' '(SIGMA-7106C) will be useful to other experiment.

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Influence of Implant Fixture Design on Implant Primary Stability

Gap-Yong Oh[1)], Sung-Hwa Park[1)], Seok-Gyu Kim[1)*]

Statement of Problem

Current tendencies of the implant macrodesign are tapered shapes for improved primary stability, but there are lack of studies regarding the relationship between the implant macrodesign and primary stability.

Purpose

The purpose is to investigate the effect of implant macrodesign on the implant primary stability by way of resonance frequency analysis in the bovine rib bones with different kinds of quality.

Methods

Fifty implants of 6 different kinds from two Korean implant systems were used for the test. Bovine rib bones were cut into one hundred pieces with the length of 5 cm.

Among them forty pieces of rib bones with similar qualities were again selected. For the experimental group 1, the thickness of cortical part was measured and 20 pieces of rib bones with the mean thickness of 1.0mm were selected for implant placement. For the experimental group 2, the cortical parts of the remaining 20 pieces of rib bones were totally removed and then implants were placed on the pure cancellous bone according to the surgical manual. After placement of all implants, the implant stability quotient(ISQ) was measured by three times, and its statistical analysis was done.


Fig 1. Aluminum block for stabilizing bone specimen.


Fig 2. Bone specimen fixed in aluminum block.


Fig 3. Tapered(TH:left) and straight(SH:right) implants in Oneplant system.

Fig 4. SS III, US III, US II, GS II in OSSTEM System

Table 1. Implant types used in this stuty

Implant type	Number	Size	System	Characteristics
Tapered hexplant(TH)	5	4.3×10	Oneplant	tapered, submerged
Straight hexplant(SH)	5	4.3×10	Oneplant	straight, submerged
US II	10	4.0×10	OSSTEM	straight, submerged
US III	10	4.0×10	OSSTEM	tapered, submerged
GS II	10	4.0×10	OSSTEM	straight, submerged
SS III	10	4.0×10	OSSTEM	tapered, non-submerged

Table 2. Surgical manual of OSSTEM Implant System

(US II, US III, SS III : D3 bone)
(1) guide drill, (2) Ø2.0 twist drill, (3) depth gauge, (4) parallel pin, (5) Ø2.0/3.0 pilot drill, (6) Ø3.0 twist drill, (7) Ø4.0 implant
(US II : D1 bone)
(1)~(6) ⇒ (7) Ø3.3 marking drill, (8) countersink, (9) Ø4.0 tap drill, (10) Ø4.0 implant
(US III, SS III : D1 bone)
(1)~(6) ⇒ (7) shaping drill, (8) tapered drill (9) Ø4.0 implant
(GS II : D3 bone)
(1)~(6) ⇒ (7) Ø3.3 marking drill, (8) Ø4.0 implant
(GS II : D1 bone)
(1)~(6) ⇒ (7) Ø3.6 marking drill, (8) Ø3.8 step drill (9) Ø4.0 implant

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Table 3. Surgical manual of Oneplant Implant System

(TH : soft bone)
(1) point drill, (2) Ø2.0 twist drill, (3) depth probe, (4) Ø3.3 step drill, (5) Ø4.3 implant
(TH : hard bone)
(1)~(4) ⇒ (5) Ø4.3 conical drill, (6) Ø4.3 tap drill, (7) Ø4.3 implant
(SH : soft bone)
(1)~(3) ⇒ (4) Ø2.0/3.0pilot drill, (5) Ø3.0 twist drill, (6) Ø4.3(4.1)implant
(SH : hard bone)
(1)~(3) ⇒ (4) Ø2.0/3.0 pilot drill, (5) Ø3.0 twist drill, (6) Ø3.5twist drill, (7) Ø4.1 cortical drill, (8) Ø4.1 tap drill (9) Ø4.3(4.1) implant

Results

There are statistically significant differences in ISQ values among 4 different kinds of OSSTEM system implants in the experimental group 2. For the experimental group 1, OSSTEM system implants showed significantly different ISQ values, but when differences in the thickness of cortical parts were statistically considered, did not show any significant differences in ISQ values. Among Oneplant system implants, there are no significant differences in ISQ values for the experimental group 2 as well as for the experimental group 1.

Table 4. Mean ISQ values in the experimental group 1

Implant	N	Mean	SD
TH	5	54.30	11.73
SH	5	58.83	7.52
US II	10	64.83	8.88
US III	10	65.00	5.47
GS II	10	57.70	5.89
SS III	10	60.30	9.45

Table 5. Mean ISQ values in the experimental group 2

Implant	N	Mean	SD
TH	5	53.73	9.38
SH	5	59.80	11.46
US II	10	47.27	11.09
US III	10	50.63	11.85
GS II	10	45.17	9.65
SS III	10	55.97	11.72

Table 6. Mean thickness of cortical bone in the experimental group 1

Implant	N	Mean	SD
TH, SH	10	0.9	0.3
US II, US III, GS II, SS III	10	1.25	0.5

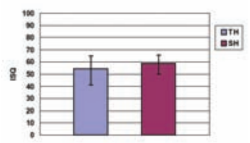


Fig 5. Mean ISQ values of Oneplant implants in the experimental group 1.

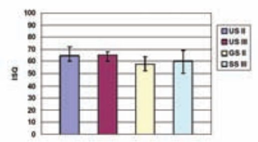


Fig 6. Mean ISQ values of OSSTEM implants in the experimental group 1.

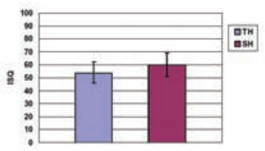


Fig 7. Mean ISQ values of Oneplant implants in the experimental group 2.

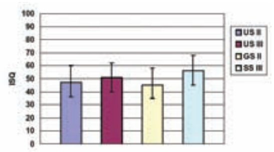


Fig 8. Mean ISQ values of OSSTEM implants in the experimental group 2.

Conclusion

Within the limits of this study, bone quality and implant design have some influences on the primary stability of implants. Especially in the bone of poor quality, tapered shape of implants are more favorable for the primary stability of implants.

The Comparative Study of Thermal Inductive Effect Between Internal Connection and External Connection Implant in Abutment Preparation

Jung-Bo Huh[1)], Suk- Min Ko[1)*]

Statement of Problem

The cement-type abutment would be needed for the reduction of its body in order to correct the axis and to assure occlusal clearance. In the case of intraoral preparation, there is a potential risk that generated heat could be transmitted into the bone-implant interface, where it can cause deterioration of tissues around the implant and failed osseointegration.

Purpose

The purpose of this study was to assess the difference of the heat transmitting effect on external and internal connection implant types under various conditions.

Methods

For evaluating the effects of alternating temperature, the thermocoupling wires were attached on 3 areas of the implant fixture surface corresponding to the cervical, middle, and apex. The abutments were removed 1㎜ in depth horizontally with diamond burs and were polished for 30 seconds at low speed with silicone points using pressure as applied in routine clinical practice. Obtained data were analyzed using Mann-Whitney rank-sum test and Wilcoxon / Kruskal-Wallis Tests.

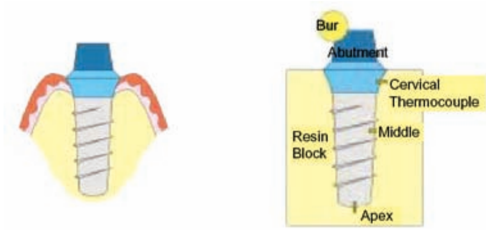


Fig 1. Experimental setup in this study. Cervical thermoelement was located in the middle of the machined surface of fixture which would correspond clinically to the level of the connective tissue, Middle thermoelement was located in the middle of fixture, Apex thermoelement was located at the lowest tip of fixture. The change in temperature were measured while reduce

Table 1. Each experimental groups

	Abutment	handpiece	coolant
1	Cemented	high speed	air & water
2			nothing
3		low speed	air & water
4			nothing
5	ComOcta	high speed	air & water
6			nothing
7		low speed	air & water
8			nothing

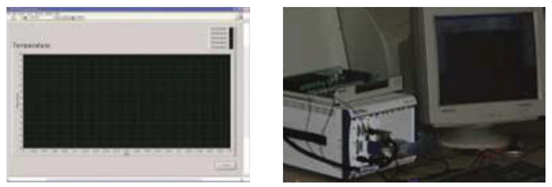


Fig 2. Temperature measuring equipment and Program.
The LabView(National Instrument, Texas, US) was used as the software in the monitoring system, PXI6259(National instrument, Texas, US) was used as the hardware

1)Dept. of Prosthodontics, Dental Center, Ajou University Hospital, South Korea

Results

Increased temperature on bone-implant interface was evident without air-water spray coolant both at high speed reduction and low speed polishing (p<.05). But, the difference between connection types was not shown.

Table 2. Mean temperature and statistical significance of temperature for external connection type abutment

Abutment type	Handpiece type	Position	Coolant	Mean temperature	Statistical significant difference of temperature (p-value)
Cemented	High	Apical	yes No	36.9 52.1	0.009
Cemented	High	Cervical	yes No	37.1 52.9	0.009
Cemented	High	Middle	yes No	37.9 52.2	0.009
Cemented	Low	Apical	yes No	36.4 40.2	0.009
Cemented	Low	Cervical	yes No	36.4 59.3	0.009
Cemented	Low	Middle	yes No	36.6 40.1	0.009

Table 3. Mean temperature and statistical significance of temperature for internal connection abutment

Abutment type	Handpiece type	Position	Coolant	Mean temperature	Statistical significant difference of temperature (p-value)
Octa	High	Apical	yes No	37.4 40.1	0.009
Octa	High	Cervical	yes No	37.6 56.8	0.009
Octa	High	Middle	yes No	37.4 42.1	0.009
Octa	Low	Apical	yes No	37 38.9	0.0086
Octa	Low	Cervical	yes No	36.3 54.1	0.009
Octa	Low	Middle	yes No	37.1 41.1	0.009

Table 4. P-value among Cemented Abutment vs. ComOcta Abutment: Wilcoxon/Kruskal-Wallis Tests was used to compare significance differences, P<0.05 has statistic significance

	Cervical	Middle	Apex
HWC	0.25	0.35	0.17
HWOC	0.12	0.75	0.60
LWC	0.40	0.75	0.40
LWOC	0.08	0.46	0.12

- HWC : high speed preparation with coolant
- HWOC : high spped preparation without coolant
- LWC : low speed preparation with coolant
- LWOC : low speed preparation without coolant

Conclusion

The reduction procedure of abutment without using proper coolant leads to serious damage of oral tissues around the implant irrespective of external and internal connection type.

The Effect of the Recipient Site Depth and Diameter on the Implant Primary Stability in Pig's Rib

Young-Jun Park*, Jin-Su Lim, Hyun-Syeob Kim, Min-Suk Kook[1], Hong-Ju Park[1], Hee-Kyun Oh[1)*]

Purpose

- Immediate implant installation has become an acceptable treatment for tooth loss. (Simsek, 2003)
- Clinically, primary stability is affected by bone quality and quantity for the implant placement, the structure of implant, the technique applied in installation. (Meredith, 1998)
- Two main factors relating with initial stability are the amount of contact between bone and implant, and the role of compressed stress between implant and tissue surface. (Meredith, 1998)
- This study was performed to compare and evaluate the effect of recipient site depth and diameter of the drills on the primary stability of implant in pig's ribs.

Materials and Methods

1) Intact pig's rib bones: width (≧8 mm), height (≧20 mm)
2) RBM surfaces OSSTEM implants (3.75 X 8 mm, US II, OSSTEM Co., Korea)
3) Engine, handpiece: INTRA surg® 300 (KaVo., Germany)
4) Implant kit: Hanaro surgical kit (OSSTEM Co., Korea)
5) Osstell™ (Model 6 Resonance Frquency Analyser: Integrtiaon Diagnotics Ltd., Sweden)
6) Periotest® (Simens AG, Germany)
7) 6 groups (n=10, respectively)
8) Statistic analysis: ANOVA using SPSS ver. 11.0 (SPSS Inc., USA)

Groups		
D3 group (Drill diameter 3.0 mm)	D3H3 (n=10) D3H5 (n=10) D3H7 (n=10)	Drilling - 3 mm in depth Drilling - 5 mm in depth Drilling - 7 mm in depth
D3.3 group (Drill diameter 3.0 mm)	D3.3H3 (n=10) D3.3H5 (n=10) D3.3H7 (n=10)	Drilling - 3 mm in depth Drilling - 5 mm in depth Drilling - 7 mm in depth



The rib bone was fixed with machine and implant was installed on pig's rib bone


Primary implant stability measured by Osstell™


Primary implant stability measured by Periotest®


Periotest® Damping capacity assessment

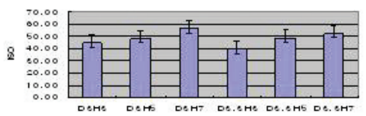

Osstell™ Resonance frequency analysis

Results

Table 1. Bucco-lingual measurements of primary stability using Osstell™

Groups	mean±SD	Duncan HSD
D3H3	44.90±3.38	AB
D3H5	48.20±5.65	B
D3H7	56.45±6.65	C
D3.3H3	39.60±5.72	A
D3.3H5	48.36±3.80	B
D3.3H7	52.20±8.32	BC

Fig 1. Mean values of primary stability of bucco-lingual measurements using Osstell™



In the bucco-lingual test of Osstell™ the mean values of D3H7 group and D3.3H7 group were higher than those of D3H3 group and D3.3H3 group (p<0.05).

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Table 2. Mesio-distal measurements of primary stability using Osstell™

Groups	mean±SD	Duncan HSD
D3H3	47.40±2.76	A
D3H5	54.50±3.95	B
D3H7	60.18±5.31	C
D3.3H3	46.70±1.06	A
D3.3H5	54.00±2.45	B
D3.3H7	59.20±1.03	C

Table 3. Bucco-lingual measurements of primary stability using Periotest®

Groups	mean±SD	Duncan HSD
D3H3	27.60±2.76	B
D3H5	11.30±3.95	D
D3H7	4.55±5.31	E
D3.3H3	33.78±1.06	A
D3.3H5	19.27±2.45	C
D3.3H7	7.40±1.03	DE

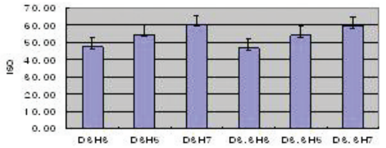
Table 4. Mesio-distal measurements of primary stability using Periotest®

Groups	mean±SD	Duncan HSD
D3H3	25.10±5.34	A
D3H5	11.00±2.94	BC
D3H7	3.09±1.45	D
D3.3H3	28.80±8.84	A
D3.3H5	16.36±7.27	B
D3.3H7	7.80±3.01	CD

Table 5. Correlations between the measurements of primary stability and the depth of implant installation

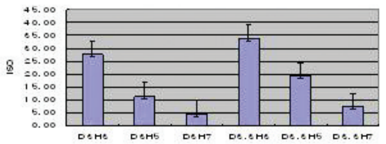
Diameter of drilling		Pearson's correlations	P
3 mm drilling	Osstell™ (MD)	0.796	0.00
	Osstell™ (BL)	0.696	0.00
	Periotest® (MD)	-0.926	0.00
	Periotest® (BL)	-0.944	0.00
3.3 mm drilling	Osstell™ (MD)	0.786	0.00
	Osstell™ (BL)	0.708	0.00
	Periotest® (MD)	-0.908	0.00
	Periotest® (BL)	-0.930	0.00

Fig 2. Mean values of primary stability of mesio-distal measurements using Osstell™



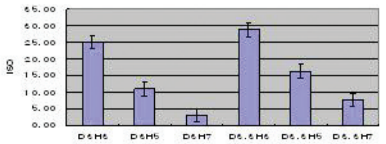
In the misio-distal test of Osstell™ the mean values of D3H7 group and D3.3H7 group were higher than those of D3H3 group and D3.3H3 group ($p<0.05$).

Fig 3. Mean values of primary stability of bucco-lingual measurements using Periotest®



In the bucco-lingual test of Peritest® the mean values of D3H7 group and D3.3H7 group were higher than those of D3H3 group and D3.3H3 group ($p<0.05$).

Fig 4. Mean values of primary stability of mesio-distal measurements using Periotest®



In the mesio-distal test of Peritest? the mean values of D3H7 group and D3.3H7 group were higher than those of D3H3 group and D3.3H3 group ($p<0.05$).

Table 6. Correlations between the measurements of OsstellTM and Periotest®

Direction	Pearson's correlations	P
Mesio-distal	-0.745	0.00
Bucco-lingual	-0.571	0.00

In tests using Periotest® and Osstell™ the mean value in 3 mm diameter of drill showed higher primary stability than that in 3.3 mm diameter of drill, but there is no statistically significant difference.

Conclusion

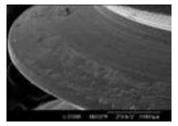
These results suggested that the primary stability of implants has a positive correlation with the depth of implant installation.

Influence of Tungsten Carbide/Carbon on the Preload of Implant Abutment Screws

Jin-Uk Choi[1)], Chang-Mo Jeong[1)*], Young-Chan Jeon[1)], Jang-Seop Lim[1)], Hee-Chan Jeong[1)], Tae-Gwan Eom[1)]

Statement of Problem

Recently, in order to increase preload with reducing the friction coefficient, abutment screws coated with pure gold and Teflon as dry lubricant coatings have been introduced. But the reported data indicate that if screw repeated tightening and loosening cycle, an efficiency of increasing preload was decreased by screw surface wearing off.



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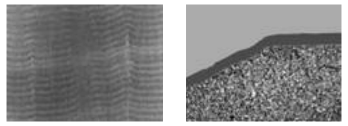
Purpose

This study was to evaluate the influence of tungsten carbide/carbon coating, which has the low friction coefficient and the high wear resistance, on the preload of abutment screws and the stability of coating surface after repeated closures.



Armorphous metal carbon coating
Multilamellar structure

Low Coefficient of Friction
Good Wear Resistance
High Load - Bearing Capacity

Materials

Features of Experimental Implant Abutment Systems (OSSTEM Implant, Korea)

Implant system	Implant Ømm	Abutment / implant interface	Abutment	Abutment screw
US II	4.1	External butt joint (external hexagon)	Cemented	Ta, WC/CTa
SS II	4.8	8° Morse taper (internal octagon)	ComOcta	Ta, WC/CTa
GS II	4.5	11° Morse taper (internal hexagon)	Transfer	Ta, WC/CTa

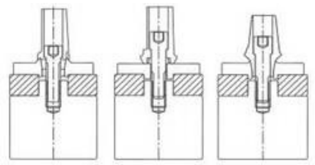
Ta = titanium alloy; WC/CTa = tungsten carbide/carbon-coated titanium alloy.

US II SS II GS II
Implant fixture

Ta WC/CTa
Abutment screw

Preload Test

To evaluate the influence of WC/C coating on the preload of implant abutment screws, each assembly (n=5) was tightened to 30Ncm and compressive force between abutment and fixture were measured in implant systems with three different joint connections, one external butt joint and two internal cones.



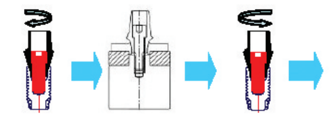
US II system SS II system GS II system
Schematic Diagram of Measurement Apparatus

Force sensor connection

Digital indicator for measuring compressive force

Consecutive Trial Test

To evaluate the stability and the alteration of coating screw, GS system assemblies (n=5) were examined by comparison of the compressive force and the removable torque values during 10 consecutive trials, and the surface change were observed.



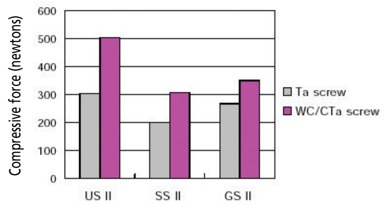
[1)]Dept. of Prosthodontics, Pusan National University Hospital, Busan, South of Korea
[2)]Implant R&D Center, OSSTEM Implant Co. Ltd., Busan, South Korea

Preload Test Results

Application of coating on implant abutment screw resulted in significant increase of compressive force in all implant systems (P<.05). The increasing rate of compressive force by coating in external butt joint was greater than those in internal cones (P<.05).

Mean Values±SDs of Compressive Force (N)

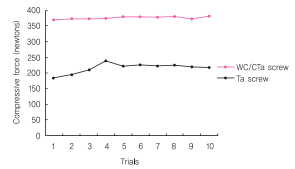
Implant system	Ta screw	WC/CTa screw	Percentage of increased compressive force
US II	303.8±12.7^{c}	503.8° ±13.9^{e}	65.8
SS II	199.6±7.8^{a}	306.4±8.6^{c}	53.5
GS II	266.6±11.0^{b}	350.0±15.0^{d}	31.3

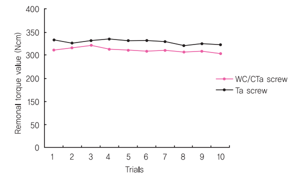


Consecutive Trial Test Results

Coated screw showed insignificant variations in the compressive forces during 10 consecutive trials (P<.05).
Removable torque values were greater with non-coated screw than that with coated screw (P<.05).

Trials	Compressive force (N)		Removable torque (Ncm)	
	Ta screw	WC/CTa screw	Ta screw	WC/CTa screw
1	180.4±10.1^{a}	367.8±15.9	23.3±1.8	21.2±0.9^{a,b}
2	192.6±11.3^{a,b}	372.0±5.4	22.6±1.7	21.6±0.7^{b,c}
3	209.4±23.6^{b,c}	372.0±4.4	23.0±1.7	22.1±0.8^{c}
4	233.4±25.6^{c}	370.8±5.5	23.6±1.1	21.4±0.2^{b,c}
5	221.4±13.6^{c}	378.2±6.4	23.1±0.7	21.2±0.6^{a,b}
6	222.6±15.7^{c}	378.8±7.8	23.1±0.7	20.9±0.6^{a,b}
7	219.8±19.9^{c}	375.8±11.1	22.9±0.8	21.1±0.5^{a,b}
8	222.0±22.4^{c}	378.2±11.6	22.1±0.9	20.8±0.6^{a,b}
9	217.8±17.3^{b,c}	374.8±11.8	22.4±0.7	20.8±0.6^{a,b}
10	216.6±16.8^{b,c}	379.8±11.7	22.2±0.7	20.5±0.5^{a}
Mean	213.6±15.7	374.8±4.0	22.8±0.5	21.2±0.5

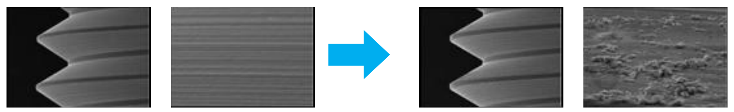




SEM Photomicrograph Results

Titanium alloy screw

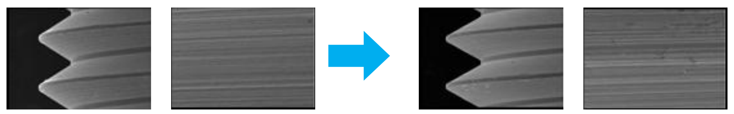
Pre-test Screws → Worn Screws



Magnification×100 Magnification×1,000 Magnification×100 Magnification×1,000

WC/C- coated titanium alloy screw

Pre-test Screws → Worn Screws



Magnification×100 Magnification×1,000 Magnification×100 Magnification×1,000

Conclusion

Tungsten carbide/carbon coating of implant abutment screw was effective in the increasing of preload and with favorable wear resistance.

Three-Dimensional Finite Analysis of Functional Stresses in Varied Width of Crestal Bone, Implant Diameter and Buccal off Center Position

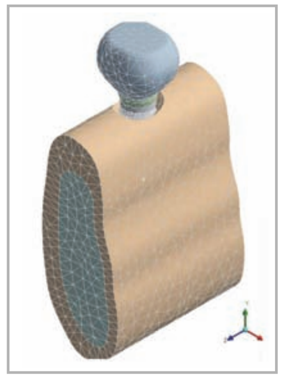
Ki-Deog Park[1)], Sang Un Han[2)], Hong-So Yang[3)*], Ju-Suk Kim[4)]

Introduction

The cumulative success rate of wide implant is still controversial. Some previous reports have shown high success rate, and some other reports shown high failure rate. The aim of this study was to analyze, and compare the biomechanics in wide implant system embeded in different width of crestal bone under different occlusal forces by finite element approach.

Materials and Methods

Three-dimensional finite element models were created based on tracing of CT image of second premolar section of mandible with one implant embedded. One standard model (6mm-crestal bone width, 4.0mm implant diameter, central position) was created. Varied crestal dimension(4, 6, 8 mm), different diameter of implants(3.3, 4.0, 5.5, 6.0mm), and buccal position implant models were generated. A 100-N vertical(L1) and 30 degree oblique load from lingual(L2) and buccal(L3) direction were applied to the occlusal surface of the crown. The analysis was performed for each load by means of the ANSYS V.9.0 program.



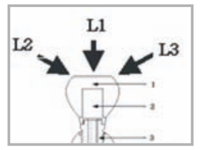
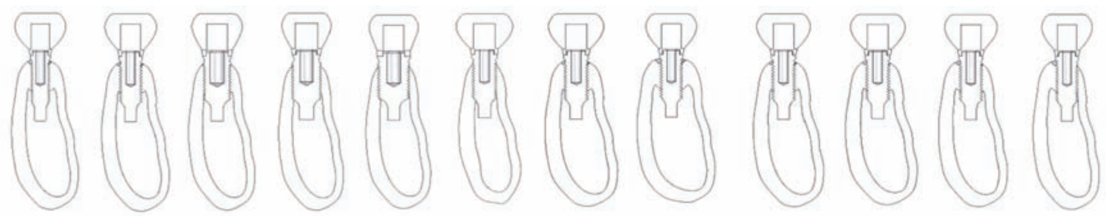


Table 1. Material properties of the each components of model

Material	Young's modulus (GPa)	Poisson's ratio
Implant & Abutment	110	0.35
Cortical Bone	13.7	0.3
Cancellous Bone	1.37	0.35
Gold alloy	170	0.35

R G. Craig and J.W. Farah, J. Prosthet. Dent, 39:274, 1978
Lewinstein I, Banks-Sills L, J Prosthet. Dent, 10:355, 1995
Yalcin Ciftci, Int, J, of Oral & Maxillofacial Implants, 15: 571, 2000

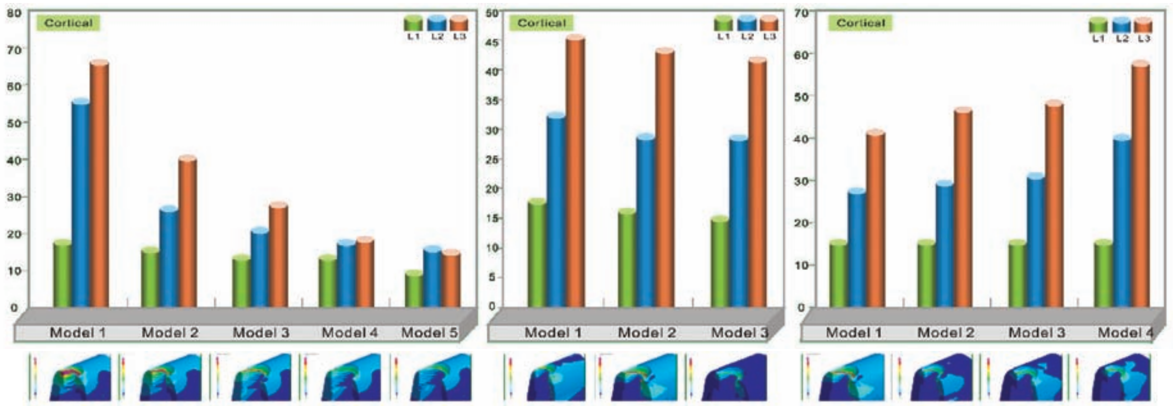
Model number	1	2	3	4	5	6	2	7	2	8	9	10
Fixture diameter	3.3	4.0	5.0	5.5	6.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Crestal bone width	6.0	6.0	6.0	6.0	6.0	4.0	6.0	8.0	6.0	6.0	6.0	6.0
Buccally offset from center	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	1.5



[1)]More Dental Clinic, Suncheon, Chonnam, South Korea.
[2)]Ye -Dental Clinic, Gwangju, South Korea.
[3)]College of Dentistry Chonnam National University, Gwangju, South Korea.
[4)]Implant R&D Center, OSSTEM Implant Co. Ltd., Busan, South Korea.

Results

Model number		1	2	3	4	5	6	2	7	2	8	9	10
	Load 1	18.6	16.7	11.2	8.8	11.5	18.1	16.7	14.0	16.7	15.6	15.1	14.9
Cortical	Load 2	56.7	27.6	23.0	17.9	16.2	32.5	27.6	29.0	27.6	29.8	31.6	42.8
	Load 3	66.9	41.8	27.1	17.4	14.6	46.0	41.8	40.7	41.8	46.7	49.1	57.4
	Load 1	1.2	1.4	2.0	1.6	1.0	1.2	1.4	1.4	1.4	1.4	1.5	1.5
Cancellous	Load 2	1.1	1.2	1.1	1.7	1.2	1.8	1.2	1.2	1.2	1.3	1.4	1.5
	Load 3	1.1	1.6	2.6	2.2	1.7	1.3	1.6	1.7	1.6	1.5	1.7	1.6



1. In all cases, maximum equivalent stress, that applied 30° oblique load around the alveolar bone crest was larger than that of the vertical load. Especially the equivalent stress that loaded obliquely in buccal side was larger.
2. In study of implant fixture diameter, stress around alveolar bone was decreased with the increase of implant diameter. In the vertical load, as the diameter of implant increased the equivalent stress decreased, but equivalent stress increased in case of the wide implant that have a little cortical bone in the buccal side. In the lateral oblique loading condition, as the diameter of implant increased the equivalent stress decreased, but in the buccal oblique load, there was not significant difference between 5.5mm and 6.0mm as the wide diameter implant.
3. In study of alveolar bone width, equivalent stress was decreased with the increase of alveolar bone width. In the vertical and oblique loading condition, as the width of alveolar bone increased 6.0mm, the equivalent stress decreased. But in the oblique loading condition, there was not much difference in equivalent stress at more than 6.0mm of alveolar bone width.
4. In study of implant fixture position, there was a small difference, but in the case of little cortical bone in the buccal side, value of the equivalent stress was most Unfavourable.
5. In all the cases, it was shown high stress around the top of fixture that contact cortical bone, but there was little stress on the bottom of fixture that play the role of stress dispersion.

Conclusion

This present study intended to search for the reason of high failure rate of wide diameter implant. However, If the peri-implant cortical bone is more than 1 mm, there appeared to be a similar stress distribution with in the cortical stress.
These results demonstrated that by obtaining the more contact from the bucco-lingual cortical bone with installing wide diameter implant plays an most important role in biomechanics.

The Effect of Internal Implant-Abutmnnt Connection and Diameter on Screw Loosening

Chun-Yeo Ha[1)], Chang-Whe Kim[1)],Young-Jun Lim[1)], Kyung-Soo Jang[1)*]

Statement of Problem

One of the common problems of dental implant prosthesis is the loosening of the screw that connects each component, and .this problem is more common in single implant-supported prostheses with external connection, and in molars.

Purpose

The purposes of this study were:
(1) to compare the initial abutment screw de torque values of the six different implant-abutment interface designs, (2) to compare the detorque values of the six different implant-abutment interface designs after cyclic loading, (3) to compare the detorque values of regular and wide diameter implants and (4) to compare the initial detorque values with the detorque values after cyclic loading.

Methods

Six different implant-abutment connection systems were used. The cement retained abutment and titanium screw of each system were assembled and tightened to 32Ncm with digital torque gauge. After 10 minutes, initial detorque values were measured. The custom titanium crown were cemented temporarily and a cyclic sine curve load(20 to 320N, 14Hz) was applied. The detorque values were measured after cyclic loading of one million times by loading machine. One-way ANOVA test, scheffe's test and Mann-Whitney U test were used.

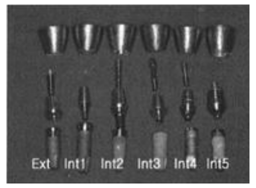


Fig 1. Regular diameter implants, abutments, abutment screws and titanium crowns.

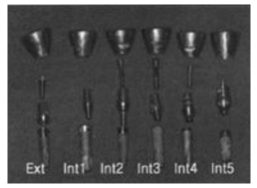


Fig 2. Wide diameter implants, abutments, abutment screws and titanium crowns.

Table 1. List of Components

Group	Brand name	Types of cemented abutments
Ext(R)	OSSTEM US II Selftapping Implant®	Hexed, collar 1m, height 5.5m
Ext(W)		Hexed, collar 1m, height 5.5m
Int1(R)	OSSTEM SS II Implant	non-octa, height 5.5m
Int1(W)		non-octa, height 5.5m
Int2(R)	Camlog®	trivam, gingival collar 1.5m
Int2(W)		trivam, gingival collar 1.5m
Int3(R)	Implantium®	non-hex, gingival collar 1.0m
Int3(W)		non-hex, gingival collar 1.0m
Int4(R)	MIS®	hexed, gingival collar 2.0m
Int4(W)		hexed, gingival collar 2.0m
Int5(R)	Tapered Screw Vent®	hexed, 5.5m wide profile
Int5(W)		hexed, 5.5m wide profile

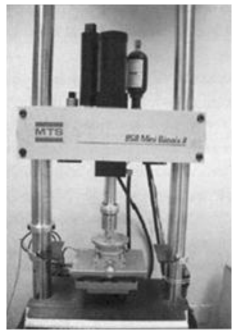


Fig 3. Loading machine

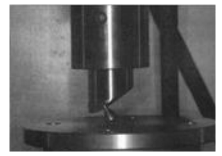


Fig 4. Customized jig


Fig 5. Digital torque gauge

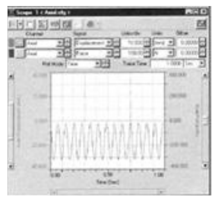


Fig 6. Loading pattern

[1)]Dept. of Prosthodontics, Graduate School, Seoul National University, South Korea

US System
Biomechanics

Results

The results were as follows:

1. The initial detorque values of six different implant-abutment connections were not significantly different($p > 0.05$).
2. The detorque values after one million dynamic cyclic loading were significantly different ($p < 0.05$).
3. The SS II regular and wide implant both recorded the higher detorque values than other groups after cyclic loading($p < 0.05$).
4. Of the wide the initial detorque values of OSSTEM Self Tapping Implant, MIS and Tapered Screw and the detorque values of MIS implant after cyclic loading were higher than their regular counterparts($p < 0.05$).
5. After cyclic loading, SS II regular and wide implants showed higher de torque values than before($p < 0.05$).

Table 2. Results of initial detorque values of regular diameter implants after 32Ncm tightening(unit:Ncm)

	1st*	2nd*	3rd*	4th*	5th*	Mean	SD	Rate(%)
Ext(R)	27.5	24.0	27.1	23.6	28.2	26.1	2.12	81.5
Int1(R)	30.4	27.1	23.9	32.5	28.4	28.5	3.27	88.9
Int2(R)	28.7	26.2	28.5	28.8	28.7	28.2	0.50	88.1
Int3(R)	26.8	32.9	25.6	26.3	25.2	27.4	1.41	85.5
Int4(R)	28.0	28.3	26.1	27.3	27.7	27.5	0.38	85.0
Int5(R)	27.3	24.4	24.0	25.6	27.6	25.8	0.73	80.5

*1st, 2nd, 3rd, 4th, 5th:the number of measurement times

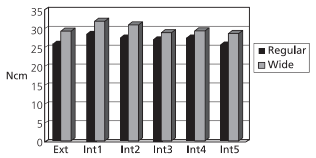


Fig 7. Mean initial detorque value

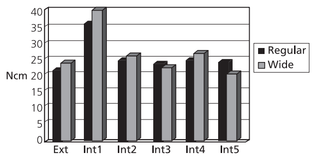


Fig 8. Mean detorque values after cyclic loading

Table 3. Results of initial detorque values of wide diameter implants after 32Ncm tightening(unit:Ncm)

	1st*	2nd*	3rd*	4th*	5th*	Mean	SD	Rate(%)
Ext(W)	29.3	29.4	30.3	28.1	30.2	29.5	0.88	92.1
Int1(W)	33.8	34.8	30.6	30.3	31.7	32.2	1.98	100.8
Int2(W)	31.7	32.2	32.8	27.0	31.6	31.1	2.32	97.1
Int3(W)	29.6	29.8	28.7	31.8	26.3	29.2	2.00	91.4
Int4(W)	28.0	29.3	31.3	30.0	29.6	29.6	1.19	92.6
Int5(W)	28.5	30.6	26.0	30.2	29.0	28.9	1.81	90.2

*1st, 2nd, 3rd, 4th, 5th:the number of measurement times

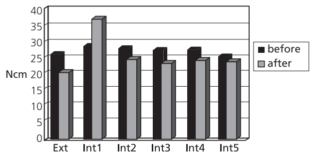


Fig 9. Mean detorque values of regular diameter implants

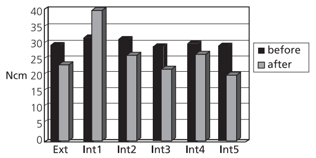


Fig 10. Mean detorque values of wide diameter implants

Table 4. Results of initial detorque values of regular diameter implants after cyclic loading(unit:Ncm)

	1st*	2nd*	3rd*	4th*	5th*	Mean	SD	Rate(%)
Ext(R)	19.2	23.4	22.0	19.0	21.9	21.1	1.92	66.0
Int1(R)	27.8	36.0	39.9	39.2	36.5	35.9	4.82	112.2
Int2(R)	24.9	24.2	24.6	24.7	24.6	24.6	0.25	76.9
Int3(R)	21.2	22.7	24.4	24.0	25.0	23.5	1.52	73.1
Int4(R)	26.1	25.7	23.7	22.0	25.4	24.6	1.70	76.8
Int5(R)	24.2	22.2	25.5	24.8	23.5	24.0	1.27	75.2

*1st, 2nd, 3rd, 4th, 5th:the number of measurement times

Table 5. Results of initial detorque values of wide diameter implants after cyclic loading(unit:Ncm)

	1st*	2nd*	3rd*	4th*	5th*	Mean	SD	Rate(%)
Ext(W)	25.4	24.9	21.6	22.8	22.8	23.5	1.59	73.5
Int1(W)	38.7	39.0	37.7	42.0	42.0	39.9	1.99	124.7
Int2(W)	28.8	26.6	22.9	25.0	26.0	25.9	2.16	80.9
Int3(W)	22.0	20.6	24.0	23.2	22.7	22.5	1.29	70.3
Int4(W)	24.5	26.4	27.5	27.9	27.8	26.8	1.43	83.8
Int5(W)	22.9	25.2	17.7	15.2	20.2	20.2	3.99	63.3

*1st, 2nd, 3rd, 4th, 5th:the number of measurement times

Conclusion

Within the limitations of this study, the following conclusions were drawn. Till ninth reuse of Smartpeg™, the ISQ measurement stability did not be affected. After twice autoclave sterilization of Smartpeg™, the ISQ measurement stability was affected.

Effect of Joint Design on Static and Dynamic Strength

Ji-Hoon Yoon[1)], Chang-Mo Jeong[2)*], Tae-Gwan Eom[1)], Mi-Hyun cheon[2)]

Introduction

Mechanical failures of component loosening and fracture of implant system have been concerned. These clinical failures may result from overload or fatigue. Although several comparatives studies on static fracture strength of different implant-abutment joint designs have been reported, the fatigue endurance of these joints has not been fully investigated.

The purpose of this study is to evaluate compressive and fatigue strength of different joint designs.

Materials and Methods

In this study four OSSTEM(Korea) implants assemblies were used, External Butt Joint-Safe Abutment(BJS), External Butt Joint-Cemented Abutment(BJC), 11° Internal Conical Joint-Transfer Abutment(CJT) and 11° Internal Conical Joint-Convertible Abutment(CJC).

Implant-abutment Joint Design

	Connection type	Materials
BJS	External Butt Joint Modified Abutment + Screw	Abutment -Ti Gr3 / Screw - Ti Gr5
BJC	External Butt Joint Abutment + Screw	Abutment - Ti Gr3 / Screw - Ti Gr5
CJT	11° internal Conical Joint Abutment + Screw	Abutment - Ti Gr3 / Screw - Ti Gr5
CJC	11° Internal Conical JointAbutment + Cylinder + Screw	Abutment - Ti Gr5 / Cylinder - Ti Gr3 / Screw - Ti Gr5

Compressive and fatigue strength of four groups were evaluated according to specified test(ISO/FDIS-14801). Tightening torque of each assembly was 30Ncm. The result of compressive strength was verified by one-way ANOVA and Turkey test. Fatigue test was started at 80% of fracture strength and failure was defined as material yielding, permanent deformation or fracture of any component. Test had been continued until three specimens reached the specified number of cycles with no failures. The failure modes were identified by SEM.(S-4200; Hitachi, Japan)

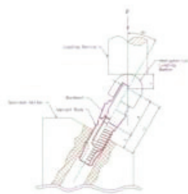

BJS

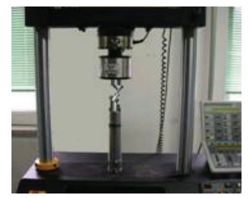

BJC


CJT


CJC

Compressive bending and Cyclic fatigue loading


Schematic Diagram of Test Condition


Cyclic Loading System (8516, Instron corp, USA)

Results

Compressive Strength

Implant-abutment Joint Design

Groups(n=5)	mean
BJS	1392.1±52.6
BJC	1153.2±39.0
CJT	1016.2±116.4
CJC	968.3±86.0

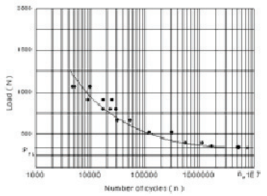
* Groups with the same letters are not significantly different. (P<0.05),

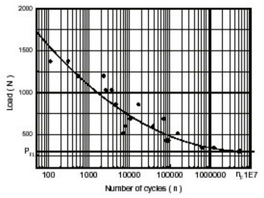
Fatigue Strength

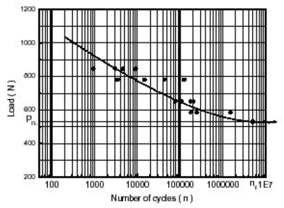
Groups	Fatigue Strength(N)
BJS	360
BJC	300
CJT	530
CJC	780

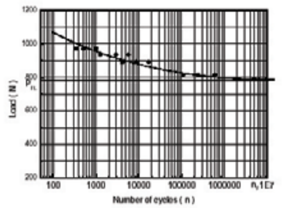
1)Implant R&D Center, OSSTEM Implant Co. Ltd., Busan, South Korea
2)The Dept. of Prosthodontics ,Pusan National University Hospital, Busan, South Korea

US System
Biomechanics


Curve for stress versus number of cycle(S-N) of BJS

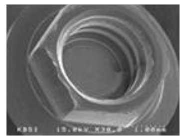

Curve for stress versus number of cycle(S-N) of BJC

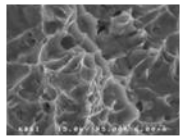

Curve for stress versus number of cycle(S-N) of CJT


Curve for stress versus number of cycle(S-N) of CJC

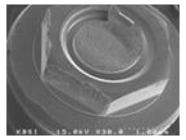
SEM examination(S-4200, Hitachi, Japan)

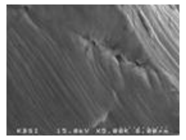
Compressive Strength


fractured abutment screw (original magnification X 30)


fractograph showing dimpled Surface (original magnificationX5.0k)

Fatigue Strength


fractured abutment screw (original magnification X 30)


fractograph showing dimpled Surface (original magnificationX5.0k)

Conclusions

Within the limits of this study ;

1.The fatigue endurance of internal conical was higher than that of external butt joint.
2. In butt joint, BJS with longer resistance arm showed higher fatigue strength than BJC.
3. CJC with internal conical joint had the strongest connection.
4. There was no direct correlation between fracture strength and fatigue strength.

Wave Analysis of Implant Screw Loosening Using an Air Cylindrical Cyclic Loading Device

Juneseok Lee[1)], Yung-Soo Kim[2)], Chang-Whe Kim[2)], Jung-Suk Han[2)]*

Statement of Problem

The mechanics of implant screw loosening or fracture are well understood in the field of engineering. They have not been as widely explored in dentistry.

Purpose

This study investigated the effects of simulated mastication on implant components and used wave analysis to document the basic mechanisms of screw loosening in a simulated oral environment.

Materials and Methods

A pneumatic cylindrical cyclic loading device was fabricated to simulate masticatory movement. Thirteen standard abutments were connected on external hexagonal implants with titanium abutment screws tightened to 20 Newton centimeters (Ncm), and single crowns were retained with gold screws tightened to 10 Ncm on each abutment, respectively. Ten single-implant crowns were loaded with the use of a cyclic loading device with 100 N of force at 30° angles to the long-axis for 0.2 seconds of contact time with a frequency of 1 Hz. Three crowns were loaded vertically under the same conditions to serve as the control group. The effects of up to 1 million cyclic loads and various tightening torque forces (2, 4, 6, 8, 10, and 12 Ncm) on screw loosening were evaluated by wave analysis. A software program was written to record every wave mode and to stop the machine automatically if the amount of horizontal displacement of the crown was more than 0.5 mm, which was designated to represent perceptible loosened implant crown mobility clinically. The general wave patterns and characteristics of loosened and stable screws and the effect of various tightening torques were analyzed by comparing the differences in wave patterns.

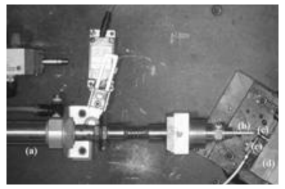


Fig 1. Experimental device comprised pneumatic cylinder (a), pushing rod assembly (b), implant assembly (c), fixing jig (d), and sensor (e).

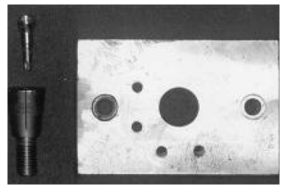


Fig 2. Implant-fixing metal jig. Note slits made through tapered chuck.

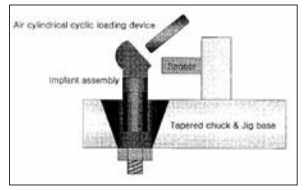


Fig 3. Arrangement of sensor, rod, implant assembly, and fixing jig.

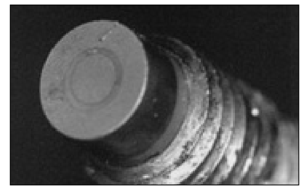


Fig 4. Noncontact displacement capacitance.

Results

The wave mode was divided into 4 stages for loosened gold screws: initial displacement, initial vibration, elastic deformation, and recovery stage. However, the initial displacement and initial vibration stages were not discernible for stable gold screws. Of the 10 gold occlusal screws, 4 loosened before the 1 million cyclic loads in the 10 single crowns tested. There was no screw loosening in the control group. There was no effect of screw loosening on the elastic deformation stage.

[1)] Bio-Top Biomaterial / Implant Center
[2)] College of Dentistry, Seoul National University, Seoul, South Korea

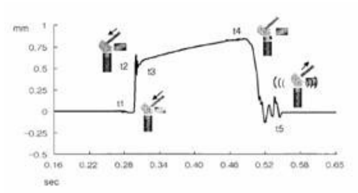


Fig 5. Deformation of implant assembly during loading cycle.

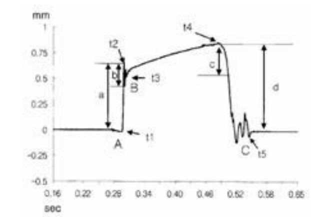


Fig 6. Typical wave pattern of a loosened screw contains characteristics of condenser-type sensor (A), initial displacement stage (t1 to t2), amount of initial displacement (a), initial vibration (B), initial vibration stage (t2 to t3), amplitude of initial vibration (b), elastic deformation stage (t3 to t4), amount of elastic deformation (c), recovery stage (t4 to t5), secondary vibration (C), and maximum deflection (d).

Table 1. Numbers of cycles required to loosen gold screws

Specimen No.	Number of strokes
1	528,794
2	544,677
3	578
4	5,226
5	> 2,000,000
6	> 2,000,000
7	> 2,000,000
8	> 2,000,000
9	> 2,000,000
10	> 2,000,000
Control	> 2,000,000
Control	> 2,000,000
Control	> 2,000,000

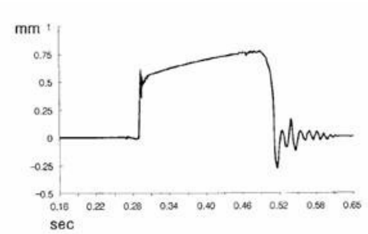


Fig 7. Wave after 535,000 cyclic loadings for loosened screw.

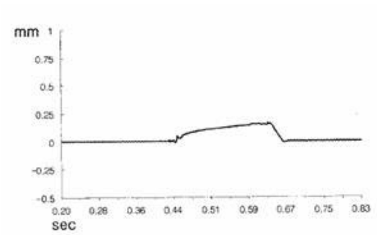


Fig 8. Wave after 1,000,000 cyclic loadings for secure screw.

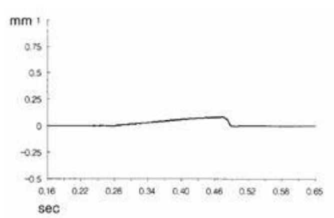


Fig 9. Wave at tightening torque of 12 Ncm.

Conclusion

Within the limitations of this study, tightening torque had a significant effect on screw loosening. It would appear that more than 10 Ncm of tightening torque should be recommended for the gold screws in this external hexagon implant system.

Prospective Clinical Study of Two OSSTEM® SS II Implant Systems with Different Surfaces in Partially Edentulous Patients

Min-Seok Oh[1)], Su-Gwan Kim[1)*], Hak-kyun Kim[1)], Seong-Yong Moon[1)]

Purpose

Non-inferiority clinical trial comparing "SS II RBM Fixture" and "SS II CMP Fixture" implants for patients missing natural teeth to evaluate the effectiveness and safety of SS II CMP Fixture

Materials and Methods

- **Calcium metaphosphate (CMP)**
  Microstructure
  - Analysis method: Surface observation using scanning electron microscopy (SEM, JSM-6480LV, JEOL)
  - Analysis Results The RBM surface configuration is made slightly smoother after the CMP coating.

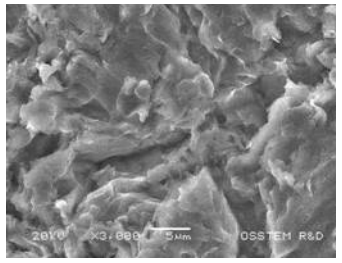


Fig 1. RBM surface (Ra=1.332㎛)

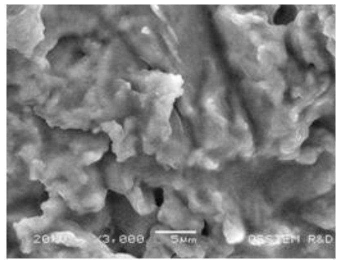


Fig 2. CMP-coated surface on RBM (Ra=1.140㎛)

- **Prospective, open, non-inferiority trial**
  - Experimental group: SS II CMP Fixture implant
  - Control group: SS II RBM Fixture implant
- **Subject**
  - Patients aged 18 years or older and with completed jaw bone growth
  - Patients with missing natural teeth
  - Patients with sufficient vertical, mesiodistal, and bucco-lingual bone
- **Clinical trial period**
  - April 1, 2006 ~ October 31, 2007
  - 24 months following the approval of clinical trial plan by the director of the Korea Food and Drug Administration
  - Subject recruitment period: About 4 months
  - Effectiveness observation period: About 12 months
  - Statistical analysis period: About 2 months
  - Report preparation period: About 2 months

Table 1.

Visit Date	Observation Period
Visit1	-4 weeks~0 day
Visit2	0 day (baseline date)
Visit3	2weeks±1week
Visit4	13weeks±2weeks (maxilla) 7weeks±2weeks (mandible)
Visit5	26weeks±2weeks (maxilla) 14weeks±2weeks (mandible)
Visit6	27weeks±2weeks (maxilla) 15weeks±2weeks (mandible)
Visit7	28weeks±2weeks (maxilla) 16weeks±2weeks (mandible)
Visit8	9months±4weeks (maxilla) 6months±4weeks (mandible)
Visit8'	9months±4weeks (mandible)
Visit9	12months±4weeks (maxilla) 12months±4weeks (mandible)

Dept. of Oral and Maxillofacial Surgery, College of Dentistry, Chosun University, South Korea

- Observation and examination items
  - Measurement of clinical index of surgery site
  - Surgery site: Record by dental formula (example: #16)
    - Implant diameter and length: Record of the implant used
  - Mobility measurement
    - Mean value of three measurements with Periotest [PTVs]
  - Grant subject identification code (CRF-00)
  - Random grouping into experimental or control group
  - Evaluating the volume of bone loss
    - Evaluate the volume of vertical and horizontal bone loss by scanning the periapical x-rays taken based on the parallel method.
  - Evaluating occlusion following prosthesis setting
    - Evaluate on visit 7 made right after setting the implant upper structure (prosthesis) using articulating paper (about 20~35㎛ thick) and shim stock (about 8㎛ thick)

Results

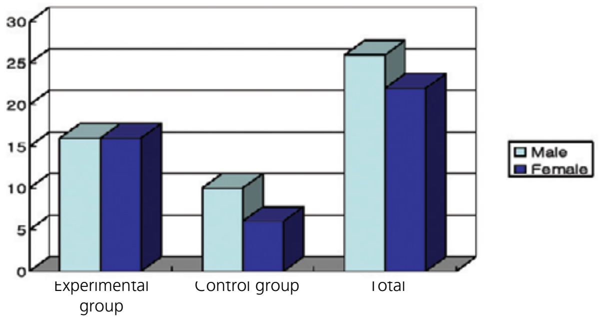
- **Classification according to implant length and diameter**
  - Experimental group (CMP coating): 32 persons - 38 fixtures
  - Control group (RBM surface): 16 persons -18 fixtures
  - 2 dropouts during the clinical trial (withdrawal of consent)

Table 2.

D	8.5mm		10.0mm		11.5mm		13mm		15.0mm	
L	SS II CMP	SS II RBM	SS II CMP	SS II RBM	SS II CMP	SS II RBM	SS II CMP	SS II RBM	SS II CMP	SS II RBM
4.1mm			7	3	6	6	5	2		
4.8mm	2		6		6	3	5		2	1

- **Classification according to age and gender**

Fig 3.



Experimental group	Control group	Total
Mean Age: 41.2 years	Mean Age: 34.1 years	Mean Age: 38.8 years

- **Classification according to the installation site**

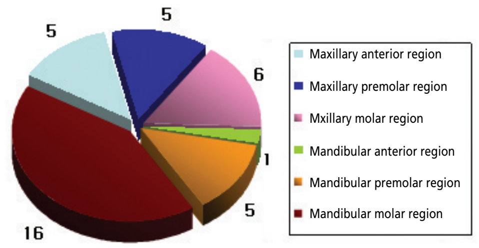


Fig 4. Experimental group (CMP): 38 fixtures

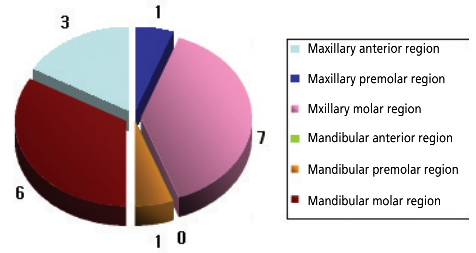


Fig 5. Control group (RBM): 18 fixtures

- **Classification according to the accompanying surgery**

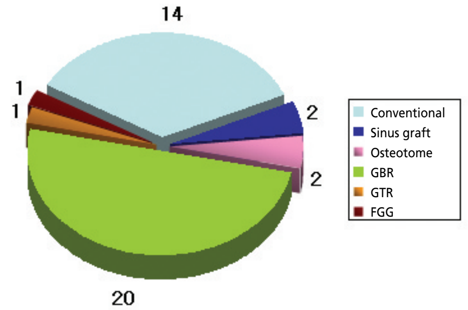


Fig 6. Experimental group (CMP): 38 fixtures

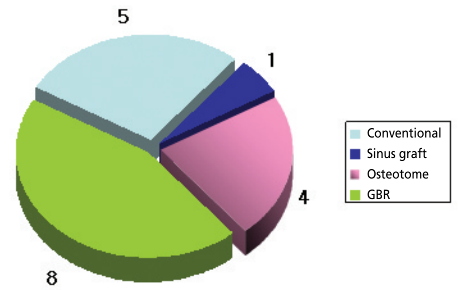


Fig 7. Control group (RBM): 18 fixtures

- **Evaluation of the volume of bone loss**
  - Distortion: Compensation by calculating the implant expansion rate
  - Baseline: First thread line of the implant
  - Bone resorption level: Mean value after evaluating the mesiodistal bone level of the fixture at the baseline

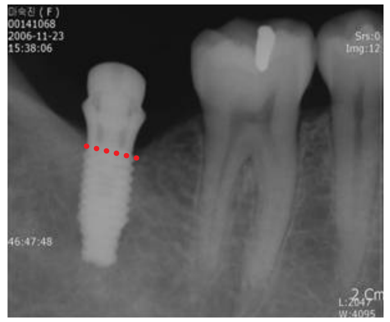


Fig 8.

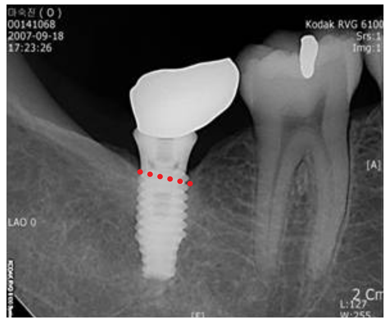


Fig 9.

• **Results of evaluation of bone loss volume**

- Experimental group (CMP coating): 32 persons - 38 fixtures
- Control group (RBM surface): 16 persons -18 fixtures
- 2 dropouts during the clinical trial (withdrawal of consent)

Table 3.

	Group	V3 Volume of Bone Loss	V5 Volume of Bone Loss	V8 Volume of Bone Loss	V8' Volume of Bone Loss	V9 Volume of Bone Loss
Total	Experimental group (M±SD)	.021±.0528 (n=38)	. 141±. 1771 (n=37)	.103±.1689 (n=35)	. 139±.2033 (n=18)	124±. 1809 (n=25)
	Control group (M±D)	.056±.0784 (n=18)	. 167±. 2058 (n=18)	.167±.1496 (n=15)	. 171±.1799 (n=07)	.182±. 1401 (n=11)
	p-value	.103	.628	.212	.715	.354
Mandible	Experimental group	.032±.0646 (n=22)	. 123±. 1412 (n=22)	.114±.1931 (n=21)	. 147±. 2065 (n=17)	. 146±. 2187 (n=13)
	Control group	.088±.0991 (n=8)	.163±. 1685 (n=8)	.186±.1676 (n=07)	.171±. 1799 (n=07)	.200±. 1633 (n=04)
	p-value	.172	.522	.391	.788	.658
Maxilla	Experimental group	.006±.0250 (n=16)	.167±.2225 (n=15)	. 086±. 1292 (n=14)		.100±. 1348 (n=12)
	Control group	.030±.0483 (n=10)	.170±.2406 (n=10)	.150±. 1414 (n= 08)		.171±. 1380 (n= 07)
	p-value	.176	.972	.291		.285

Statistical analysis Results
By observation period, there was no significant difference (p>0.05) in bone loss between the experimental and control groups.
The volume of bone loss increases for both groups as the observation period changes.

• **Results of the mobility analysis**

Table 4.

	Group	V2Mobility	V4Mobility	V7Mobility	V8Mobility	V8'Mobility	V9Mobility
Total	Experimental group (M±SD)	-1.055±.9078 (n=38)	-3.561±3.5931 (n=38)	-2.740±2.5058 (n=35)	-2.043±2.8440 (n=35)	-1.576±2.3023 (n=17)	-1.628±2.3341 (n=25)
	Control group (M±D)	1.606±9.4437 (n=18)	-2.811±3.3715 (n=18)	-1.369±3.4869 (n=16)	-.973±3.2587 (n=154)	-1.143±2.2963 (n=07)	-1.270±2.4340 (n=10)
	p-value	.364	.461	.116	.249	.679	.688
Mandible	Experimental group	-2.309±3.3001 (n=22)	-4.550±3.1356 (n=22)	-3.082±2.5959 (n=22)	-1.943±3.0214 (n=21)	-1.576±2.3023 (n=17)	-1.523±2.2234 (n=13)
	Control group	-.413±10.8791 (n=08)	-3.650±3.2859 (n=08)	-1.188±3.2140 (n=08)	-.314±2.5823 (n=07)	-1.143±2.2293 (n=07)	-2.233±.6807 (n=03)
	p-value	.642	.498	.108	.213	.679	.351
Maxilla	Experimental group	.669±4.1164 (n=16)	-2.200±3.8301 (n=16)	-2.162±2.3283 (n=13)	-2.193±2.6589 (n=14)		-1.742±2.5429 (n=12)
	Control group	3.220±8.3599 (n=10)	-2.140±3.4565 (n=10)	-1.550±3.8352 (n=08)	-1.550±3.8352 (n=08)		-.857±2.8407 (n=07)
	p-value	.307	.968	.659	.647		.493

Statistical analysis Results
By observation period, there was no significant difference (p>0.05) in mobility between the experimental and control groups.

• **Types of complications and treatments**

· Complications occurring in a total of 4 cases
· Damage of the inferior alveolar nerve: 1 case
- Cause: Excessive traction of the flap and heat production during drilling - neuropraxia
- Treatment: TENS and soft laser
· Loss of bone graft material and intervention of granulomatous tissue: 2 cases
- Cause: Early exposure of the non-absorbable membrane
- Treatment: After removing the exposed membrane, conduct debriment and autogenous bone graft.
· Proliferative gingivitis around the implant: 1 case
- Cause: Insufficient volume of keratinized gingiva
- Treatment: Free gingival graft following gingival curettage and topical antibiotic (tetracyclin) application

• **Evaluation of periodontal tissue [Visit 9]**

· Plaque index
0: No plaque accumulation [T:24/38] [C:11/18]
1: Detected upon probing following the gingival margin [T:11/38] [C:5/18]
2: Can be seen by the naked eye [T:3/38] [C:2/18]
3: Abundant

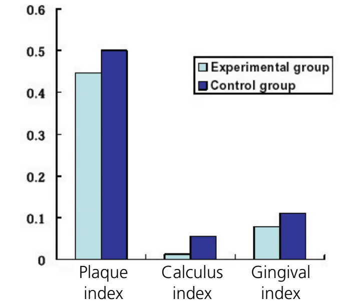


Fig 10.

· Calculus index
0: No calculus accumulation[T:37/38] [C:17/18]
1: Slight calculus accumulation with early calcification[T:1/38] [C:1/18]
2: Calculus accumulation 1/2mm wide on the cervical area of the lingual surface
3: Calculus accumulation 2mm wide on the cervical area of the lingual surface and buildup in the interproximal area

· Gingival index
0: No impression of inflammation, discoloration and bleeding, etc. [T:35/38] [C:16/18]
1: Slight discoloration and inflammation, but no bleeding [T:3/38] [C:2/18]
2: Moderate inflammation, redness, swelling, and bleeding upon probing
3: Severe inflammation, redness, swelling, and spontaneous bleeding

Conclusions

Calcium metaphospate coated group (experimental group) was not inferior than resorbable blasting media group (control group) in prospective clinical evaluation and stastical examination.

Comparison of Corticocancellous Block and Particulate Bone Grafts in Maxillary Sinus Floor Augmentation for Bone Healing Around Dental Implants

Seoung-Ho Lee[1)], Byung-Ho Choi[2)*], Jingxu Li[3)], Seung-Mi Jeong[3)], Han-Sung Kim[4)] and Chang-Yong Ko[4)]

Purpose

The aim of this study was to compare 2 types of bone used for maxillary sinus floor augmentation, corticocancellous block or particulate bone grafts, on bone healing around dental implants when installed simultaneously with the implant.

Materials and Methods

The mucous membranes of 12 sinuses in 6 dogs were elevated bilaterally. On one side of the maxillary sinus, autogenous corticocancellous block bone was grafted into the space between the membrane and sinus wall. On the opposite side, autogenous corticocancellous particulate bone was grafted. Simultaneously, 2 dental implants were inserted into the grafting material through the maxillary sinus floor. The animals were killed 6 months after surgical procedure.

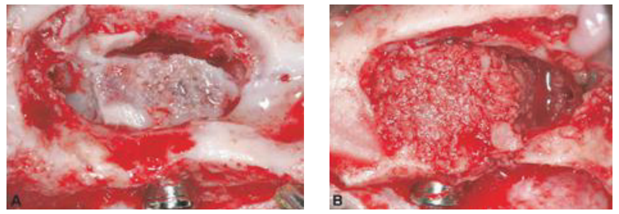


Fig 1. View of the implant and autogenous bone immediately after placement in the space between the sinus membrane and sinus floor. A, Corticocancellous block bone graft. B, Corticocancellous particulate bone graft.

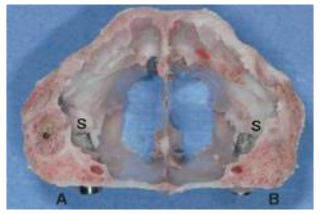


Fig 2. Photograph of the maxillary sinuses, showing the augmented area and implant. S, maxillary sinus cavity.
A, Corticocancellous block bone graft.
B, Corticocancellous particulate bone graft.

Results

The mean bone-implant contact was 56.7% on the block side and 32.1% on the particulate side (P< .05). The mean height of newly formed bone in the augmented area was 12.3 mm on the block side and 9.7 mm on the particulate side (P< .05).

Fig 3. Three-dimensional microCT showing the bone (yellow) around implants (gray).
A, Corticocancellous block bone graft.
B, Corticocancellous particulate bone graft.

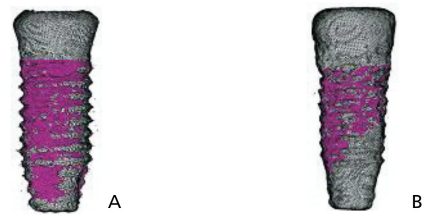


Fig 4. Three-dimensional microCT overview of the bone-to-implant contact area (red) around the implant (gray).
A, Corticocancellous block bone graft.
B, Corticocancellous particulate bone graft.

Table 1. Parameters of bone-to-implant contact and bone height around dental implants when placed simulaneously with either corticocancellous block or particulate bone grafts for maxillary sinus floor augmentation

	Block bone	Particulate bone
Bone-implant contact (%)	56.7±15.2	32.1±13.1
Height of newly formed bone	12.3±2.6	9.7±2.5

Conclusion

Our results show that maxillary sinus floor augmentation using corticocancellous block bone grafts, when installed simultaneously with the implant, is superior to corticocancellous particulate bone grafts for bone healing around dental implants.

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[2)]Dept. of Oral & Maxillofacial Surgery, College of Dentistry, Yonsei University, Seoul, South Korea
[3)]Dept. of Dentistry, Yonsei University Wonju College of Medicine, Wonju, South Korea
[4)]Dept. of Biomedical Engineering, College of Health Science, Institute of Medical Engineering, Yonsei University, Wonju, South Korea

Platelet-Enriched Fibrin Glue and Platelet Rich Plasma in the Repair of Bone Defects Adjacent to Titanium Dental Implants

Tae-Min You[1)], Byung-Ho Choi[1)*], Shi-Jiang Zhu[2)], Jae-Hyung Jung[1)], Seoung-Ho Lee[3)], Jin-Young Huh[1)], Hyun-Jung Lee[1)], Jingxu Li[2)]

Purpose

The aim of this study was to compare the effects of platelet-enriched fibrin glue and platelet-rich plasma (PRP) on the repair of bone defects adjacent to titanium dental implants.

Materials and Methods

In 6 mongrel dogs, 3 screw-shaped titanium dental implants per dog were placed into the osteotomy sites in the tibia. Before implantation, a standardized gap (2.0 mm) was created between the implant surface and the surrounding bone walls. Six gaps were left empty (control group), 6 gaps were filled with autogenous particulate bone mixed with platelet-enriched fibrin glue (fibrin glue group).

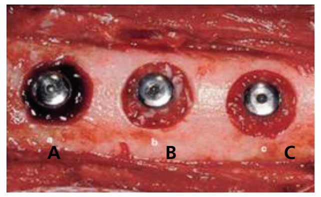

Fig 1. Experimental design. (a) The control defect remained empty. (b) The cortical defect was filled with autogenous particulate bone mixed with PRP. (c) The cortical defect was filled with autogenous particulate bone mixed with platelet-enriched fibrin glue.

Results

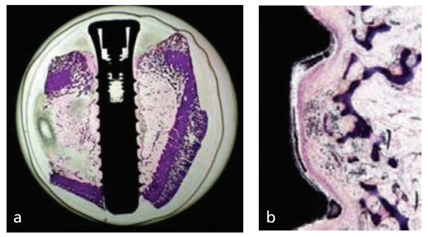

Fig 2. A section from the control group at original magnifications of (a) X5 and (b) X100 (toluidine blue). A fibrous membrane surrounds the implant surface and no bone contacts the implant.

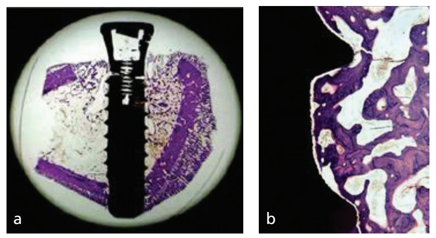

Fig 3. A section from the PRP group at original magnifications of (a) X5 and (b) X100 (toluidine blue). The newly formed bone contacts the implant surface; no fibrous membrane is seen.

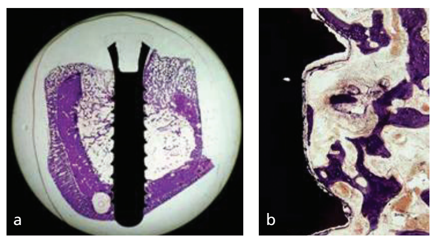

Fig 4. A section from the fibrin glue group at original magnifications of (a) X5 and (b) X100 (toluidine blue). The new trabeculae are thicker and better formed than in the PRP group.

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Implant Research
Biology

Table 1. Percentage of BIC in the examined dog tibiae

Dog number	Control group	PRP group	Fibrin glue group
1	8.1	29.6	33.9
2	10.3	30.2	59.0
3	12.7	34.4	62.8
4	10.1	40.1	67.5
5	8.1	21.7	60.5
6	11.7	19.3	74.2
Mean±SD	10.2±1.9	29.2±7.8	59.7±13.8

After 6 weeks, the quantitative morphometric analysis showed significantly more BIC in the fibrin glue group than in the other 2 groups together. The bone-implant contact was 59.7% in the fibrin glue group, 29.2% in the PRP group, and 10.2% in the control defects; this difference was statistically significant ($p < .05$).

Conclusions

Greater bone-implant contact was achieved with platelet-enriched fibrin glue than with PRP. The results indicate that platelet-enriched fibrin glue can induce a stronger peri-implant bone reaction than PRP in the treatment of bone defects adjacent to titanium dental implants.

The Effect of Platelet-Rich Plasma on Bone Healing Around Implants Placed in Bone Defects Treated with Bio-Oss: a Pilot Study in the Dog Tibia

Tae-Min You[1)], Byung-Ho Choi[1)*], Jingxu Li[2)], Jae-Hyung Jung[1)], Hyeon-Jung Lee[1)], Seoung-Ho Lee[3)], and Seung-Mi Jeong[2)]

Purpose

The aim of this study was to examine the influence of platelet-rich plasma (PRP) used as an adjunct to Bio-Oss for the repair of bone defects adjacent to titanium dental implants.

Materials and Methods

In 6 mongrel dogs, 12 screw-shaped titanium dental implants were inserted into the osteotomy sites in the dogs' tibias. Before implantation, a standardized gap (2.0 mm) was created between the implant surface and the surrounding bony walls. The gaps were filled with either Bio-Oss cancellous granules alone or Bio-Oss cancellous granules mixed with PRP.

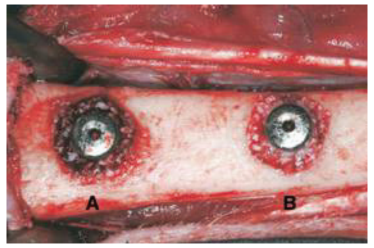

Fig 1. Experimental design.
A, The cortical defect filled with Bio-Oss;
B, the cortical defect filled with Bio-Oss and platelet-rich plasma (PRP).

Animals were killed 4 months after the surgical procedure, and bone blocks with the implants were excised. A morphometric study using an image analysis system was used to quantify the newly formed bone around the implants.

Results

No postoperative infections or loose implants were observed during the follow-up period. In the Bio-Oss group, the newly formed bone was in contact with the implant surface. New bone was formed largely at the implant interface in the upper cortical portions (Fig 2., A, B). In the Bio-Oss and PRP group, a fibrous membrane with fibers parallel to the implant surface was found in contact with the implant surface (Fig 3., A, B).

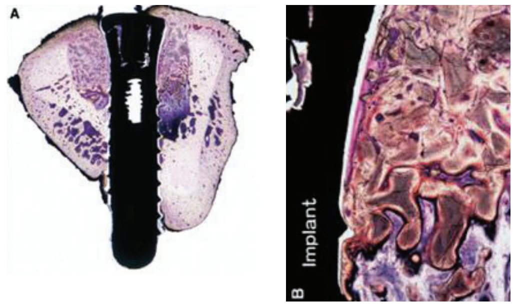

Fig 2. Section from the Bio-Oss group.
A, Original magnification X5.
B, Original magnification X100. The newly formed bone contacts the implant surface.

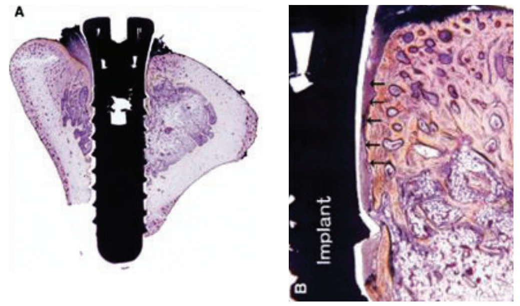

Fig 3. Section from the Bio-Oss and PRP group.
A, Original magnification X5.
B, Original magnification X100. A fibrous membrane (arrows) surrounds the implant surface.

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Table 1. Bone-to-implant contact in the examined dog tibia

Dog number	Bio-Oss group (%)	Bio-Oss + PRP group (%)
1	54.6	33.1
2	72.9	29.2
3	56.9	28.3
4	62.9	34.7
5	68.3	20.7
6	45.2	38.8
Mean	60.1±10.0	30.8±6.3

After 4 months, the Bio-Oss treated defects revealed a significantly higher percentage of bone-implant contact than the defects treated with Bio-Oss and PRP (60.1% vs. 30.8%; P<.05).

Conclusion

The results indicate that when PRP is used as an adjunct to Bio-Oss in the repair of bone defects adjacent to titanium dental implants, PRP may decrease periimplant bone healing.

Comparative Study of Removal Effect on Artificial Plaque from RBM Treated Implant

Uttom Kumar[1)], Choong-Ho Choi[1)], Suk-Jin Hong[1)], Hee-Jyun Oh[1)*]

Introduction

- Bacteria attached in implant surface form dental plaque and they cause the oral disease. A representative bacterium is Streptococci group in initial dental plaque. (Liljemark, 1996)
- Proper oral hygiene is necessary for a long term implant success. (Lindquist, 1996)
- Modified toothbrush is more efficient brushing method in the implant patient. (Jacqueline, 1998)
- Change of the surface appearance after prophylaxis using the various oral hygiene instrument in the rough surface implant treated by sandblasting and acid etching. (Lee, 2004)

Purpose

- The purpose of this study was to evaluate the removal effect of various cleansing methods on the removal of artificial plaque from RBM treated implant surfaces.

Materials and Methods

- 70 round titanium plate (OSSTEM implant, Korea): Diameter (10 mm), height (1 mm)
- Saliva collection from 20-year-old healthful adults and saliva centrifugation
- Saliva + titanium plate: Pellicle formation for baterination during 1 day
- Baterination of Streptococcus mutans: Artificial plaque formation during 3 days
- 1 control group, 6 treatment groups.
- Statistic analysis: SPSS ver. 12.0 (SPSS Inc., USA)

Control group: Bacterination and no other treatment

Interdental brush group: Using interdental brush (Oral B, USA) during 5 seconds and pressure of 80-130 g

PMTC group: Using Propin angle, Eva tip, paste during 5 seconds and pressure of 80-130 g

Prophyflex group: Using Prophyflex 3 (Kavo, German) during 5 seconds, 10mm distance

Chlorhexidine group: Scrubbing 0.1% Chlorhexidine soaking cotton pellet during 30 seconds
Tetracycline HCl group: Scrubbing HCl tetracycline 50 mg/ml soaking cotton pellet during 30 seconds and pressure of 80 g
Citric acid group: Scrubbing Citric acid (pH 1) soaking cotton pellet during 30 seconds and pressure of 80 g

Measurement of weight before and after plaque removal treatment using electronic scale (GB204, Mettler -Toledo, Switzerland)

Comparison of surface appearance using SEM (FE-SEM, S-4700, Hitachi, Japan)

Control group		Artificial plaque (n=10)
Treatment groups	Mechanical groups	Interdental brush (n=10) Professional Mechanical Tooth Cleaning(PMTC) (n=10) Prophyflex (n=10)
	Chemical groups	0.1% Chlorhexidine (n=10) Citric acid (n=10) Tetracycline HCl (n=10)

Results

Table 1. Changes of weight before and after chemical or mechanical removal of plaque (mg).

Groups	N	Before (A)	After (B)	Delta (B-A)
Chemical	15	502.14±5.23	502.30±5.15	0.16±0.25
Mechanical	15	501.20±5.92	501.52±6.03	0.32±0.22
Control	5	501.94±8.81	502.81±8.77	0.87±0.13

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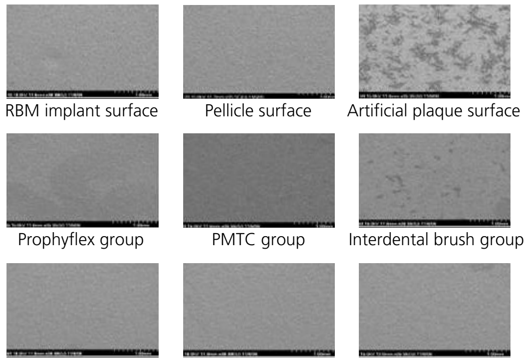
Table 2. Changes of weight before and after removal of plaque according to plaque removal methods (mg).

Groups	N	Before (A)	After (B)	Delta (B-A)
Control	5	501.94±8.81	502.81±8.77	0.87±0.13
Prophyflex	5	502.40±8.42	502.85±8.46	0.45±0.12
PMTC	5	500.76±6.37	500.89±6.56	0.13±0.24
Interdental brush	5	500.44±2.89	500.83±3.03	0.39±0.17
Chlorhexidine	5	500.54±4.60	500.59±4.62	0.05±0.25
Citric acid	5	505.34±6.00	505.45±5.86	0.11±0.31
Tetracyline HCl	5	500.54±4.40	500.85±4.30	0.31±0.11

Table 3. State of residuals according to plaque removal methods.

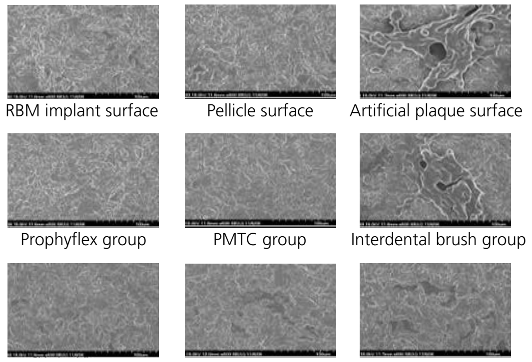
Groups	By-product of bacteria	Survival bacteria	Paste
Sound	-	-	-
Control	+++++	+++++	-
Prophyflex	+	+	-
PMTC	+	++	++
Interdental brush	++	+++	-
Chlorhexidine	++	++	-
Citric acid	+++	++	-
Tetracyline HCl	+++	++	-

Fig 1. SEM findings for perspective view (X 35).



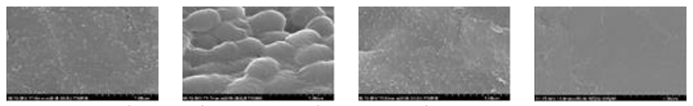
RBM implant surface, Pellicle surface, Artificial plaque surface
Prophyflex group, PMTC group, Interdental brush group
Chlorhexidine group, Citric acid group, Tetracycline HCl group

Fig 2. SEM findings for survey of residuals on surface (X 500).



RBM implant surface, Pellicle surface, Artificial plaque surface
Prophyflex group, PMTC group, Interdental brush group
Chlorhexidine group, Citric acid group, Tetracycline HCl group

Fig 3. SEM findings for survey of characteristic view (X 50,000).



RBM implant surface, Artificial plaque surface, Prophyflex group, Tetracycline HCl group

Conclusions

1. In weight changes, there was significant difference between each treatment group and the control group ($p < 0.05$). Therefore all treatment methods using this study have good ability to remove plaques.
2. In weight changes, there was no significant differences between mechanical and chemical groups, and there were no significant differences between each groups.
3. SEM findings after mechanical treatment disclosed as follows; Prophyflex group looked like sound implant surface, and there were some paste on implant surface at PMTC group, and there were some artificial plaque at interdental brush group.
4. SEM findings after chemical treatment disclosed as follows; there were some dark lesions which were supposed as the by-product from Streptococcus mutans at Chlorhexidine, Citric acid and Tetracycline HCl groups.

In conclusion, all 6 methods using in this study have good ability to remove artificial plaque on RBM treated implant. According to SEM findings, Prophyflex is a superior method for removing of dental plaque among treatment groups.

Analysis of Failed Implants

Young-Jong Kim[1)], Su-Gwan Kim[1)*], Young-Kyun Kim[2)], Suk-Young Kim[3)]

Purpose

The purpose of this study was to analyze the causes of implant failure with respect to implant type and surface treatment by using scanning electron microscopy to examine the surfaces of failed implants.

Materials and Methods

From June 2003 to December 2005, of 32 implants removed after implanting at the Bundang Seoul National University Dental Clinics and Chosun University Dental Hospital referred to us for its esthetic complications or neurological injuries after implanting and removed at our hospital, by reviewing their medical record, diagnosis request, and radiographs, the following items were examined.

For the cases performed at other hospitals, some items were unable to examine because of medical disputes as well as the lack of cooperation in providing the information by the doctors in charge of the patient. The analysis of the level of osseointegration according to the surface treatment methods, the analysis of the level of osseointegration depending on gender and age, and the analysis of the level of osseointegration depending on the type of bone substitute material as well as with or without its use, etiology of implant removal were performed.

Results

Table 1. Retrieved implant data according to surface treatment methods

SurfaceTreatment	Osseointegration				
	none	poor	moderate	good	excellent
Resorbable Blasting Media	1	1	1	2	1
Sandblasted / Acid-etched	7	4	1	1	1
Advanced blasting / etching	1				
Dual Acid Etching	3				
Anodizing		1			
Others			2	3	2
Total	12	6	4	6	4

Table 2. Retrieved implant data according to manufacturers

Manufacturer	Osseointegration				
	none	poor	moderate	good	excellent
SS II	1	1	1	1	1
XIVE	4		1		
Implantium	3	3		1	
ITI		1			1
OnePlant	1				
3I	3				
Branemark		1			
DIO				1	
Others			2	3	2
Total	12	6	4	6	4

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[3)]College of Technology, Yeungnam University, Kyungpook, South Korea

Table 3. Retrieved implant data according to sex and age

Sex	Age	Osseointegration				
		none	poor	moderate	good	excellent
male	20					
	30	3	1			1
	40	1	2	2		
	50	4		1	1	
	60		1			
female	20	2				
	30				1	
	40			1	1	1
	50	2	1			
	60		1		3	2
Total		12	6	4	6	4

Table 4. Retrieved implant data according to the bone substitutes

SurfaceTreatment	Osseointegration				
	none	poor	moderate	good	excellent
autograft	2	2	1	1	
substitute	5	2	1		
auto/sub	1				
none	3	1		1	1
others	1	1	2	4	3
Total	12	6	4	6	4

Conclusions

1. Various results were obtained depending on diverse surface treatment methods, and evaluating based on the obtained results only, relatively high osseointegration was obtained in others (unknown). RBM (resorbable blasting media) was distributed relatively evenly from none to excellent, and it is considered to be superior to other treatment methods. It is considered that perhaps, the surface roughness was substantial and the fixation force by mechanical interlocking was high, and thus good results were obtained.
2. By comparing the level of osseointegration depending on gender, a distinct trend could not be detected, nonetheless, in female patients, generally, the level of osseointegration in a wide distribution was shown, and in male patients, their osseointegration was distributed in the lower side.
3. The use of autologous bone or artificial bone were shown to be in the poor side of the adhesion of implants to bone generally, however, the original bone condition of such patients was poor and thus bone substitutes were used, hence, it could not be concluded that osseointegration was poor because of the use of bone substitutes.

Effect on Osseointegration of Dental Implants After Horizontal Distraction Osteogenesis by Using Nitrified Distractor

Su-Gwan Kim[1)*]

Introduction

1) Insufficient alveolar ridge
- bone graft, bone splitting, distraction osteogenesis (Buser D et al., Quintessence 1994 and Misch CM, Oral Maxillofac Surg Clin North Am 2004)

2) Advantage of distraction osteogenesis
- No need for additional surgery at the donor site
- Coordinated lengthening of the bone and soft tissues
- Distraction osteogenesis is most effective (Jensen OT at al., Int J Oral Maxillofac Implants 2002)
- Vertical alveolar distraction allow longer implant
- Horizontal alveolar distraction allow implant with greater diameter (Abel et al., J Oral Maxillofac Surg 2004)

3) TiN coating
- Decreasing proliferation of bacteria
- Effect of increasing surface hardness, anti-corrosion and wear resistance
- Increasing adhesion of fibroblast (Czarnowska et al. , J. Mater. Process. Technol. 1990 Scarano et al., J. Oral Implantol. 2003 Shenhar et al., Surf. Coat. Technol. 2000)

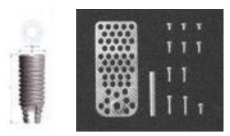
Materials and Methods

1) Animal (4 dogs)
- Age: 12 months
- Weight: 9-10kg

2) Implant: GS II OSSTEM implant, Korea
- 3.75 x 10mm (24 implants)

3) Distraction device
- 0.3 mm wide titanium meshplate and titanium nitrified meshplate
- 2 x 12mm titanium screw

4) Groups
- Group 1: Pure Titanum device
- Group 2: TiN coated device



Extraction of P1, 2, 3, 4 and M1 of the Lt. Mandible

▼ 8 weeks

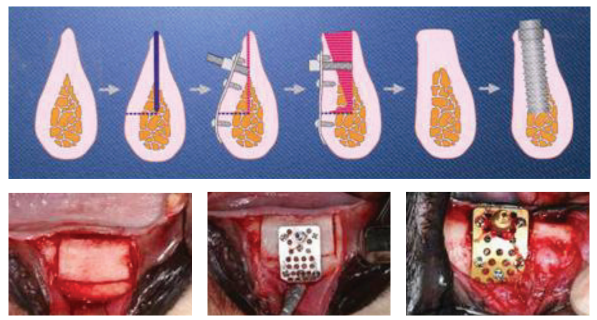
Horizontal distraction device fixation
9 days latency period
5 days distraction period (0.5 mm twice/day)

▼

Device removal and Implant installation

▼

Sacrifice



Osteotomy Group 1 Group 2

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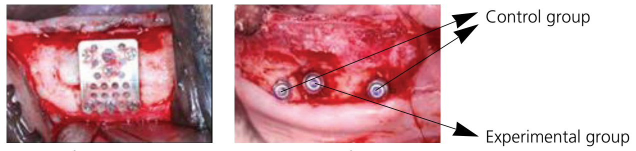


After 8 weeks — Placement of implants

5) Histomorphometric analysis
- New bone formation rate = Dimension of new bone formation / Dimension of thread outside × 100 (%)

5) Statistical analysis
- Student t-test ($p<0.05$)

Results

Direct bone contact with the implant surface was observed.

Control group — Experimental group 1 — Experimental group 2

New bone formation rate (cortical bone)

Groups	Mean±SD
Control	70.98±6.01
Exp. 1	72.91±4.28
Exp. 2	68.04±3.83
Total	70.64±4.82

As a result of ANOVA test each group showed no statistical significance in P=0.391 .

Conclusions

Horizontal alveolar ridge distraction can be a beneficial technique for the placement of implants in the narrow alveolar ridge of dogs. Horizontal alveolar distraction was successfully performed in dogs. Further study of the technique with long-term follow-up to confirm bone and implant stability.

Expression of Osteoclastogenesis Related Factors in Oral Implant Patients

Seong-Hee Ryu[1)*], Min-Gi Yu[1)], Min-Suk Kook[1)], Hong-Ju Park[1)], Hee-Kyun Oh[1)], Seung-Ho Ohk[2)]

Introduction

Periodontal ligament leads the resorption and formation of the alveolar bone enabling tooth movement through physical stimuli. Periodontal ligament is the tissue where cytokines are always secreted in response to mechanical stimuli from the continuous mastication force. Implant teeth loose their tissue, periodontal ligament, for example, inevitably during the installation process. The physiological change of a implant tooth would be different from the change in a natural tooth. For these reasons, bone remodeling phenomena in implant teeth would require a different approach from the existing remodeling view on normal tooth conditions.
This study was performed to evaluate the expression of osteoclastogenesis related factors in implant patients.

Materials and Methods

1) Study subjects

24 patients (17 male and 7 female)

Site I : Implant
A : Adjacent
O : Opposite
N : Normal

2) Measurement

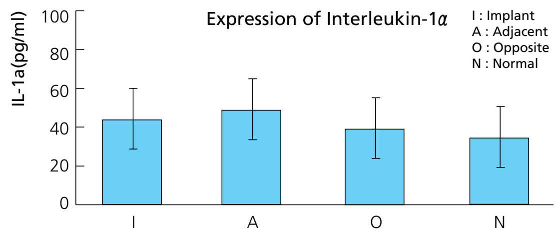
- Enzyme linked immunosorbent assay (ELISA method)

IL-1a	Assay Designs, U.S.A.
IL-1b	Assay Designs, U.S.A.
IL-6	Endogen CO.
OPG	Immundiagnostik AG, Germany
PGE2	Biomedica Medizinprodukte GmbH & Co KG, Vienna, Austria

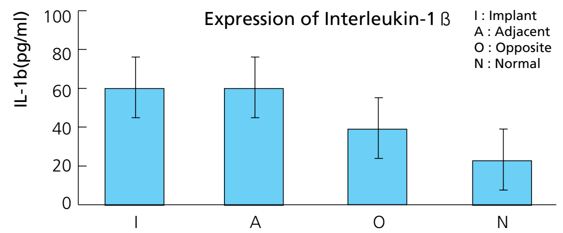
3) Statistical analysis of the results

- One-way ANOVA
- t-test

Results



	Mean	SD
Implant	44.1	11.13
Adjacent	49.8	11.06
Opposite	34.0	9.68
Normal	27.5	5.78



	Mean	SD
Implant	59.1	21.07
Adjacent	59.4	19.62
Opposite	33.0	9.64
Normal	20.6	4.30

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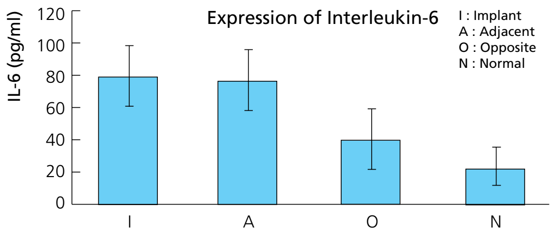
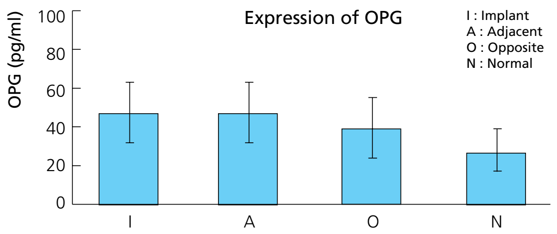
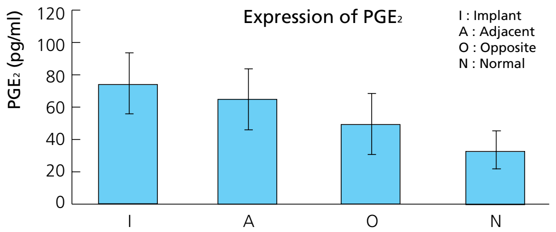


	Mean	SD
Implant	77.0	31.59
Adjacent	71.4	29.44
Opposite	40.8	19.24
Normal	24.1	6.85



	Mean	SD
Implant	49.0	15.05
Adjacent	49.3	16.06
Opposite	39.5	15.28
Normal	29.7	7.43



	Mean	SD
Implant	73.7	31.44
Adjacent	64.5	25.22
Opposite	49.8	18.20
Normal	32.4	12.55

Discussion

Periodontal ligament cells express osteocalcin and alkaline phosphatase which are the target factor for the differentiation of the osteoblasts as well as form the calcification crystals particularly. In addition, it is reported that these cells involve the formation of IL-6 which is an osteoclast differentiation inducing factor by the stimulation of IL-1ß, acting as bone resorption inducing cytokines. As the following results, it is implicated that the periodontal ligament cells have a similar property of osteoblasts.

Besides the activity of interleukines, it is demonstrated that periodontal ligament cells and osteocytes have bone formation functions by the activation in the formation of collagen and alkaline phosphatase (ALP), and recently they secrete osteoprotegerin and the coupling factors of osteoprotegerin ligand and control the degree of the differentiation and activity of osteoclasts in the alveolar bones, thus mediate the bone resorption function.

Conclusions

1. The expression levels of IL-1α, IL-1ß, IL-6, OPG and PGE_2 in dental implant teeth were higher than those of normal teeth.
2. IL-1α revealed higher expression level in adjacent teeth than in dental implant teeth.
3. Dental implant teeth and adjacent teeth did not show remarkable difference in the expression of IL-1ß.
4. All the other cytokines are highly expressed in dental implant than in adjacent teeth.

From these results it might be inferred that there might be close correlation between dental implant and adjacent teeth in the expressions of cytokines that affect the development and regulation of osteoclasts.

Histometric Analysis of Immediate Implantation and Immediate Loading of CMP and RBM Implants after Tooth Extraction in Dogs

Key-Joon Yi[1)*] and Su-Gwan Kim[1)]

Introduction

Implant bodies are made from pure titanium or titanium alloy. The implant surface is treated using various methods to give a smooth, machined, or turned surface, using methods such as hydroxyapatite coating (HA coating) of the implant body, titanium plasma spraying (TPS), blasting, acid etching after sandblasting, and acid etching.

This study evaluated chemical and mechanical polished (CMP) and resorbable blast media (RBM) implants histometrically after placing implants into the socket immediately after tooth extraction and immediately applying a load in dogs.

Materials and Methods

Five adult mongrel dogs aged 8-9 months and weighing at least 10 kg. Twenty RBM implants (OSSTEM Implant Co., Ltd., Korea) that were 10 mm long and 3.5 mm in diameter, and 20 SS III CMP implants (OSSTEM Implant Co., Ltd., Korea) with the same dimensions were used. Eight implants were used in each dog. A cemented-type abutment was used after implantation. Each dog was anesthetized with a 2 cc intramuscular injection of xylazine (Rompun®) and ketamine (Ketara®) into the thigh for general anesthesia. Then, 2% lidocaine (containing 1:100,000 epinephrine) was infiltrated at the site of implantation to prevent bleeding and pain. In each dog, the 1st, 2nd, 3rd, and 4th mandibular premolars were extracted from both sides of the mandible. After the eight premolars, four CMP implants were placed in the left side and four RBM implants in the right. For the three posterior teeth, an abutment was placed on both sides of the implant to place a prosthesis using temporary resin, and the prosthesis was splinted. A cover screw was used to submerge the anterior-most tooth as a control. To prevent postoperative infection, 2 cc of gentamicin were injected intramuscularly for 3 days and followed by 1 cc for 2 days. The dogs were fed soft food. Implant specimens obtained 16 weeks after implantation were fixed immediately after sample collection in 70% alcohol for 6 days. Then, they were dehydrated in alcohol and embedded in glycolmethacrylate resin. The polymerized samples were cut longitudinally at 200 ㎛ thicknesses using a high precision diamond disk and polished into 30 ㎛ thick specimens using a lapping and polishing machine.

Results

1) Experimental design

	Immediate Loading	Non-Loading
RBM surface implant	Experimental 1	Control 1
CMP surface implant	Experimental 2	Control 2

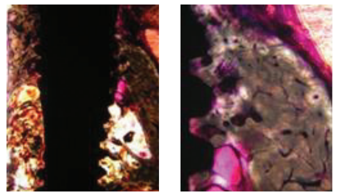
2) Histologic findings

The space between the screw threads was filled completely with mature bone, in both experimental and control groups. No downward proliferation of the epithelium was observed below the upper 1/3 of the implant in the experimental or control groups.

[1)]Dept. of Oral & Maxillofacial Surgery, College of Dentistry, Chosun University, GwangJu, South Korea

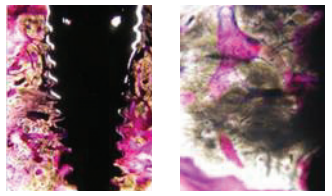
Implant Research
Biology

Experimental 1.
Immature new bone formation was observed in the implant surface and not observed immflamation of RBM thread implant.

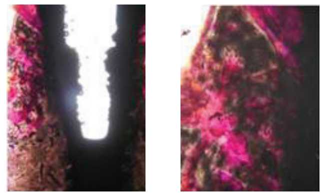


Control 1.
New trabecular bone of lammellar type was seen in the threaded portion of RBM thread implant.

Experimental 2.
New trabecular bone of lammellar type was seen around CMP implant surface.



Control 2.
New bone formation and ingrowth of new bone was seen on CMP implant surface.



3) Implant survival rate (mean %)

	Immediate loading	Non-Loading
RBM surface implant	87	80
CMP surface implant	67	80

4) Rate of new bone formation

	Immediate loading	Non-Loading
RBM surface implant	51.86±2.63	58.50±7.79
CMP surface implant	52.90±3.18	58.00±4.35

For all groups : $p > 0.05$

Conclusions

1. When immediate loading was applied to RBM and CMP implants placed immediately after tooth extraction, the rates of new bone formation were similar between the two groups ($p > 0.05$).
2. For RBM and CMP implants placed immediately after tooth extraction, the rates of new bone formation were similar with and without immediate loading ($p > 0.05$).
3. For RBM and CMP implants placed immediately after tooth extraction, the rates of new bone formation were similar when no immediate loading was applied ($p > 0.05$).

Stability was not significantly different in implants placed immediately after tooth extraction according to immediate loading. No significant differences were seen between RBM and CMP implants according to immediate loading. The implant survival rate and implant-to-bone contact rate after immediate loading were similar to those of submerged implants.
The CMP and RBM dental implants did not differ in terms of implant survival rate and implant-to-bone contact rate.

Histomorphometric Evaluation of Immediately Loaded Implants with Various Coatings in Dogs

Min-Seok Oh[1)*] and Su-Gwan Kim[1)]

Introduction

This study compared splint and non-splint methods for immediately loaded implants and examined the implant success rate for smooth, oxidized, and resorbable blastin media (RBM) surfaces. The 1st, 2nd, 3rd, and 4th mandibular premolars were extracted from six young adult dogs. Twelve weeks after extraction, implantation was performed at the extraction sites. The implants had one of three surface treatments: smooth, oxidized, or RBM. Sixteen weeks after implantation, the dogs were euthanized; the hemi-mandibles were obtained and processed histologically to obtain non-decalcified sections. Longitudinal sections were made for each implant and analyzed using light microscopy. The average implant success rate for all groups was 83.3% in this study. Radiographically, the three oxidized surface implants showed vertical bone resorption to the middle third of the implant. Histomorphometrically, the experimental group had a better bone-to-metal contact rate than the control group. The immediately loaded implant showed results similar to those of the two stage implant method. For the immediate loading of implants, the results were poorer for implants with a smooth surface.

Materials and Methods

1) Study animals

Six mongrel dogs, 6 months old and weighing at least 12 kg.

2) Implants

We used SS II implants (OSSTEM Implant Co., Ltd., Korea) that were 10 mm long and 3.5 mm in diameter. The implant surface was treated to produce one of three different surfaces: smooth, oxidized, or RBM.

Table 1. Experimental design

	Non-Splinting	Splinting
Smooth surface	Control group 1(4)	Experimental group 1(16)
Oxidation surface	Control group 2(4)	Experimental group 2(16)
RBM surface	Control group 3(4)	Experimental group 3(16)

At 16 weeks after implantation, the implants were removed from the euthanized dogs, And the tissues samples were prepared for microscopic observation.

Table 2. Experimental Schedule

Ectraction	Healing Periods 12weeks	Implantation & Immediate loading	Osseointegration 16weeks	Sacrifice

3) Clinical evaluation

For clinical evaluation, the protocol of Zablosky was used to examine implant stability, radiographic bone height, and signs of infection.

4) Histomorphometric evaluation

New bone formation rate = [new bone surface area/surface area outside the thread]×100.

5) Histological evaluation

The implants in experimental groups 1, 2, and 3 were also compared histologically. For histological evaluation, the tissue from the mid-portion (cancellous bone) of the implant was used rather than that from the top portion.

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[2)]Dept. of Oral Microbiology, School of Dentistry, Chonnam National University, Gwangju, South Korea

Results

1) Clinical results

Of the 60 implants, five showed significant mobility and bone destruction on radiographs. All five of these implants were smooth surface implants. The rate of success in control group 1 and experimental group 1 was 75%; the success rate was 100% in the remaining groups.

2) Histomorphometric results

Table 3 shows the rate of new bone formation, together with the standard deviation (SD) and significance, in each group at 16 weeks after implantation.

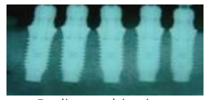
Table 3. The bone-to-metal contact rate (BTMR) for each group at 16 weeks after implantation.

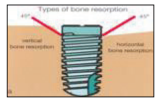
	Non-splinting			Splinting		
	Con1	Con2	Con3	Expt1	Expt2	Expt3
BTMR	45.5±2.0	64.6±5.9	64.7±5.0	46.2±11.2	67.4±8.0*	68.2±6.1

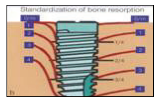
Con: control group, Expt: experimental group.
* Statistically significant difference relative to Expt 1, $P < 0.05$.

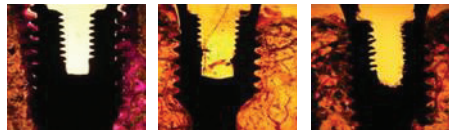

Implantation.
Shortly after implantation after 12 weeks figure

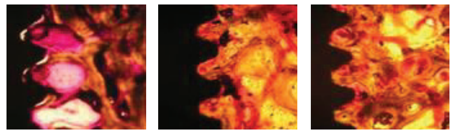

Temporary restoration.
prosthesis is made of temporary resin

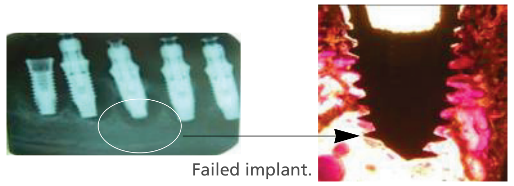

Radiographic view




After sacrifice, the immediate-loaded prosthesis is well maintained


Smooth surface Oxidized surface RBM surface
Experimental Group (×15)


Smooth surface Oxidized surface RBM surface
Experimental Group (×40)


Failed implant.
Surrounding soft tissue.

Conclusions

1. Implants with smooth, oxidized, and RBM surfaces had significantly different outcomes, with the oxidized and RBM surfaces producing better results.
2. There was no significant difference in outcome or in histological and histomorphometric results between the oxidized- and RBM surface implants.

Based on our findings, immediately loaded implants and two-stage implants give similar outcomes. Treated implant surfaces produce better outcomes than a smooth surface. Further studies are needed to evaluate the long-term effectiveness of immediate implant loading.

The Effects of Exposing Dental Implants to the Maxillary Sinus Cavity on Sinus Complications

Jae-Hyung Jung[1)], Byung-Ho Choi[1)*], Shi-Jiang Zhu[2)], Seoung-Ho Lee[3)], Jin-Young Huh[1)], Tae-Min You[1)], Hyeon-Jung Lee[1)], Jingxu Li[2)]

Purpose

The aim of this study was to investigate whether dental implant exposure to the maxillary sinus cavity increases the risk of maxillary sinus complications.

Materials and Methods

An implant was placed bilaterally in the maxillary sinus of 8 adult female mongrel dogs in a way that it penetrated the bone and mucous membrane of the maxillary sinus floor to the extent of 2 mm, 4 mm, or 8 mm. The implants were left in place for 6 months.

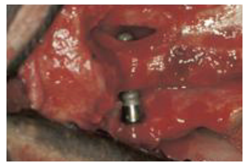


Fig 1. View of the implant immediately after placement in the maxillary sinus.


Fig 2. CT image showing the implants exposed to the sinus cavity with no signs of infection in the maxillary sinus.

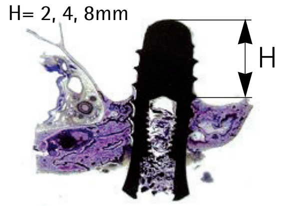


Fig 3. View of the specimen showing the implant and the maxillary sinus.

Results

Radiographic and histologic examinations did not show any signs of pathologic findings in the maxillary sinus of the 8 dogs.
On gross examination of the 2 mm penetrating implant side, the parts of the implants that had been introduced into the sinus cavity were found to be covered with a newly formed membrane.
On the 4 mm and 8 mm penetrating implant sides, the parts of the implants that had been introduced into the sinus cavity were not fully covered with sinus membrane. Debris accumulated on the surface of the apical parts of the implants exposed to the sinus cavity. Histological examination showed that the implants were all integrated into the jawbone without fibrous tissue formation in the interface, and the antral mucosa had no discernible inflammatory reactions in any of the maxillary sinus cavities. Photograph of the maxillary sinus showing spontaneous covering of the implant with the sinus mucosa on the 2mm penetrating implant side. Photograph of the maxillary sinus showing that the implant is not covered by the antral membrane and has debris on the surface of the 4 mm penetrating implant side.

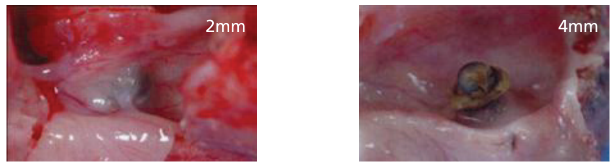


Fig 4. Photography of the maxillary sinus

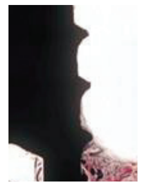


Fig 5. View of the specimen showing direct attachment of the antral membrane to the implant (X50)

Conclusions

This study indicates that implant protrusion into the maxillary sinus cavity is not related to the development of sinus complications in canines.

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[3)]Dept. of Periodontology, Ewha Womans University, Seoul, South Korea.

Effects of Synthetic Peptides on Osteoblasts

Eun-Jung Kang[1)*], Young-Bae An[1)], Tae-Gwan Eom[1)], Sung-Wook Choi[2)], Jae-Ho Kim[2)]

Introduction

Titanium is a widely used material in the dental and orthopedic fields. Numerous studies were performed that titanium implant characteristics such as a texture, surface topography, charge and porosity that influence the osseointegration. Moreover researchers have been trying to apply several biomaterials such as BMPs (bone morphogenetic proteins), ECMs (extracellular matrices) on the Ti surface for the improvement of osseointegration nowadays.

In this study, we synthesized several synthetic peptides (contained 6~20 amino acid sequence) derived from BMP, fibronectine and vitronectine by PepTron Inc. (Daejeon, Korea) to a purity of over 95% and compared the cellular activities of osteoblast-like cell line MG63 on various synthetic peptide-modified Ti surfaces. And We observed the cellular activities of MG63 on syntheticpeptide-modified Ti surfaces.

The purpose of this study was to investigate the cellular activities of MG63 on Surface-modified titanium discs for use of various synthesized peptides.

Materials and Methods

1) Cell culture

- Osteoblast like-cell line MG63
- Medium: Minimum Essential Medium (α-MEM, Gibco) contained 10% FBS
- Cell loading density: 1×105 cells/disk
- Incubation condition: 37℃, CO^2 incubator, 2hr attachment in serum free media
- Culture condition: 1~14days, α-MEM contained 10% FBS media changed period-2days

2) Preparation of surface-modified titanium disks

The synthetic peptides were attached to the surface by the immobilization method (OSSTEM confidential).

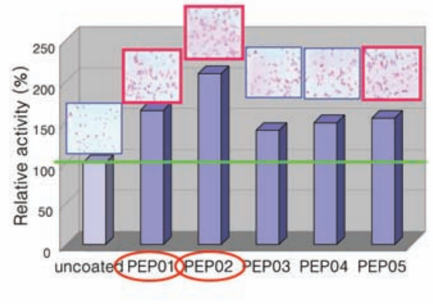
3) Characterization & Assays

- SEM (Scanning Electron Microscopy, JEOL Japan)
- Cell adhesion assay (0.04% cresyl violet staining, Sigma)
- MTS assay (CellTiter 96 Aqueous Non-radioactive proliferation assay. Promega)
- Alkaline phosphatase (ALP) assay (Sigma)

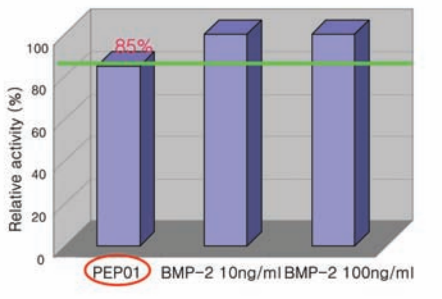
Results

1) Screening of synthetic peptides

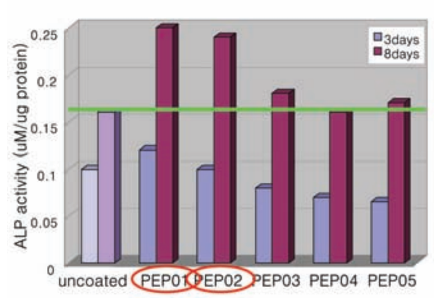
Cell adhesion assay on culture plate



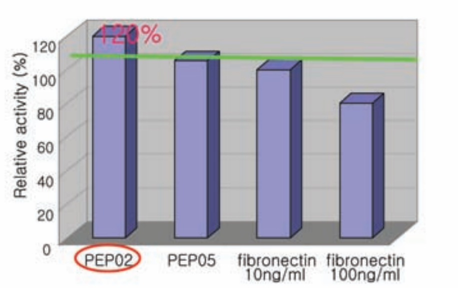
Cell adhesion assay on culture plate



ALP assay (3, 8days) on culture plate



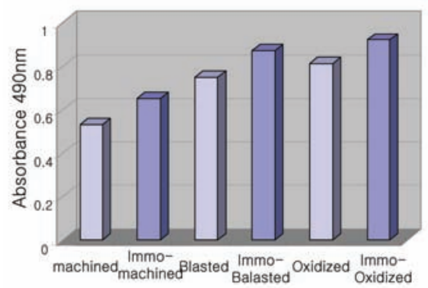
Cell adhesion assay on culture plate



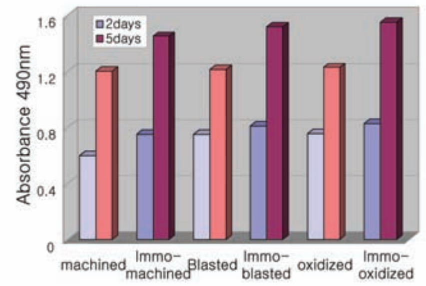
PEP01, 02 showd the effective differences among various peptides in cell adhesion assay, ALP assay.

2) Immobilization on TiO_2 disks

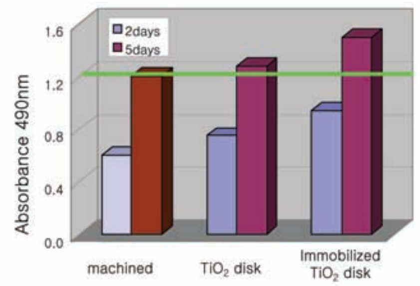
Cell adhesion assay on immobilized disks



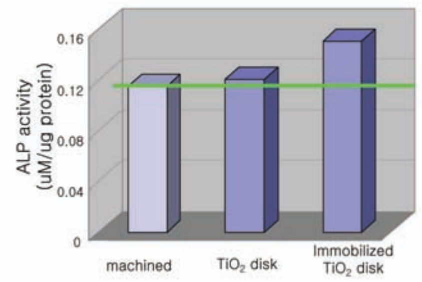
MTS assay on immobilized disks



MTS assay - TiO_2 disk + PEP01



ALP assay (7days) - TiO_2 disk + PEP01



TiO_2 disk (anidic oxidation) was chosen as the basal surface to immobilize synthetic peptides.

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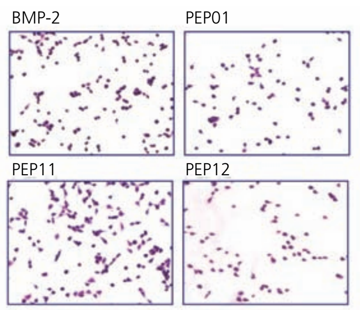
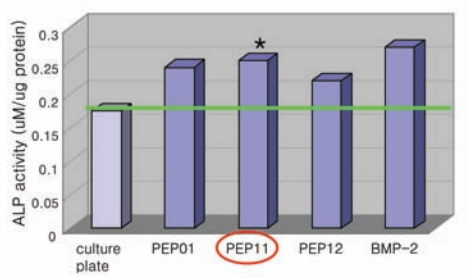
[1)]Dept. of Molecular Science & Technology, Ajou University, South Korea

3) Modification of PEP01 (PEP11/PEP12)

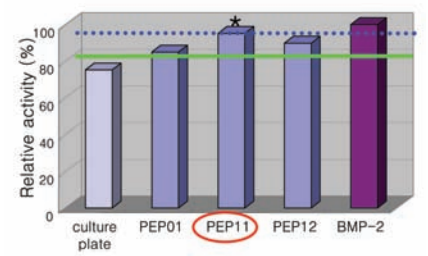
Cell adhesion assay on culture plate



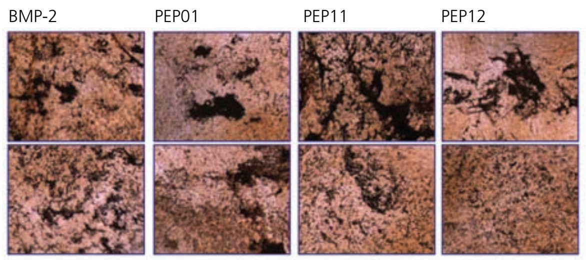
ALP assay (7days) on culture plate



Cell adhesion assay on culture plate



Von kossa stain on culture plate



NOTE> 1. osteogenic media treated
2. cultivation for 7 days

PEP11, 12 derived from PEP01 had the almost same activities as BMP-2 in the results of cell adhesion assay, ALP assay von Kossa stain.

Conclusions

In the results of cell adhesion assay and MTS assay, the initial attachment rates and proliferation rates were significantly different within all specimens. In the early stage of cell adhesion, fibronectine-derived synthetic peptides are better than BMP- and vitronectine-derived synthetic peptides. However, in the results of ALP assay and von Kossa stain, the markers of osteoblast differentiation, BMP-derived synthetic peptides showed the highest results in comparison to the other peptides. These results suggest that the synthetic peptides derived from BMP on Ti surface be used to enhance bone formation and osseointegration.
Furthermore, we are planning to evaluate the effects of synthetic peptides on titanium implant surface in vivo.

** This investigation was supported by the 2005 Components & Materials Technology Development Program of the MOCIE (Ministry of Commerce, Industry and Energy) Republic of Korea.

The Effect of Micro Thread Dimension for Dental Implant on Osteoblasts

Eun-Jung Kang[1)*], Byung-Kook Kim[1)], Hyo-Young Yang[1)], Soo-Young Bae[1)], Tae-Gwan Eom[1)]

Introduction

Titanium is a widely used material in the dental and orthopedic fields. Numerous studies were performed that titanium implant characteristics such as a texture, surface topography, charge and porosity that influence the osseointegration.
Surface topography is one of the essential parameters influencing cellular reactions towards titanium material.
The micro thread structure may be useful for improvement of the adhesion, proliferation of osteoblasts on titanium surface.

Purpose

In this study, we observed the influence of micro thread structure on attachment, proliferation and differentiation of osteoblast-like cell MG63 in vitro.
The micro thread structure can provide a potential of improving cellular activities, eventually osseointegration.

Materials and Methods

1) Design of titanium disks

- CP Ti Gr4
- ø 12x1mm disk (Carpenter Technology corp, USA)

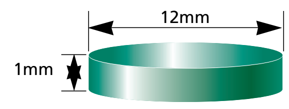


Fig 1. Machined type (turned surface)

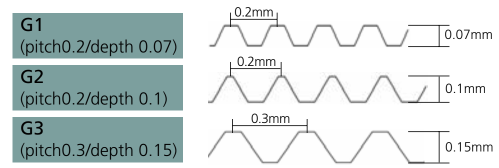


Fig 2. Micro thread types

2) Cell culture

- Osteoblast like-cell line MG63
- Medium: Minimum Essential Medium (α-MEM, Gibco), 10% fetal bovine serum
- Cell concentration: 1×10^5 cells/disk
- Incubation condition: 37℃, CO_2 incubator, 2hr attachment removing of unattached cells with PBS buffer (pH 7.2)
- Culture condition: 1~14days, medium change period-2days

3) Characterization and Assays

- SEM (Scanning Electron Microscopy) Model: JSM-6480LV (Jeol, Japan)
- Cell adhesion assay: 0.05% cresyl violet staining (Sigma Co.)
- MTS assay: CellTiter 96 Aqueous Non-Radioactive Cell Proliferation assay (Promega Co.)
- Alkaline phosphatase (ALP) assay: ALP activity was measured using p-nitrophenol (Sigma Co.) as a substrate.

Results

1) Cell adhesion assay

	Cell adhesion assay				
	N	Mean	S.D.	Max.	Min.
Machined	6	0.916	0.1814	1.114	0.757
G1	6	1.255	0.0766	1.307	1.167
G2	6	1.494	0.1106	1.612	1.392
G3	6	1.136	0.1533	1.299	0.996

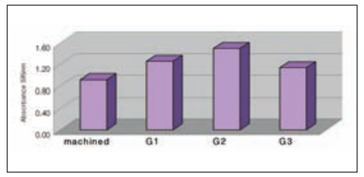


Fig 3. Cell adhesion assay. MG63 were incubated at 37°C, CO_2 incubator, unattached cells were removed with PBS buffer (pH 7.2) after 1hr.

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Implant Research
Biology

2) SEM observation

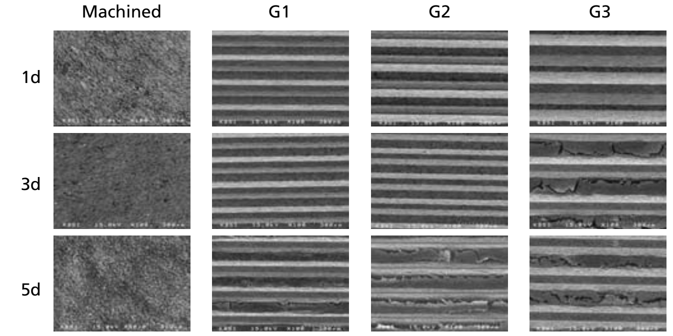


Fig 4. Scanning electron micrographs of experimental micro thread titanium surface.

3) MTS assay

Group	1day		3-day		5-day	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Machined	0.262	0.0387	1.077	0.0221	1.425	0.1160
G1	0.336	0.003	1.257	0.0327	1.672	0.1301
G2	0.355	0.0379	1.561	0.0033	1.817	0.0640
G3	0.342	0.0243	1.347	0.0532	1.807	0.0239

(a) 1-day (b) 3-day (c) 5-day

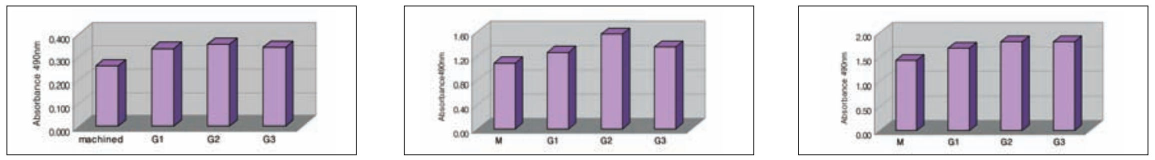


Fig 5. Cell proliferation assay.

4) ALP assay

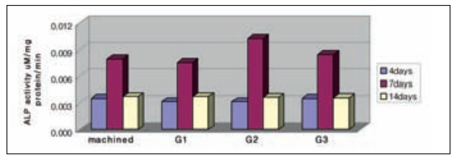


Fig 6. Cell differentiation assay. MG63 were cultured on various micro thread discs for 4, 7 and 14 days.

Conclusions

In the results, G2 (pitch 0.2/depth 0.1) supported better osteoblasts attachment and proliferation than the other micro thread structures.

1. Cell showed a flattened and fibroblast-like morphology by SEM (Scanning Electron Microscopy).
2. G2 micro thread structure was the best in the cell adhesion assay among of them.
3. In the cell proliferation assay, there were slightly differences in G2 micro thread structure compared to G1 and G3.
4. G2 micro thread structure was slightly different in the differentiation assay among of them.

The results of our present investigation is indicative of the fact that micro thread structure of titanium surface offered better cell adhesion and proliferation activity compared to the machined surfaces.
Furthermore, optimal micro thread structure can provide a factor of positive influences in osseointegration.

The Investigations of Alkali Treated Titanium after Anodic Oxidation

Myung-Duk Kim[1)*], Ji-Won Shin[2)], In-Ae Kim[2)], Su-A Park[2)], Tae-Gwan Eom[1)], Kyu-Ok Choi[1)], Jung-Woog Shin[1)]

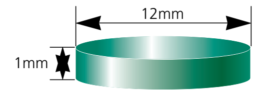
Purpose

Titanium has been widely used in the orthopedic implants and dental implant due to its excellent mechanical strength and biocompatibility. For the successful outcomes, The degrees of osseointegration on the interface between implant surface and bones is known to be one of the major factors for the successful outcomes. For this, various techniques for the surface modification of titanium implant have been suggested and studied. The purpose of this study is to evaluate reactions of the MG63 cells to the changes of the surface characteristics resulting from the alkali treatment on the anodic oxidized titanium surface.

Materials and Methods

Four groups of specimens were prepared in the form of disk with commercially available pure titanium (Grade 3) to study the surface characteristics and related cellular responses with MG63.

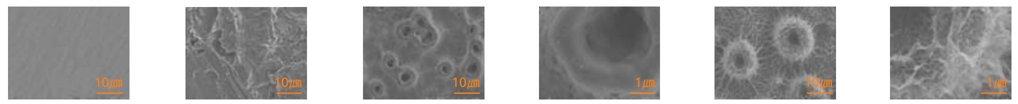
1) Group 1: polished surface
2) Group 2: blasted surface with HA powders whose diameters were ranged between 300 ~ 600 ㎛
3) Group 3: anodic oxidized surface in electrolyte of H_2SO_4 and H_3PO_4
4) Group 4: treated surface in the same way as those in Group 3 followed by alkali treatment



An observation of the SEM (scanning electron microscopic) images and roughness tests were conducted for the changes in surface morphology. Also, compositions and crystal phase of the surfaces were evaluated by EDX (energy dispersive X-ray spectrometer) and XRD (X-ray diffractometer). The wettability of the surface was evaluated by measurement of the contact angles. To evaluate cellular responses the proliferation and differentiation were examined with MG63 cells.

Results

The porous layers were observed in Group 3 while nano-sized radial type cilia structures were observed in Group 4 through the SEM. The measurements of surface roughness showed that Group 2 has higher average values of Ra (arithmetical mean deviation of the profile) and Rz (ten point height) than the other groups. Then, Group 3, Group 4 and Group 1 followed. Composition analysis at the surfaces showed 100% Ti for Group 1 and Group 2. For Group 3, the detected elements were: 70.49 at% O, 25.08 at% Ti and 4.43 at% P due to the anodic oxidation electrolyte which contains P. For Group 4, 67.61 at% O, 23.36 at% Ti, 1.20 at% P, and a very small amounts of 0.22 at% Na were detected. Studies of the crystal phases showed that the only phase Ti was detected in both Group 1 and Group 2, while Ti and TiO_2 in a form of anatase were detected in Group 3. The crystal phases of Group 4 was the similar to that of Group 3. The contact angle was measured least in Group 4 ($8.1 \pm 1.3°$).



G1. Polished G2. RBM G3. Anodic oxidation G4. Alkali treated

Fig 1. The porous layers were observed in Group 3 while nano-sized radial type cilia structures were observed in Group 4 through the FE-SEM(S-4300SE, HITACHI, Japan).

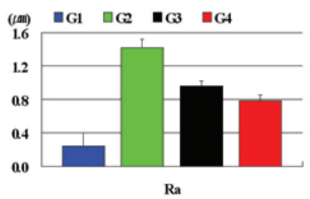


Fig 2. The measurements (Cut-off length 0.025mm, Gaussian filtering) of surface roughness (FTSS S5, Taylor Hobson Ltd, UK) showed that Group 2 has higher average values of Ra (arithmetical mean deviation of the profile)

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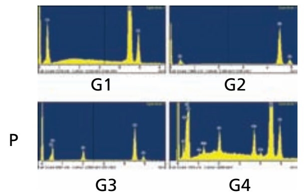
[2)]Dept. of Biomedical Engineering, Inje University, Gyongnam, South Korea

Table 1. Compositions (EDX-EMAX, Horiba, Japan, at%) on the surfaces: G1. polishing, G2. RBM, G3. anodic oxidation, G4. alkali treatment after anodic oxidation

Element	C	O	Na	Mg	P	Ca	Ti	Sum
G1	-	-	-	-	-	-	100	100
G2	-	-	-	-	-	-	100	100
G3	-	70.5	-	-	4.4	-	25.1	100
G4	5.5	67.6	0.2	0.6	1.2	1.6	23.4	100



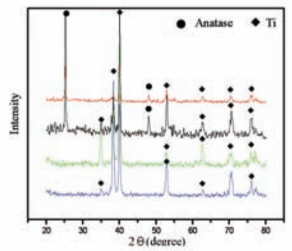


Fig 3. Studies of the crystal phases (D/max 2100II, RIGAKU Co., Japan) showed that the only phase Ti was detected in both Group 1 and Group 2, while Ti and TiO_2 in a form of anatase were detected in Group 3.

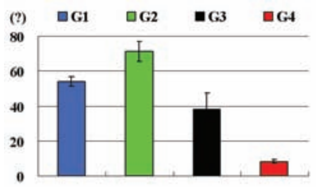


Fig 4. The contact angle (OCA15+, Datahysics Int., Germany) was measured least in Group 4 (8.1±1.3°). G4 > G3 > G1 > G2 (n=6)

Reactions of MG63 cells to each group were also evaluated for 4 hrs, 3, 7 and up to 10 days. The results of the DNA contents showed a significant increase of the cell proliferation for all groups with time, and the increases were observable in Group 4. ALP activities were decreased significantly in all groups with time, while the decrease was reduced after 7 days. Significantly more calcium were produced in Group 4 compared to other groups. (n=6, Statistical Analysis ANOVA (p<0.05), LSD (SPSS, Ver10.0)) The osteocalcin staining and SEM image results were not significantly different on all sample surfaces.

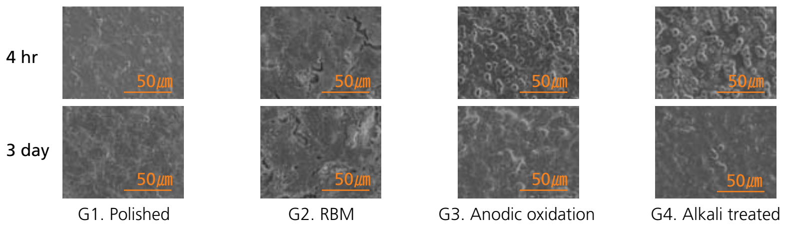


Fig 5. Reactions of MG63 cells to each group were also evaluated for 4 hrs, 3, 7 and up to 10 days.

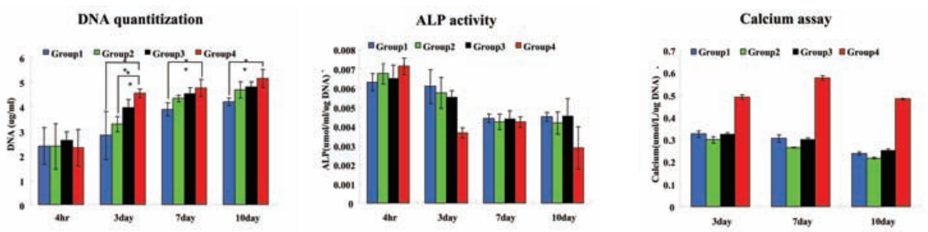


Fig 6. Reactions of MG63 cells to each group were also evaluated for 4 hrs, 3, 7 and up to 10 days.

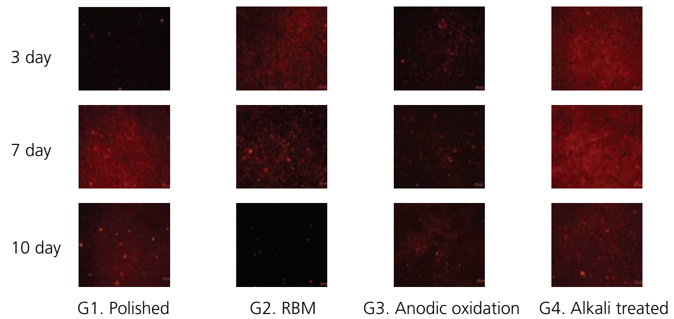


Fig 7. The osteocalcin staining results were not significantly different on all sample surfaces.

Conclusions

In this study, alkali treatment of the anodic oxidized titanium surface resulted in 'the fine nano-sized radial type cilia structures on the porous, micro-sized oxide layer'. From the all the data obtained through this study, this nano-sized structure has a potential of promoting the osseointegration in dental implant.

However, further studies with animals and histological evaluation about this results are recommended.

Photocatalytic Bactericidal Effect on Various Titanium Surfaces

Hyeon-Cheol Joo[1)*], Chang-Whe Kim[1)], Young-Jun Lim[1)]

Purpose

The success of implant depends on such factors as the surgical method, its host, the patient's occlusion, and the characteristics of the implant. The characteristics factors of the implant consist of its diameter and length, design, and surface roughness. It is well known that the moderately roughened surfaces of dental implants enhance direct bone-implant contact. However, rough implant when exposed to the oral cavity. Anatase titanium dioxide (TiO_2) display photocatalytic activity under ultraviolet (UV) illumination. Anatase TiO_2 electrodes can directly splint the water molecules. It is well known that a photocatalyst can decompose various organic compounds is also useful for killing bacteria. The purpose of this study was to evaluate the photocatalytic bactericidal effect according to the surface characterization on titanium against Escherichia coli.

Materials and Methods

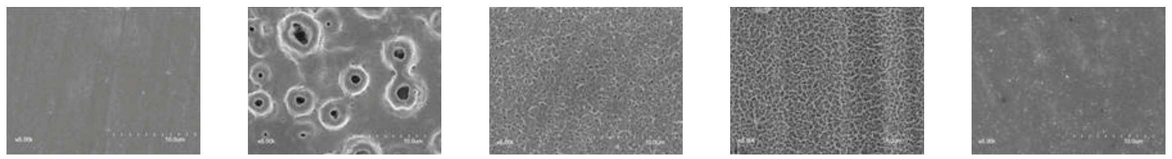
The disks were fabricated from grade 3 commercially pure titanium, 1 mm thick and 12 mm long in diameter.

Groups

- Group 1: Machined surface
- Group 2: Anodized
- Group 3: NaOH-treated
- Group 4: NaOH-and water treated
- Group 5: Heat-treated

Surface analysis was carried out using optical interferometer, scanning electron microscopy (SEM), thin-film X-ray diffractometry. The photocatalytic properties of the each group were confirmed by the degradation of methylene blue, E. coli cells were incubated and seeded on the disks. The disks were then exposed to UV illumination. After illumination, the survival ratio was calculated to evaluate the bactericidal effect.

Results



Machiend (X5,000) | Anodized (X5,000) | NaOH-treated (X5,000) | NaOH and Water treated (X5,000) | Heat-treated (X5,000)

Fig 1. displays the findings of SEM of the disks.

Scanning electron micrographs of the different disk surfaces used in this study.

Table 1. The surface roughness of the titanium disks

Groups	Average roughness (Ra, ㎛)	10 point roughness (Rq, ㎛)	Peak-to-valley height (Rmax or Rt, ㎛)
Machined0.	116±0.107	0.157±0.095	0.907±1.003
Anodized	1.197±0.726	1.555±0.917	11.884±7.059
NaOH	0.252±0.044	0.340±0.058	5.687±2.303
NaOH and water	0.585±0.140	0.795±0.136	8.492±4.024
Heat	0.317±0.124	0.432±0.151	3.858±2.576

[1)]Dept. of Prosthodontics, Seoul National University, Seoul, South Korea

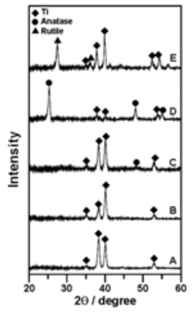


Fig 2. TF-XRD patterns of the surfaces of the 5 groups
E : Heat
D : Anodized
C : NaOH and water
B : NaOH
A : Machined

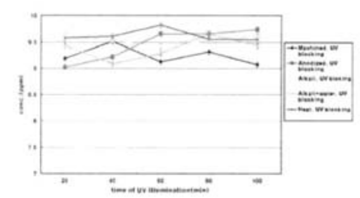


Fig 3. Photocatalytic degradation of methytene blue without the presence of UV illumination.

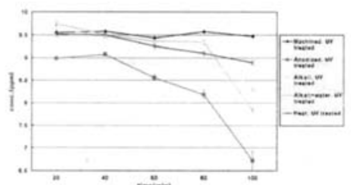


Fig 4. Photocatalytic degradation of methylene blue under UV illumination.

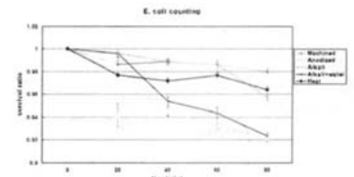


Fig 5. The change in the survival ration of E. coli in five groups.

Conclusions

1. On the surfaces of the anodized titanium and NaOH and water treated titanium, anatase could be seen as a predominant phase.
2. The anodized titanium surface (group 2) and NaOH-and water treated titanium (group 4) showed more photocatalytic effect and bactericidal effect ($P<0.01$), although their surfaces were rougher.
3. Anatase structures on the titanium surfaces were required for the observed bactericidal effect under UV conditions.
4. As the photocatalytic effect increased, so did the bactericidal effect of the titanium surface.

Characterization and in Vivo Evaluation of Calcium Phosphate Coated CP-Titanium by Dip-Spin Method

Chang-Kook You[1)], In-Sung Yeo[2)], Myung-Duk Kim[3)], Tae-Gwan Eom[3)], Jae-Yeol Lee[1)], Suk-Young Kim[1)*]

Purpose

Calcium phosphate ceramics like hydroxyapatite (HA) and tricalcium phosphate (TCP) are good candidates for bone substitutes due to their chemical similarity to bone minerals. Additionally, the biodegradation property of bone substitutes may allow the organism to replace the foreign material by fully functional new bone in a balanced time schedule. Thus, the coating of biodegradable calcium phosphate ceramics on dental implants was conducted in this study to enhance the biocompatibility and eliminate the long-term adverse effects of HA coated implants. The purpose of this study was to test for the biocompatibility and histomorphometry of a newly designed calcium metaphosphate (CMP) coated implant.

Materials and Methods

Biodegradable calcium metaphosphate (CMP) sol was prepared and then coated on CP-Ti substrates by a dip-spin coating technique. The coated specimens were heat-treated at 600℃ for 6 h. CMP coated layer on CP-Ti was smooth and uniform with fine grains. Each rabbit was implanted with two implants; the CMP coated one in one leg and the control (machined) at the same site in the contra-lateral extremity. The bone responses were evaluated and compared by histomorphometry.

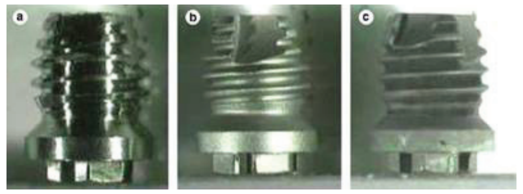


Fig 1. CP-Ti screw implants with different surface morphology. (a) As-machined, (b) blasted with CMP, and (c) blasted and CMP coated.

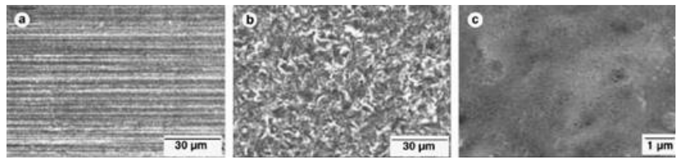


Fig 2. SEM of surface of CP-Ti screw implants with different surface morphology. (a) As-machined, (b) blasted with CMP, and (c) blasted and CMP coated.

Results

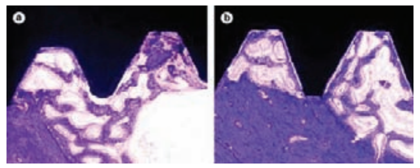


Fig 3. (a) CMP-coated implant and (b) machined implant at 2 weeks (hematoxylin-eosin; X100).

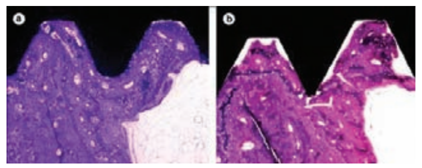


Fig 4. (a) CMP-coated implant and (b) machined implant at 6 weeks (hematoxylin-eosin; X100).

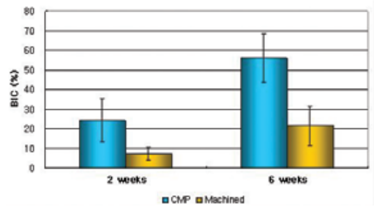


Fig 5. Bone-to-implant contact

It is observed that bone-to-implant contact area of CMP coated specimen at both 2 and 6 weeks was significantly higher than that of non-coated group.

Conclusions

These results suggested that bone defects around titanium implants can be treated successfully with DBP and that PRP may improve bone formation.

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The Effects of the Surface Morphology in Anodic Oxidized Titanium with Sulphuric Acid and Phosphoric Acid on the Osteogenesis

Tae-Yong Park[1)], Sang-Hoon Eom[1)], Myung-Duk Kim[2,3)], Su-Hyang Kim[2)], Hyoung-Il Kim[4)], Gye-Rok Jeon[5)], Ho-Joon Shin[2)], and Jung-Woog Shin[2)*]

Purpose

The purpose of the present study is to investigate the effect of the applied voltage in anodic oxidized titanium with H_2SO_4, and H_3PO_4 on the osteogenesis.

Materials and Methods

In the present study, the titanium surface was treated by anodic oxidation in 0.25 M H_2SO_4 and 0.25 M H_3PO_4. The parameters of the oxidation process were: 380 A/m2 of current density, 1hour of oxidation time. Under this condition, 220V and 320V were applied. Surface roughness, morphological alterations, cell growth, and osteogenesis of bone marrow stromal cells (BMSC) were assessed. Surface oxide properties were characterized by using various surface analytic techniques involving scanning x-ray diffraction, surface roughness tester and scanning electron microscopy (SEM). Cellular response was observed by F-actin stain and SEM, osteogenesis of BMSC was examined by alkaline phosphatase (ALP) activity and calcium depositions. In addition to those two specimens, machined surface was also prepared.

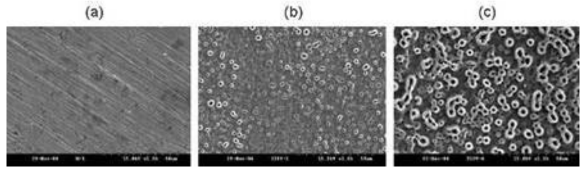

Fig 1. SEM morphology of (a) machined, at (b) 220V and (c) 320V of anodic oxidation titanium surface (x1,000).

Results

In anodic oxidized titanium, the pore sizes were up to 5.5 μm in diameter and the surface roughness was in the range of 0.22~0.73 μm compared with 0.09 μm in machined titanium. The chemical compositions consisted mainly of TiO_2, especially a mixtures of anatase and rutile type.

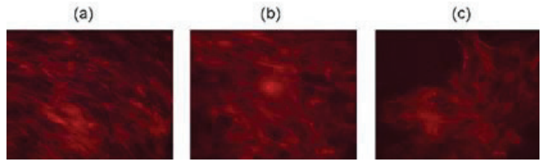

Fig 2. F-actin of mesenchymal stem cells above (a) machined, at (b) 220V and (c) 320V of anodic oxidation titanium surface after 1 day in culture (x200).

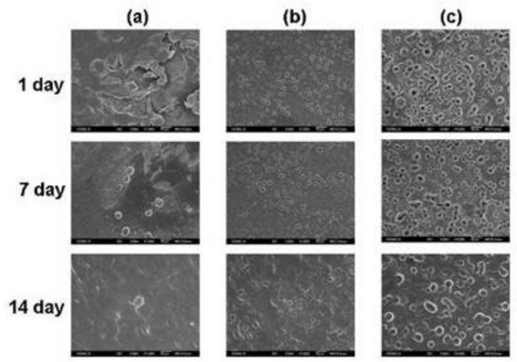

Fig 3. SEM morphology of MSCs above (a) machined, at (b) 220V and (c) 320V of anodic oxidation titanium surface with time (1, 7 and 14 days in culture, x1,000)

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[4)]Dept. of Dental Material, Pusan National University, Busan South Korea
[5)]Dept. of Biomedical Engineering, College of Medicine, Pusan University, Busan , South Korea

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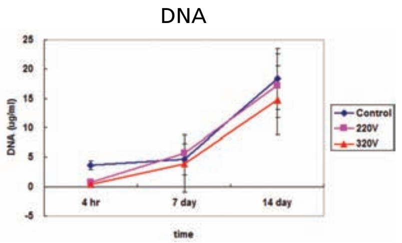

Fig 4. DNA contents of MG-63 above machined, at 220V and 320V of anodic oxidation titanium surface with time (n=5).

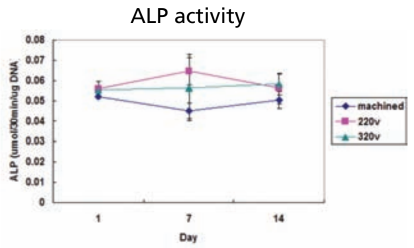

Fig 5. Normalized alkaline phosphatase (ALP) activity of MSCs above machined, at 220V and 320V of anodic oxidation titanium surface with time (n=5).

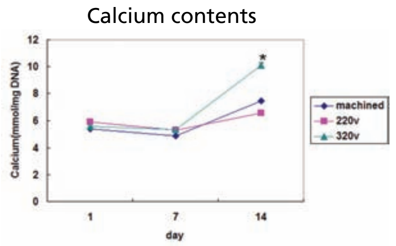

Fig 6. Normalized calcium depositions of MSCs above machined, at 220V and 320V of anodic oxidation titanium surface with time? (*: $p<0.05$, n=5)

Three types of titanium were able to support cell growth with cells rapidly spreading on the surface because of flattened cells observed at 4 hours after BMSC seeding. ALP activities of BMSC on three types of titanium disc were gradually increased with time (1, 7, and 14 days). But there was no significantly higher in 320V oxidation of titanium than in both 220V oxidation of titanium and machined titanium in 14days after rabbit BMSC culture.

Conclusions

In conclusions, we found the applied voltage of 320V provided better condition for osteogenesis for TiO_2. And we found that oxide properties of each titanium, i.e. the microporous structure, chemical composition and the surface roughness influence the osteogenesis. Based on the results obtained, we could come to the conclusions that the roughness and porous morphology affect the osteogenesis and this surface treatment technique may change the surface morphology to promote osteogenesis by adjusting the applied voltage.

Cellular Activities of MG63 on Surface-modified Titanium Disks for Use of Dental Implants: In-Vitro Study

Eun-Jung Kang[1)*], Young-Kook Jung[1)], Young-Bae An[1)], Myung-Duk Kim[1),2)], and Jung-Woog Shin[2)]

Introduction

Titanium is one of the major materials used in the dental as well as orthopedic fields. In addition, various studies to modify the surface morphology have been reported to promote the osseointegration.

Especially, among surface properties, morphology, roughness and composition have been considered important factors for cell-to-implant interactions.

Purpose

The purpose of this study was to investigate the roles of composition and characteristics of surface-modified titanium in cellular behavior of osteoblast.

Materials and Methods

1) Cell culture

- Osteoblast like-cell line MG63
- Medium: Minimum Essential Medium (α-MEM, Gibco)
- Cell concentration: 1×10^5 cells/disk
- Incubation condition: 37℃, CO_2 incubator, 2hr attachment
- Culture condition: 1~14days, medium change period-2days

2) Preparation of surface-modified titanium disks

Group 1: machined disks
method - manufactured by CNC machine
roughness: Ra 0.1~0.3㎛

Group 2: hydroxyapatite blasted disks
method - blasting media size: 40~80mesh,
blasting pressure: 6~6.3 atm,
blasting time: 10sec
roughness: Ra 1.2~1.8㎛

Group 3: anodized disks
method - electrolytic solution: H_2SO_4, H_3PO_4
voltage: 300V, current density: 0.053A/m2
roughness: Ra 0.8~1.2㎛

Group 4: anodized disks
method - electrolytic solution: CaGP, CA
voltage: 350V, current density: 0.018A/m2
roughness: Ra 0.5~1.0㎛

3) Characterization and Assays

- SEM (Scanning Electron Microscopy)
- MTS assay
- Alkaline phosphatase (ALP) assay

[1)]Implant R&D Center, OSSTEM Implant Co., Ltd., Busan, South Korea
[2)]Dept. of Biomedical Engineering, Inje University, Gyongnam, South Korea

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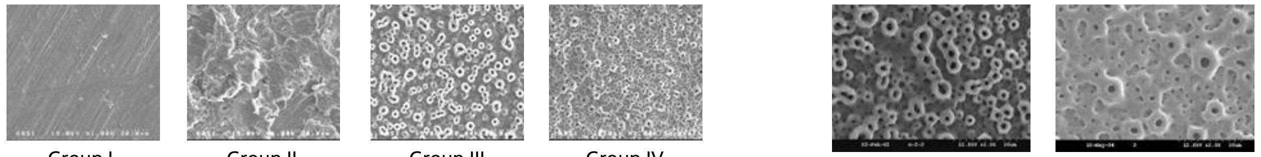
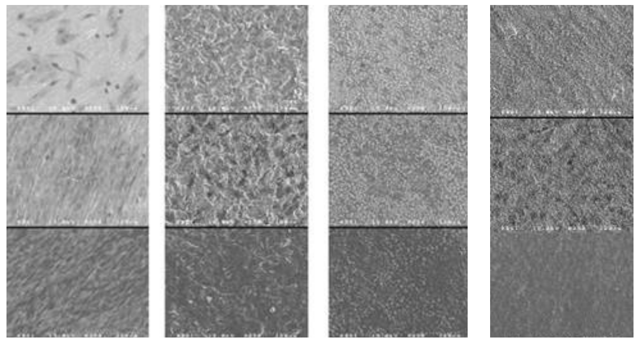
Results

1) Morphology of surface-modified titanium disks



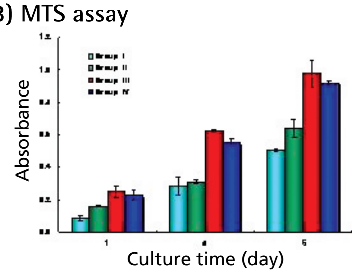
The surfaces of anodized disks (Group III, IV) show different topographies and chemical composition of surface oxides on titanium. Group III shows micro-pores (diameter: 1~3㎛, depth: 3~5㎛) on its surface and Group IV shows micro-pores (diameter: 0.5~2㎛, depth: 0.5~3㎛)

2) Osteoblast cultures on surface-modified titanium disks

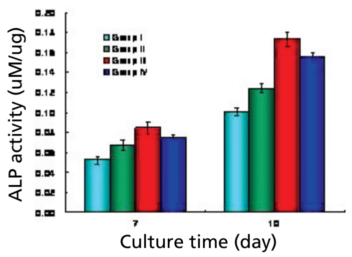


The results showed that the initial cell adhesion rate and proliferation rate are higher on the anodized discs (Group III) than on the other groups. Especially, the ALP activity of MG63 on the anodized disks (Group III) was significantly higher (30-40% approx.) than on the other groups.

3) MTS assay



4) ALP assay



Conclusions

In conclusion, the results of our present investigation is indicative of the fact that anodized surface (Group III) offered remarkably better cell proliferation and differentiation as well as attachment than the other surfaces studied. The surface modification by anodization provides a potential of improving cellular activities, eventually osseointegration, which is a prerequisite to be considered in dental implants.

Expression of Osseointegration-Related Genes Round Titanium Implant: BMP2, BMP4

Cheong-Hwan Shim[1)], Yu-Jin Jee[2)*], Hyun-Chul Song[3)]

Purpose

After dental implant are planted into their bony site among the various growth factors associated with bone formation. BMP is expressed in the bone surrounding the implant fixture. By taking a close look at BMP2, BMP4 which are growth factors that take put in bone formation, its histologic features and radiographic bone healing patterns we would like to examine the mechanism of osseointegration.

Materials and Methods

We randomly used 8 male and female house rabbit and used diameter 5mm height spiral shaped implants (OSSTEM Implant Co., Ltd., Korea) for animal use handled as a resorbable blast madia (RBM) surface and machined surface. 2 group were formed and each group had RBM surface and machined surface implant or a simple bone cavity. After 3, 7, 14 and 28 days post surgery 2 objects were sacrificed from each group and histologic specimens were acquired. RT-PCR analysis was conducted and after H&E staining the extent of osseointegration was measured applying a histologic feature and histomorphometric analysis program. Quantity one -4.41 (Bio-Rad, USA) was used after scanning the PCR product image of the growth factors manifested in each group.

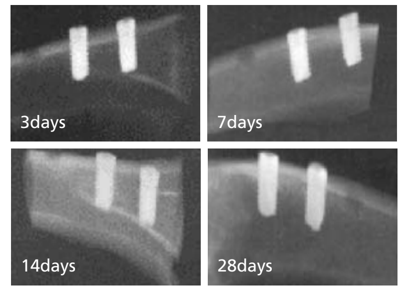


Fig 1. Radiographic features of 3rd, 7th, 14th, 28th day after implantation.

Results

According to the histomorphometric features the RBM, Machined surface group showed increased contact between bone and implant surface at 3, 7, 14 and 28 days after surgery. The BMP2 level increased in both experiment groups but remained unchanged in the contrast group. BMP4 levels stayed steady after the early post implantation period for RBM but showed decreased in the machined surface group and contrast group.

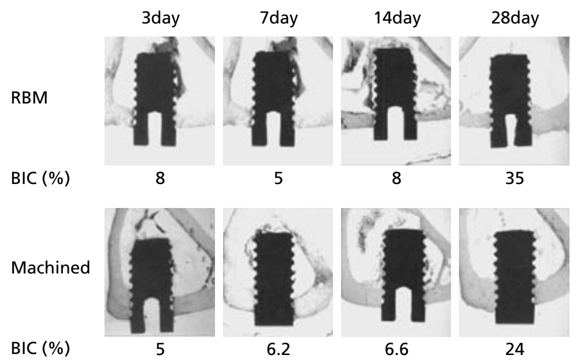


Fig 2. Histomorphometric features and percentage of bone-to-implant contact (BIC)

	3 day	7 day	14 day	28 day
RBM	935	897	958	1009
Machined	985	1007	946	1014
Control	1050	903	889	1053

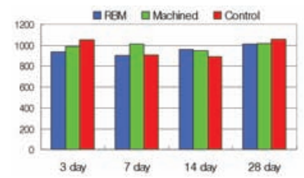


Fig 3. Expression of BMP2

	3 day	7 day	14 day	28 day
RBM	726	722	707	751
Machined	750	713	665	621
Control	726	633	697	679

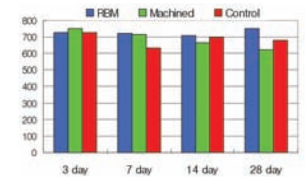


Fig 4. Expression of BMP4

Conclusions

The amount of contract between bone and implant surface increased with the passage of time. BMP2, BMP4 were expressed in both experimental group and contrast group. These growth factors play a role in osseointegration of implant.

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Elemental Analysis of the Surface Residues on Dental Implants

Tae-Il Kim[2)], Tae-Gwan Eom[2)], Tae-Hee Byun[2)], Kyu-Ok Choi[2)], and Jae-Ho Kim[1)*]

Purpose

The objective of this study is to assess the presence, type and amount of surface contaminants of implant from 7 different implant systems X-ray photoelectron spectroscopy (XPS).

Materials and Methods

The total number of implants used in this study was 60 samples manufactured by 7 different implant systems.
- A (USA, 5ea): Partial surface treatment product
- B (Sweden, 5ea): Electrochemical oxide formed surface
- C (Switzerland, 5ea): Surface blasted with Al_2O_3 and etched
- OSSTEM (Korea, 30ea): Surface blasted with hydroxyapatite
- D (Korea, 5ea): Surface blasted with TiO_2 and etched
- E (Korea, 5ea): Surface blasted with hydroxyapatite
- F (Korea, 5ea): Surface blasted with Al_2O_3 and etched

Fig 1. The photograph of implant samples

1) X-ray photoelectron Spectroscopy
   Different implant systems were analyzed to identify elements of surface contaminants by X-ray photoelectron spectroscopy (XPS) and to determine relative amount of residual elements on the surface of each implant system.
2) Scanning electron microscopic analysis
   Randomly selected an implant sample from each implant system was used to investigate the morphological condition and the surface cleanliness by using a scanning electron microscope.
3) Surface roughness measurement
   Surface roughness values were measured and averaged with 3 samples from 7 implant systems.

Results

Analytical data indicates that the majorities of the elemental contamination are the organic carbon and trace amounts of N, Ca, P, Cl, S Na and Si.

Table 1. Elemental analysis of the surface residues on 7 implant samples

SPL \ ELE	Na	N	C	Zn	P	Cl	Si	Ti	Ca	O	Al	Cu	Rel.Con.
A	0	0	30.42	0	0	0	0	20.1	0	49.44	0	0	0.340
B	0	0	22.19	0	8.73	0	0	14.6	0.40	54.49	0	0	0.308
C	0	1.57	31.64	0	0	0	0.92	19.2	0	46.64	0	0	0.304
OSSTEM	0	1.36	20.80	0	1.97	0	1.02	19.8	0.41	54.62	0	0	0.264
D	1.12	0.64	41.00	0.4	0	1.4	2.8	9.9	2.60	40.10	0	0	0.506
E	0	1.60	24.00	0	1.80	0	0.5	17.4	0	51.60	2.80	0.3	0.310
F	0	1.00	26.98	0	0	0	9.39	12.0	0	49.42	1.19	0	0.386

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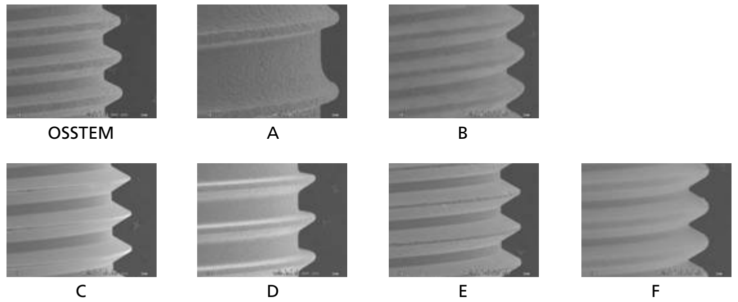


Fig 2. The SEM images of seven different implant samples.

Table 2. The mean values of surface roughness (Each implant sample was measured at 9 different sampling areas)

Samples	OSSTEM	A	B	C	D	E	F
Ra (㎛)	1.8	0.96	1.5	2.71	1.21	1.07	0.82

Conclusions

OSSTEM implant shows the highest concentration of Ti, and O while the lowest concentration of other contaminating elements. This reflects that OSSTEM implant were produced under the optimal mechanical manufacturing process and surface treatment including final cleaning process.

A Comparative Study of Osseointegration of OSSTEM Implants in a Demineralized Freeze-Dried Bone Alone or with Platelet-Rich Plasma

Su-Gwan Kim[1)*], Woon-Kyu Kim[2)], Joo-Cheol Park[3)], and Heung-Jung Kim[3)]

Purpose

The purpose of this study was to assess the efficacy of demineralized bone powder (DBP) alone or combined in a mixture with platelet-rich plasma (PRP) used to enhance osseointegration of dental implants in a dog model.

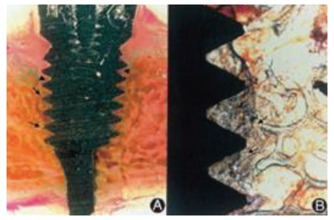
Materials and Methods

Tissue integration was assessed using standard histomorphometric methods at 6 and 12 weeks after surgery. A total of 30 OSSTEM dental implants (OSSTEM Implant Co., Ltd., Korea) were inserted in the animals. They were self-tapping screw implants, 10 mm in length and 4 mm in diameter, made of commercially pure titanium. A titanium implant was then placed centrally in each defect. In each dog, the defects were treated with 1 of the following 3 treatment modalities; 1) no treatment (control), 2) grafting with DBP, or 3) grafting with DBP and PRP.

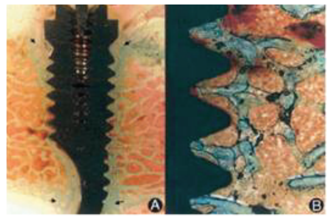
Results

Histological analysis showed that all of the bone defects surrounding the implants that were treated with DBP, with and without PRP, were filled with new bone. The defects that were not treated (control) showed new bone formation only in the inferior threaded portion of the implants.

(1) Control group

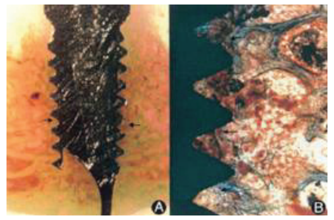


6 weeks

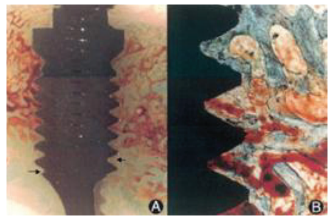


12 weeks

(2) DBF group

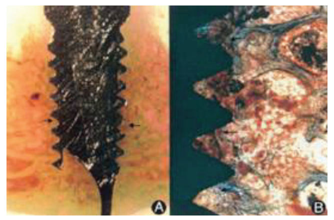


6 weeks

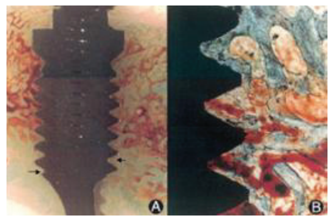


12 weeks

(3) PRP group



6 weeks



12 weeks

Table 1. Bone-to-implant contact around dental implants Mean±SD Percentage of direct bone in contact (%)

	Control	DBP	PRP
6 weeks	10±18.4	48±10.5*	74±13.1* †
12 weeks	17±2.5	56±15.9*	80±15.2*

*Statistically significant difference relative to group 1.
† Statistically significant difference relative to group 2.

Table 2. Bone-to-implant contact around dental implants Mean±SD Bone Region in Implant Threads of Direct Bone in Contact (%)

	Control	DBP	PRP
6 weeks	17±12.2	48±10.5*	74±13.1* †
12 weeks	25±20.8	56±15.9*	80±15.2*

*Statistically significant difference relative to group 1.
† Statistically significant difference relative to group 2.

Histomorphometric results revealed a higher percentage of bone contact with DBP and PRP compared with control and DBP.

Conclusions

These results suggested that bone defects around titanium implants can be treated successfully with DBP and that PRP may improve bone formation.

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A Histomorphometric Study of Two Different Threaded CP Titanium Implants

Dong-Hoo Han[1)], Young-Sik Jeon[1)], Jin Kim[1)*], Seon-Jae Kim[1)]

Purpose

The purpose of this study was to compare surface roughness and bone formation around two types of threaded commercially pure titanium implants manufactured by two different companies.

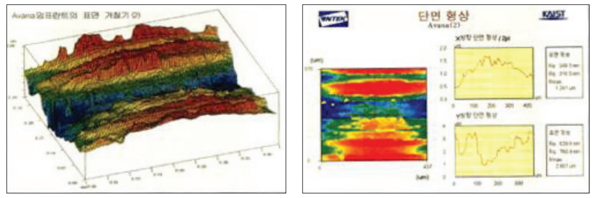
Materials and Methods

The test implants were manufactured by OSSTEM implant (Seoul, Korea), while the controls were manufactured by NobelBiocare (MKII, Goteborg, Sweden). To compare bone formation adjacent to newly product implant with Branemark MK II implant, surface roughness was measured by Accurate 1500M and histomorphometric analysis was done.

Results

1) Surface roughness

Measurement of surface roughness showed that OSSTEM implant had a slightly more irregular surface compared with Branemark implant.


OSSTEM implant

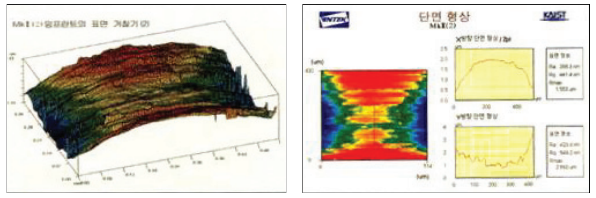
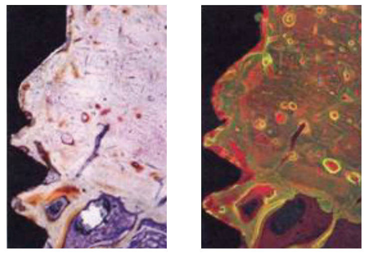

Branemark implant

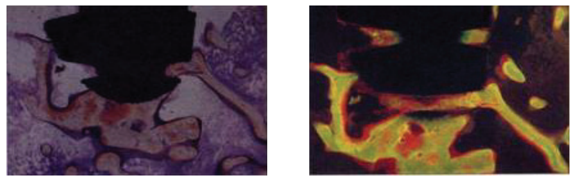
Table 1. Surface roughness (㎛)

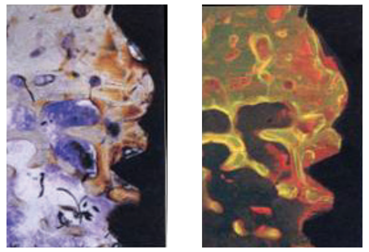
	Ra	Rq	Rma	Rsk	Rku
OSSTEM implant	0.704	0.883	7.8	0.15	6.72
Branemark implant	0.505	0.649	3.6	0.35	3.18

2) Histomorphometric analysis

In the light microscopic studies, no infiltration of inflammatory cells nor the giant cells were observed on both groups. In the light and fluorescent microscopic studies, the amount of osseointegration and the extent and the timing of bone formation were similar.


OSSTEM implant in the femoral diaphysis of dog (longitudinal section)


OSSTEM implant in the femoral diaphysis of dog (cross section)


Branemark implant in the femoral diaphysis of dog (longitudinal section)

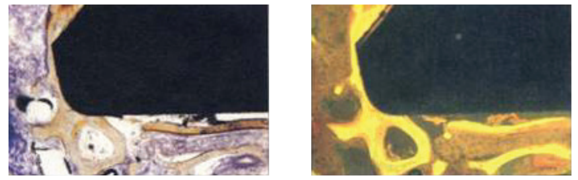

Branemark implant in the femoral diaphysis of dog (cross section)

Table 2. Bone-to-implant contact around dental implants

	BIC (%)	SD
OSSTEM implant	70	16
Branemark implant	67	23

There were no statistically difference between two groups in the average bone to implant contacts.

Conclusions

Comparing with Branemark implant, OSSTEM implant made of CP grade II titanium showed similar good bone healing, formation and osseointegration.

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The Effect of Various Taper Angles of the Internal Morse Taper Connection Type Dental Implant Fixture on Their Stress Distribution by FEA Study

Seung-Woo Suh[1)*], Myung-Duk Kim[1)],Tae-Gwan Eom[1)]

Introduction

In Dental Implant, The Morse taper use widely where it can transfer bite force effectively. This study is determined optimal morse taper angle using 3D Finite Element Analysis where it minimizes the stress which is delivered in alveolar bone.

Materials and Methods

1. Design of Finite Element Model

In this study, the condition is that placed implant in mandibular 2nd premolar region and single implant restoration.

- **Alveolar Bone** : 3D Modeling support organization of the mandibular 2nd premolar from tracing tomography of the patient
- **Implant** : GS II implant system (OSSTEM Co.Ltd., Korea) where it has type Internal morse taper connection and submerged. implant 3D design model of manufacture company in standard modeling Implant-abutment interface morse taper angle where it is used from FE-Model about under variable angle each component to be linked in angle change and in order to become modify, it embodied. The element formed mesh with 10 nodes tetrahedral element of ANSYS® solid 187.

Table 1. Fixtures and abutments used in this study

Components	Sizes	Material
GS II fixture	φ4.0㎜×11.5㎜	Titanium Gr4
Transfer Abutment	φ5.0㎜×5.5㎜	Titanium Gr3
Abutment screw	φ2.0×Pitch0.4㎜	Ti-6Al-4V
Crown	8.5㎜×11.0㎜×13.5㎜	Gold Alloy

(a) GS II implant Components (b) CAD Model (c) Meshed FE-Model

Fig 1. Finite Element Modeling

2. Contact and Loading Condition

A. Properties and Contact

FE-Analysis performed using ANSYS® 11.0 (ANSYS Inc., Southpointe, USA), it provides the contact condition which they used. Implant-abutment interface applied 0.3 where they are Titanium coefficients of friction, the remaining part in order for each material surface to have a continuity each other, created model. The whole model assumed homogeneity, isotropy and linear elasticity.

Table 2. Material properties

Components	Material	Young's modulus	Poisson's ratio
Fixture	Ti Gr4	105㎬	0.34
Abutment	Ti Gr3	104㎬	0.34
Screw	Ti-6Al-4V	113㎬	0.342
Crown	ADA type III Gold Alloy	170㎬	0.3
Cortical Bone	-	13.7㎬	0.3

B. Loading Condition

It gave an identical loading condition from the FE model, average bite force 250N vertical force from the posterior region on the center.

[1)] Implant R&D Center,OSSTEM Implant Co. Ltd., Busan, South Korea

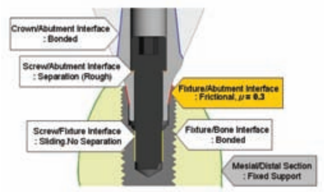

Fig 2. Contact and support of FE-model.

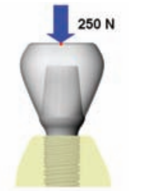

Fig 3. Loading Condition

3. FEA with Design Optimizing tool for Taper angle

In this study, it is determined with ANSYS® v11.0 Analysis Tool (Workbench™) and Optimizing tool (DesignXplorer™) which stress (Max. Equivalent stress) in fixture and bone according to the variable morse taper angle, 0~30degree, at implant-abutment interface. So it is detected the angle where becomes optimum in bite force distribution of alveolar bone in implant and bone.

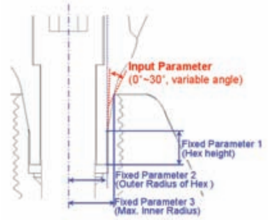

Fig 4. Schematic diagram for implant Shape

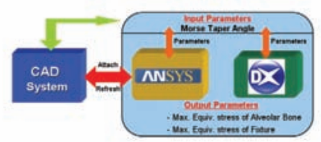

Fig 5. Schematic diagram for Method

Results

The variation of stress under the each Taper Angle

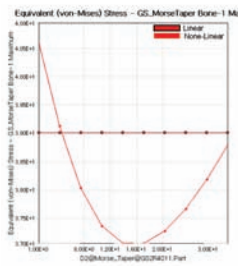

Fig 6. Max. Equiv.Stress of alveolar bone by Angle Variation

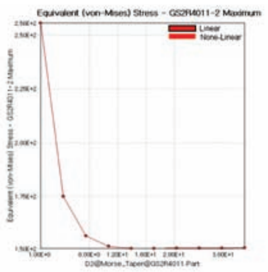

Fig 7. Max. Equiv.Stress of implant fixture by Angle Variation

Table 3. Output Parameter Minimums

	Max. Equiv. Stress - implant (㎫)	Max. Equiv. Stress - Bone(㎫)
Morse_Taper Angle	15.501	1.0015
Minimum	150.46	38.997

Table 4. Output Parameter Maximums

	Max. Equiv. Stress - implant (㎫)	Max. Equiv. Stress - Bone(㎫)
Morse_Taper Angle	1.0015	1.0015
Minimum	255.48	38.997

Accoarding to the FE-analysis results, Equivalent (von-Mises) stress of the alveolar bone is uniformed irrespective of Morse taper angles (39㎫). The other side, Equivalent stress at Taper angle 1˚, the maximum mount (255.48 ㎫) seemed from implant, the smallest stress (150.46㎫) appeared from 15.5˚, where it is after maximum angle gets peeled off the tendency little increase appeared until 30˚

Candidate Designs

Generate or update candidate designs based on the current goals

Parameter	Candidate A		Candidate B		Candidate C	
D2@Morse_Taper@GS2R4011.Part	15.501	—	16.951	—	18.404	—
Equivalent (von-Mises) Stress - GS2R4011-2 Maximum	150.46 MPa	★★★	150.48 MPa	★★★	150.52 MPa	★★★
Equivalent (von-Mises) Stress - GS_MorseTaper Bone-1 Maximum	38.997 MPa	—	38.997 MPa	—	38.997 MPa	—

Fig 8. Candidate Designs by ANSYS DesignXplorer™

The Optimal Design tool use result, it recommended 'Candidate Designs' that the angle is generated where implant stresses occur with smallest. (Fig 8.)

Discussions

Implant-abutment interface area increase too, where the angle increase. It is similar with implant stress tendencies which it follows in angle. (Fig 9.)

So, It is analogized that implant stresses are concerned with variation of interface area. The stress change which it follows in angle did not appear, it means morse taper angle have no concern with stress of alveolar bone in this study. It is a necessity must verify the mechanical reason.

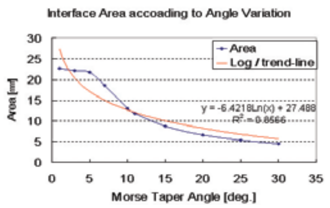

Fig. 9. Implant Abutment interface Area by Angle Variation

It is applied in Implant-Abutment, Morse Taper where interface not only the role which distributed an external force(bite force), it accomplishes the function of implant stability and sealing effect by friction fit. From research of after, it seek the morse taper angle which is stabilized under friction fit for stable angle, lateral force and marginal bone loss situations

Conclusions

1. When Morse Taper angle increase at Implant-Abutment interface, implant fixture stress increase by bite force, and the stress of alveolar bone uniform.
2. When Morse Taper angle increase at Implant-Abutment interface, Surface area of interface decrease, so it is similar to the case in stress of implant.
3. it is recommended with 15.5˚ by Optimum design tool that implant-abutment interface morse taper angle is effective in stress distribution.
4. There is necessary for the additional research, it is used from internal connection in the various condition related to Implant-Abutment Interface morse taper angle.

Peferences

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Effect of Tightening Torque on Abutment-Fixture Joint Stability using Three Dimensional Finite Element Analysis

Tae-Gwan Eom[1)*], Sung-Geun Lee SG[1)], Seung-Woo Suh[1)], Gye-Rok Jeon[2)], Jung-Woog Shin[3)], Chang-Mo Jeong[4)]

Introduction

The direct application of tightening torque on an abutment screw during a dental implant to derive preload was evaluated using a three-dimensional finite element model. The effect of tightening torque during the application of stress on the dynamic characteristics of the joints between the fixture and the abutment was also analyzed.

Materials and Methods

Table 1. Specification of experimental materials

Components	Sizes	Material
US II fixture	φ4.1㎜×L11㎜	Titanium Gr4
Cemented abutment	φ5.0㎜×H5.5㎜	Titanium Gr3
Abutment screw	M2.0×0.4P(φ2.0×Pitch0.4㎜)	Ti-6Al-4V

1st Step - Verification of the Finite Element Model

Data for verification
Mechanical Test : Theoretical Formula : Finite Element Model
* Comparison of preload on each tightening torque

2nd Step - Finite Element Analysis for External Loading

Input Parameter :
Tightening Torque (10, 20, 30, 40㎝) External Load (250N, tilted 30˚)
Response Parameter:
Stress Distribution
Gap Distance at Fixture-Abutment Interface
Allowable stress for Abutment screw
*Comparison of Stress Distribution, Max. Stress, and Allowable Stress

Fig 1. Schematic diagram for Method

1st Step - Verification of the Finite Element Model

A. Measuring Screw Preload by Mechanical Test

① Time-course measurement of preload upon applying tightening torques of 10, 20, 30, and 40Ncm to an abutment screw (n=20) using Preload Measuring Device (OSSTEM, Korea)

② Verification of significance of preload measurement via one-way ANOVA using Minitab 14.0 (Minitab Inc., USA) followed by turkey test

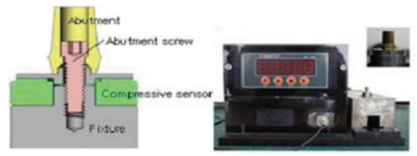

Fig 2. Preload measuring device.

B. Calculating Preload by Theoretical Formula

$$T_{in} = F_p\left(\frac{P}{2\pi} + \frac{\mu_t r_t}{\cos\beta} + \mu_n r_n\right)$$

Where, T_{in} tightening torque, F_P preload
P (pitch) 0.40㎜, β (lead angle) 30˚, r_t (significant radius of Screw) 0.85㎜
r_n (significant radius of Screw head) 1.1㎜
μ_t (Friction Coefficient of Thread Connection Region) 0.5
μ_n (Friction Coefficient of Screw head/abutment) 0.5

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Implant Research
Biomechanics

2nd Step - Finite Element Analysis for External Loading

Finite Element Analysis was performed using ANSYS Workbench 10.0 (ANSYS Inc., South Pointe, USA); linear elasticity, isotrophy, and homogeneity were assumed. The mesh form used in this analysis was 10-node tetrahedral element of ANSYS's solid 187.

Table 2. Material properties

	Material	Young's modulus	Poisson's ratio
Fixture	Ti Gr4	105㎬	0.34
Abutment	Ti Gr3	104㎬	0.34
Screw	Ti-6Al-4V	113㎬	0.342
Crown	-	13.7㎬	0.3
Cortical Bone	-	1.37㎬	0.3

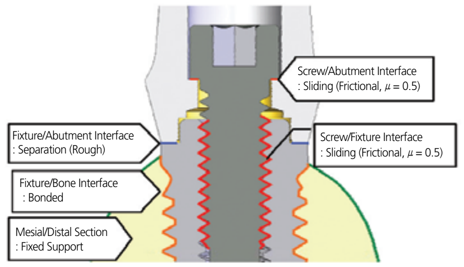

Fig 3. Contact and boundary conditions of FE-model.

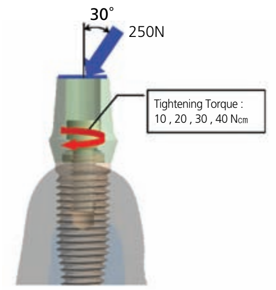

Fig 4. Application method of Loading Condition

Results

1st Step Verification of the Finite Element Model

Table 3. Preload[N] of Each Verification Method for Tightening Torque Unit : N

Tightening torque	Mech. Test (n=5) Mean ± SD*	Theoretical Formula	FE-Analysis Screw/Abutment interface	FE-Analysis Fixture/Abutment interface
10N㎝	47.7±2.1[a]	90.6	81.3	81.3
20N㎝	126.0±14.2[b]	181.2	161.6	161.6
30N㎝	253.0±9.2[c]	271.8	238.2	238.2
40N㎝	396.7±29.1[d]	362.4	342.0	342.0

*Same letters indicate values that were not statistically different.

As showed in Table 3, the application of tightening torques of 10N㎝ and 20N㎝ yielded lower experimental values than those from the theoretical formula. At 30N㎝, the experimental value was identical to that from the theoretical formula. On the other hand, 40N㎝ of tightening torque resulted in higher experimental value. Fig 5. shows the result of the regression analysis of the Experimental, Theoretical, and Analytical preload values. At 10N㎝ of tightening torque, however, all of them were beyond the 95% significance range.

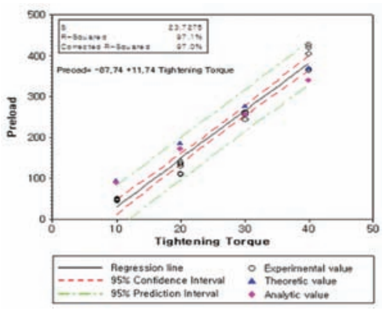

Fig 5. Experimental value, theoretic value or analytic value about preload.

2nd Step - Finite Element Analysis for External Loading

Upon the analysis of the finite element model with application of only the tight-ening torque, equivalent stress reached the maximum value at the neck region of the abutment screw; this was correlated with general node location in the clinic.

A. Finite Element Analysis Under Tightening Torque

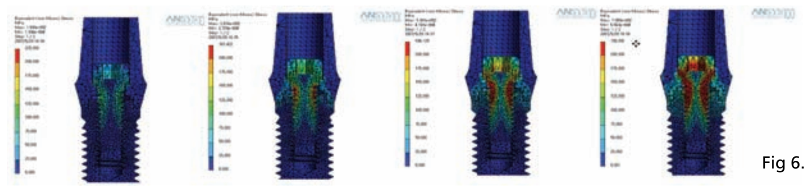

Fig 6. Equivalent stress Distribution for Tightening Torque

B. Finite Element Analysis Under External Loading

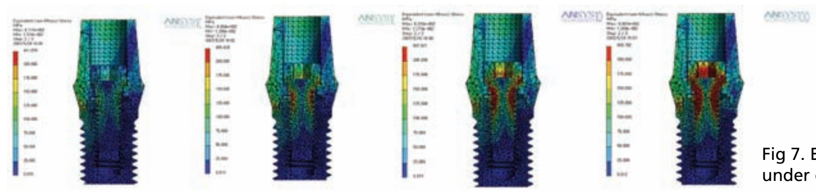

Fig 7. Equivalent stress distribution for tightening torque under external loading

Table 4. Maximum equivalent stress[MPa] on the abutment screw

Tightening torque	10N㎝	20N㎝	30N㎝	40N㎝
Tightening torque condition [MPa]	193.0	387.4	594.1	798.0
External loading condition [MPa]	411.1	406.4	601.6	800.7

Table 5. Gap distance[㎜] for Each Tightening Torque under External Loading

Tightening torque	10N㎝	20N㎝	30N㎝	40N㎝
Gap distance [㎜]	0.005	0.002	0.000	0.000

The allowable stress under external loading was calculated to be 643.3㎫. At 40 Ncm of tightening torque, the max. equivalent stress before and after external loading exceeded the allowable stress; under other tightening torque conditions, however, the max. equivalent stress was lower than that of the allowable stress.

Discussion

An increase in tightening torque leads to increase in preload; hence the smaller chance of joint opening. In this study, however, we showed that excessive tight-ening torque (e.g., 40Ncm) followed by external loading may result in the rupture or opening of an abutment screw due to repetitive loads exceeding the allowable stress. Therefore, we suggest an appropriate tightening torque of 30Ncm to maintain the stability of external butt joint of the US II Implant System.

Conclusion

1. There was the proportional relation between the tightening torque and preload.
2. In case of applying only the tightening torque, the maximum stress was found at the screw neck.
3. The maximum stress was also shown at the screw neck under the external loading condition. However in case of applying 10N㎝ tightening torque, it was found at the undersurface of the screw head.
4. The joint opening was observed under the external loading in case of applying 10N㎝ and 20N㎝ of tightening torque.
5. When the tightening torque was applied at 40N㎝, under the external loading the maximum stress exceeded the allowable stress value of the titanium alloy.

Peferences

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2) RL. Burguete,et al. "Tightening characteristics… implants."J Prosthet Dent Vol. 71, pp. 592-599, 1994

The Effect of the Recipient Site Depth and Diameter on the Implant Primary Stability in Pig's Rib

Young-Jun Park*, Jin-Su Lim, Hyun-Syeob Kim, Min-Suk Kook[1)], Hong-Ju Park[1)], Hee-Kyun Oh[1)*]

Purpose

- Immediate implant installation has become an acceptable treatment for tooth loss. (Simsek, 2003)
- Clinically, primary stability is affected by bone quality and quantity for the implant placement, the structure of implant, the technique applied in installation. (Meredith, 1998)
- Two main factors relating with initial stability are the amount of contact between bone and implant, and the role of compressed stress between implant and tissue surface. (Meredith, 1998)
- This study was performed to compare and evaluate the effect of recipient site depth and diameter of the drills on the primary stability of implant in pig's ribs.

Materials and Methods

1) Intact pig's rib bones: width (≧8 mm), height (≧20 mm)
2) RBM surfaces OSSTEM implants (3.75 X 8 mm, US II, OSSTEM Co., Korea)
3) Engine, handpiece: INTRA surg® 300 (KaVo., Germany)
4) Implant kit: Hanaro surgical kit (OSSTEM Co., Korea)
5) Osstell™ (Model 6 Resonance Frquency Analyser: Integrtiaon Diagnotics Ltd., Sweden)
6) Periotest® (Simens AG, Germany)
7) 6 groups (n=10, respectively)
8) Statistic analysis: ANOVA using SPSS ver. 11.0 (SPSS Inc., USA)

Groups		
D3 group (Drill diameter 3.0 mm)	D3H3 (n=10)	Drilling - 3 mm in depth
	D3H5 (n=10)	Drilling - 5 mm in depth
	D3H7 (n=10)	Drilling - 7 mm in depth
D3.3 group (Drill diameter 3.0 mm)	D3.3H3 (n=10)	Drilling - 3 mm in depth
	D3.3H5 (n=10)	Drilling - 5 mm in depth
	D3.3H7 (n=10)	Drilling - 7 mm in depth



The rib bone was fixed with machine and implant was installed on pig's rib bone


Primary implant stability measured by Osstell™


Primary implant stability measured by Periotest®


Periotest® Damping capacity assessment

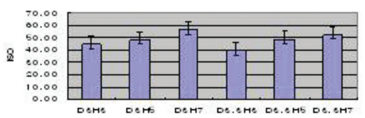

Osstell™ Resonance frequency analysis

Results

Table 1. Bucco-lingual measurements of primary stability using Osstell™

Groups	mean±SD	Duncan HSD
D3H3	44.90±3.38	AB
D3H5	48.20±5.65	B
D3H7	56.45±6.65	C
D3.3H3	39.60±5.72	A
D3.3H5	48.36±3.80	B
D3.3H7	52.20±8.32	BC

Fig 1. Mean values of primary stability of bucco-lingual measurements using Osstell™

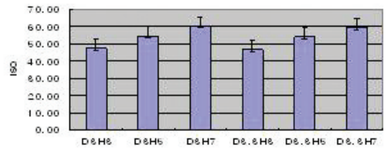


In the bucco-lingual test of Osstell™ the mean values of D3H7 group and D3.3H7 group were higher than those of D3H3 group and D3.3H3 group (p<0.05).

Table 2. Mesio-distal measurements of primary stability using Osstell™

Groups	mean±SD	Duncan HSD
D3H3	47.40±2.76	A
D3H5	54.50±3.95	B
D3H7	60.18±5.31	C
D3.3H3	46.70±1.06	A
D3.3H5	54.00±2.45	B
D3.3H7	59.20±1.03	C

Fig 2. Mean values of primary stability of mesio-distal measurements using Osstell™

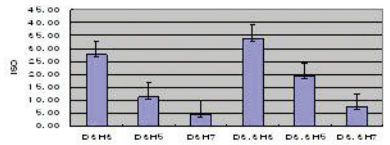


In the misio-distal test of Osstell™ the mean values of D3H7 group and D3.3H7 group were higher than those of D3H3 group and D3.3H3 group (p<0.05).

Table 3. Bucco-lingual measurements of primary stability using Periotest®

Groups	mean±SD	Duncan HSD
D3H3	27.60±2.76	B
D3H5	11.30±3.95	D
D3H7	4.55±5.31	E
D3.3H3	33.78±1.06	A
D3.3H5	19.27±2.45	C
D3.3H7	7.40±1.03	DE

Fig 3. Mean values of primary stability of bucco-lingual measurements using Periotest®

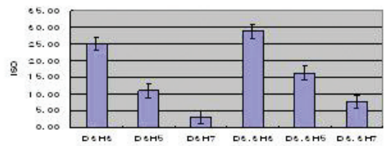


In the bucco-lingual test of Peritest® the mean values of D3H7 group and D3.3H7 group were higher than those of D3H3 group and D3.3H3 group (p<0.05).

Table 4. Mesio-distal measurements of primary stability using Periotest®

Groups	mean±SD	Duncan HSD
D3H3	25.10±5.34	A
D3H5	11.00±2.94	BC
D3H7	3.09±1.45	D
D3.3H3	28.80±8.84	A
D3.3H5	16.36±7.27	B
D3.3H7	7.80±3.01	CD

Fig 4. Mean values of primary stability of mesio-distal measurements using Periotest®



In the mesio-distal test of Peritest? the mean values of D3H7 group and D3.3H7 group were higher than those of D3H3 group and D3.3H3 group (p<0.05).

Table 5. Correlations between the measurements of primary stability and the depth of implant installation

Diameter of drilling		Pearson's correlations	P
3 mm drilling	Osstell™ (MD)	0.796	0.00
	Osstell™ (BL)	0.696	0.00
	Periotest® (MD)	-0.926	0.00
	Periotest® (BL)	-0.944	0.00
3.3 mm drilling	Osstell™ (MD)	0.786	0.00
	Osstell™ (BL)	0.708	0.00
	Periotest® (MD)	-0.908	0.00
	Periotest® (BL)	-0.930	0.00

Table 6. Correlations between the measurements of OstellTM and Periotest®

Direction	Pearson's correlations	P
Mesio-distal	-0.745	0.00
Bucco-lingual	-0.571	0.00

In tests using Periotest® and OstellTM the mean value in 3 mm diameter of drill showed higher primary stability than that in 3.3 mm diameter of drill, but there is no statistically significant difference.

Conclusion

These results suggested that the primary stability of implants has a positive correlation with the depth of implant installation.

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Implant Research
Biomechanics

The Effect of Various Designs of Dental Implant Fixtures on Their Initial Stability

Dae-Woong Kang[1)], Sang-Wan Shin[1)*]

Purpose

There are few studies of the effect of change in dental implant fixtures on the primary stability of implants even though a number of implant designs have been commercially used. This investigation aims to help in the choice of different dental implant designs that are currently in clinical use, based on the understanding the change of primary stability according to varying implant fixtures by researching how taper and thread number of implants have effects on primary stability characteristics.

Methods

A total of 12 implant fixture samples which were 11.5㎜ in length and 4㎜ in diameter were made and each sample had 0, 1, 3, 5 degree in taper and single, double, triple thread in thread number. Balsa was used by fixture site model. Each implant fixture sample was placed ten times using INTRAsurg 300 plus and peak insertion torque(IT) after placement was measured. Resonance frequency analysis(RFA) measurements and removal torque(RT) measurements were also performed. Statistical significance was verified by 2-way ANOVA, 1-way ANOVA at the P≤0.05 leve1 and Scheffé test was performed.

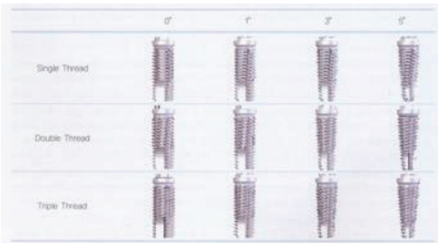

Fig 1. Twelve implant types for initial stability test.

Fig 2. Balsa for implant placement.

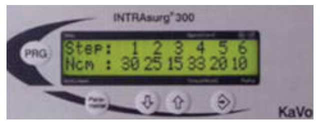

Fig 3. INTRAsurg 300 PLUS for insertion torque.


Fig 4. Osstell Mentor for RFA.


Fig 5. Tohnichi torque gauge for removal torque.

Results

IT and RT va1ue significantly increased as the taper increased from 0 degree to 1 degree to 3 degree but decreased in 5 degree taper. There was no significantly difference between 1 degree and 3 degree (0°<5°<1°=3°). Also IT and RT value increased as thread number increased from single to double to triple and there was no significantly difference between double and triple(1thread<2thread=3thread). Measured RFA values were almost the same in all tested groups independent of body taper and thread number.

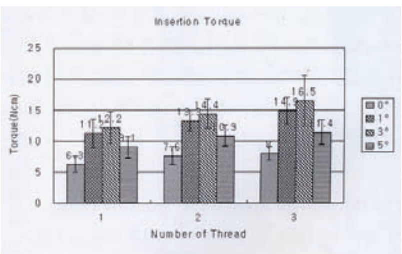

Fig 6. Mean peak insertion torque values for each implant type.

Table 1. ANOVA table for Insertion Torque

Variable	Sum of Squares	Degree of Freedom(df)	Mean Square	F Value	p Value
Thread	182.400	2	91.200	19.398	0.000*
Angle	881.400	3	293.956	62.494	0.000*
Thread×Angle	22.933	6	3.822	0.813	0.562
Error	508.000	108	4.704		
Total	1522.367	119			

* p<0.05

Table 2. One-way ANOVA Analysis for Insertion Torque

Sample	Mean	Standard Deviation	F Value	p Value	Post Hoc Test
0°	7.30	1.49			
1°	13.10	2.52	14.137	0.000*	0°<5°<(1°=3°)
3°	14.37	3.45			
5°	10.43	2.03			

* p<0.05

Table 3. One-way ANOVA Analysis for Insertion Torque

Sample	Mean	Standard Deviation	F Value	p Value	Post Hoc Test
Single Thread	9.70	2.99			
Double Thread	11.50	3.16	15.000	0.000*	Single<(double =triple)
Triple Thread	12.70	4.16			

* p<0.05

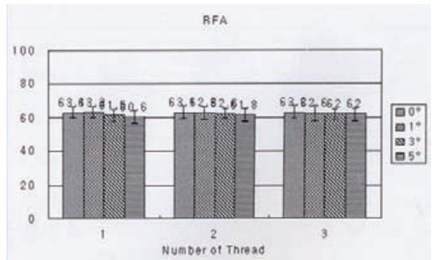

Fig 7. Mean RFA values for each implant type.

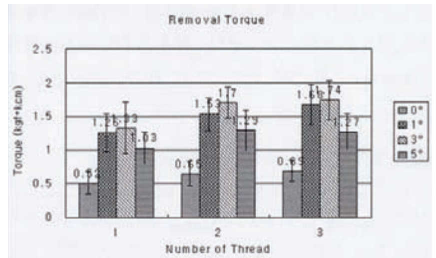

Fig 8. Mean peak removal torque values for each implant type.

Table 4. Table for RFA

Variable	Sum of Squares	Degree of Freedom(df)	Mean Square	F Value	p Value
Thread	4.317	2	2.158	0.161	0.852
Angle	53.767	3	17.922	1.336	0.266
Thread×Angle	15.883	6	2.647	0.197	0.977
Error	1448.400	108	13.411		
Total	1522.367	119			

* p<0.05

Table 5. ANOVA table for Removal Toruqe

Variable	Sum of Squares	Degree of Freedom(df)	Mean Square	F Value	p Value
Thread	2.202	2	1.101	16.011	0.000*
Angle	17.108	3	5.703	82.927	0.000*
Thread×Angle	0.303	6	0.050	0.733	0.624
Error	7.427	108	0.069		
Total	27.040	119			

* p<0.05

Table 6. One-way ANOVA Analysis for Removal Torque

Sample	Mean	Standard Deviation	F Value	p Value	Post Hoc Test
0°	0.62	0.18			
1°	1.49	0.32	26.923	0.000*	0°<5°<(1°=3°)
3°	1.59	0.35			
5°	1.20	0.29			

* p<0.05

Table 7. One-way ANOVA Analysis for Removal Torque

Sample	Mean	Standard Deviation	F Value	p Value	Post Hoc Test
Single Thread	1.03	0.42			
Double Thread	1.29	0.47	9.029	0.003*	Single<(double =triple)
Triple Thread	0.49	0.49			

* p<0.05

Conclusion

Higher primary stability was retained in tapered implant body and the thread number more than one.

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Comparative Study on the Fracture Strength of Metal-Ceramic versus Composite Resin-Veneered Metal Crowns in Cement-Retained Implant-Supported Crowns under Vertical Compressive Load

Ahran Pae[1)], Kyung-A Jeon[1)], Myung-Rae Kim[1)], Sung-Hun Kim[2)*]

Statement of Problem

racture of the tooth-colored superstructure material is one of the main prosthetic complications in implant-supported prostheses.

Purpose

The purpose of this in vitro study was to compare the fracture strength between the cement-retained implant-supported metal-ceramic crowns and the indirect composite resinveneered metal crowns under the vertical compressive load.

Materials and Methods

Standard implants of external type (AVANA IFR 415 Pre-mount; OSSTEM Co., Busan, Korea) were embedded in stainless steel blocks perpendicular to their long axis.

Customized abutments were fabricated using plastic UCLA abutments (Esthetic plastic cylinder; OSSTEM Co., Busan, Korea). Thirty standardized copings were cast with non-precious metal (Rexillium III, Pentron, Walling ford, Conn., USA). Copings were divided into two groups of 15 specimens each (n = 15). For Group I specimens, metal-ceramic crowns were fabricated. For Group II specimens, composite resin-veneered (Sinfony, 3M-ESPE, St. Paul, MN, USA) meta crowns (Sinfony-veneered crowns) were fabricated according to manufacturer's instructions. All crowns were temporary cemented and vertically loaded with an Instron universal testing machine (Instron 3366, Instron Corp., Norwood, MA, USA). The maximum load value (N) at the moment of complete failure was recorded and all data were statistically analyzed by independent sample t-test at the significance level of 0.05. The modes of failure were also investigated with visual analysis.

Fig. 1. Instron universal testing machine (Instron 3366, Instron Co., Mass., USA) .

Fig. 2. Specimen loaded to failure.

Results

The fracture strength of Sinfony-veneered crowns (2292.7 ± 576.0 N) was significantly greater than that of metal-ceramic crowns (1150.6 ± 268.2 N) ($P < 0.05$). With regard to the failure mode, Sinfony-veneered crowns exhibited adhesive failure, while metal-ceramic crowns tended to fracture in a manner that resulted in combined failure.

Table 1. Fracture force values (N), mean values and standard deviations (SD) in parenthesis of specimens

Specimen No.	Metal-ceramic crown	Sinfony-veneered crown
1	1174	1744
2	1245	3213
3	718	1328
4	1263	2878
5	1341	3409
6	1529	2223
7	1528	2306
8	952	2360
9	1019	2324
10	1215	2396
11	1381	1873
12	881	2027
13	1199	1805
14	1197	2736
15	617	1768
Mean	1150.6	2292.7
(SD)	(268.2)	(576.0)

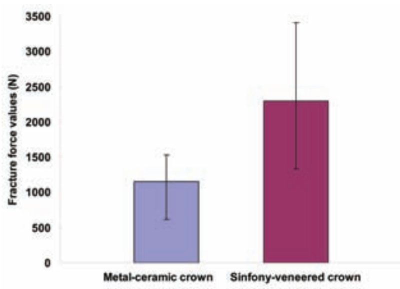

Fig 3. Means and standard deviations of the specimens investigated (P< 0.05).

Table 2. Results of Independent sample t-test

	t-test for equality of means						
	t	df	Sig. (2 tailed)	Mean difference	Std. error ce differen	95 % Confidence interval of the difference Lower	Upper
Equal variances assumed	-6.961	28	.000	-1142.05	164.052	-1478.092	-806.002
Equal variances not assumed	-6.961	19.796	.000	-1142.05	164.052	-1484.479	-799.615

(a) fractured metal-ceramic crown.

(b) fractured Sinfony-veneered crown.

Fig 4. The mode of failure.

Conclusion

Sinfony-veneered crowns demonstrated a significantly higher fracture strength than that of metal-ceramic crowns in cement-retained implant-supported prostheses.

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Evolution of the Interlayer Microstructure and the Fracture Modes of the Zirconia/Cu-Ag-Ti Filler/Ti Active Brazing Joints

Oleg Smorygo[1)*], Ju-Suk Kim[2)], Myung-Duk Kim[2)], Tae-Gwan Eom[2)]

Introduction

In this Study, the joint survivability can be also dependent on the joint fracture behavior resulting in the brittle or ductile fracture mode. Hence, the objective of this work was to study the evolution of the interfacial microstructure and its influence on the mechanical fracture mode after active brazing of the commercially pure titanium and 3Y-PSZ ceramics with the Ag-Cu-Ti filler.

Experimental Procedures

Zirconia and Ti rods Ø8×35 ㎜ were brazed in a simple butt joint configuration in a specially manufactured graphite jig. 3Y-PSZ zirconia samples were received from Kookje Ceramics, Korea. Ti samples were manufactured from the ASTM Grade 4 titanium alloy. Contact surfaces were ground to Ra<1 ㎛. Commercially available alloy Cusil ABA®, WesgoMetals (wt.%: 63 Ag-35.25 Cu-1.75 Ti)was used as the brazing filler. Liquidus and solidus temperatures of the filler are 815 ℃ and 780 ℃ correspondingly. The filler was supplied as 50 ㎛ thick foil, from which Ø8 ㎜ round samples were cut to fit the contact surfaces. The samples were ultrasonically cleaned in ethanol, then assembled and brazed upright under a contact pressure within 2-26 ㎪ and a vacuum greater than 10-3 ㎩. The brazing regimes were as follows: heating to 700 ℃ at a rate of 10 ℃/min; heating to the brazing temperature(840-870 ℃) at a rate of 5 ℃/min; soaking for 5 or 30 min; cooling at a rate of 10 ℃/min. The three-point bend testing was performed using MTS 858.20 Bionix testing machine on the samples loaded at the joint area with a cross head speed of 0.5 ㎜/min. The joint microstructure and the fracture surface observations as well as quantitative elemental analysis were performed at an accelerating voltage of 20 ㎸ using Hitachi S-4200 scanning electron microscope (SEM) equipped with the energy-dispersive X-ray spectrometer (EDS). Samples of the joint cross-section were prepared by a common metallographic procedure using Buehler Phoenix Beta grinder-polisher.

Results and Discussions

The brazing regimes studied and the results of the 3-point bend test are summarized in Table 1. The studied temperature range(840-870 ℃) was expected to be optimum for the PSZ-titanium brazing process with the Ag-Cu-Ti filler, since the lower limit(840-850 ℃) ensures the formation of the continuous reaction layer between the filler and PSZ, while the upper limit was chosen to be below $\alpha \rightarrow \beta$ transus of titanium(882 ℃) in order to prevent excessive grain growth in the β-phase field. SEM images of the bond layer formed after the brazing at 870 ℃(5 min soaking) are shown in Fig 1(a-b); various characteristic sublayers are specified by Roman numerals I-IV. Ti, Cu, Ag and Zr EDS profiles across the joint are shown in Fig 2.

Table 1. Brazing conditions and the joint strength

No.	Brazing temperature (℃)	Soak (min)	Contact load (㎫)	Bend strength (㎫)[a]
1.	840	5	0.0037	242 (18)
2.	850	5	0.0259	246 (24)
3.	870	5	0.0020	230 (31)
4.	870	5	0.0127	227 (34)
5.	870	30	0.0259	237 (26)

[a] Standard deviation in parenthesis.

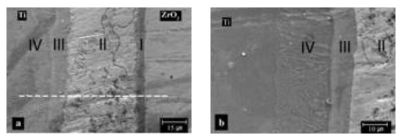

Fig 1. SEM image of the bond layer (870°, 5min): (a) all bond layerwith the EDX scan line; (b) reaction layer at the Ti-filler interface.

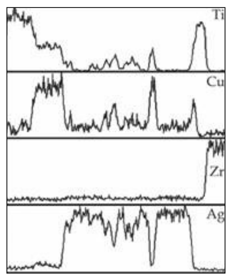

Fig 2. Elemental EDS profiles across the bond layer.

[1)]Powder Metallurgy Institute, 41, Platonov str., Minsk 220005, Belarus
[2)]mplant R&D Center,OSSTEM Implant Co. Ltd., Busan, South Korea,

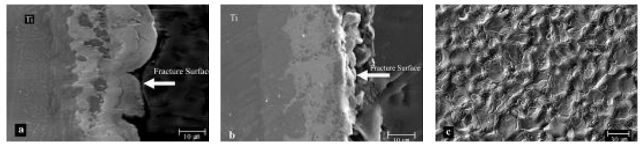

Fig 3. SEM images of the fractured bond layers at the Ti/filler reaction layer: (a)cross-section, 840℃, 5min; (b)cross-section, 870℃, 5min; (c)fractography, 870 ℃, 5 min.

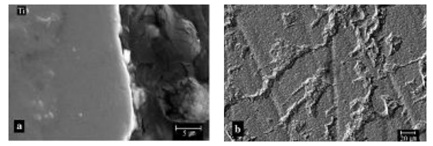

Fig 4. SEMimages of the fractured bond layer at the Ti/filler reaction layer, 870 ° C, 30 min: (a) cross-section and (b) fractography.

The following sublayers were observed in the joint:

I. Reaction layer between the filler and the zirconia sample. This thin layer(3-4 ㎛) is formed due to the reduction of zirconia by titanium contained in the melted filler, which is followed by precipitation of titanium oxides at the interface. Titanium from the filler concentrates close to the TiOx reaction layer and its concentration in the vicinity of this layer was determined to be as high as N90 at.%.

II. Thick bond layer between the zirconia and titanium samples. This layer(45-50 ㎛) consists predominately of Ag with 10-15 at.% of the dissolved Cu. Dark intermetallide inclusions consisting of Ti (∼40 at.%), Cu (∼35 at.%) and Ag (∼25 t.%) were also present.

III. Reaction layer between the filler and Ti sample. This intermetallide layer contained Cu and Ti in equiatomic amounts and just several percent of Ag, which indicated the formation of the CuTi-rich zone.

IV. Diffusive layer. Just traces of Ag were found here, Cu concentration gradually decreased to the depth of the Ti sample. Cu must be bound to CuTi2 in this zone. The formation of CuTi and CuTi2 intermetallides in the layers III and IV follows from the CuTi equilibrium phase diagram and the chemical compositions of the layers.

It was determined that after "low temperature" brazing at 840 ℃ (5 min soaking) a clear boundary between the intermetallide reaction layer and the Ag-rich bond layer did not form(Fig. 3(a)). The sample fractured through the Ag-rich layer with a ductile fracture surface appearance. Increasing the brazing temperature to 850 ℃(5 min soaking) resulted in a more pronounced interface between the two sublayers (Fig 3(b)) with a similar fracture mode. At last, brazing at 870 ℃ (5 min soaking) resulted in the formation of sublayers with distinct boundaries and the CuTi layer thickness was 7-10 ㎛ (Fig 2). The SEM image of the fracture surface with characteristic ductile vein patterns corresponding this brazing condition is presented in Fig 3(c). An EDS analysis detected predominantly Ag on this surface (72 at.%) with significant contents of Cu and Ti (15.2 and 12.8 at.% respectively). The increased Ti content in the bond layer compared to the original filler composition must be a result of its diffusion from the brazed metal part.
The fracture mode was determined to change after the brazing with long soaking at maximum temperature. Brazing at 870 ℃ during 30 min resulted in the most pronounced interface between the intermetallide reaction layer and the Ag-rich layer, such that the thickness of the intermetallide layer increased to ∼15 ㎛. The fracture was brittle and went through the CuTi layer close to its interface with the Ag-rich bond layer (Fig 4(a-b)), which was confirmed by the relationship between the atomic fractions of Ti and Cu on the fracture surface. Specially, the average composition at the fracture surface was as follows: Ti and Cu in equiatomic amounts (50.5 and 47.3 at.% correspondingly) with traces of Ag (2.2 at.%).
In summary, the brazing joint quality is usually associated with the reliable cohesive joining of the bond layer to the ceramic surface, and the features of the interface between the bond layer and the etallic part are considered not to affect significantly the joint performance. The study showed that a minor change of the brazing conditions could result in a remarkable evolution of the bond layer microstructure and change the fracture behavior, which can be very important for the brazing joints operating under cyclic or dynamic loading conditions.

Heat Transfer to the Implant-Bone Interface During Setting of Autopolymerizing Acrylic Resin Applied to Impression Copings for US II Implant System Impression

Jung-Bo Huh[1)], Suk- Min Ko[1)*]

Statement of Problem

The deformity must be minimized during the impression taking procedure for the passive adhesion of the multiple fixed prosthodontic implants to occur. The first method that has been introduced for this is to tie the coping intraorally before the impression taking procedure. Autopolymerizing acrylic resin is a generally used material intraorally during the impression taking procedure to connect the coping. However the acrylic resin produces much heat during curing and it has a risk that it transfers much heat to the implant-bone interface when applied directly to the copings for implant impression or the abutment.

Purpose

The purpose of this study was to evaluate the amount of heat transferred to the implant-bone interface in the procedure where the autopolymerizing acrylic resin was used to connect the coping before the impression taking procedure of several implants.

Methods

The domestic OSSTEM implant(OSSTEM Implant Co.Ltd., Busan, South Korea), with diameter of 4mm, length of 13mm of the US II(external hexagon connection, RBM surface)implant fixture was used and thermocouple wire was attached to the first thread , middle and apex of the cervical area. This particular fixture and the fixture with no thermocouple wire attached were covered with acrylic resin with 2cm distance apart. The platform and exterior hexagon of the fixture was taken caution of not to be flasked in the acrylic resin block. The specimen was placed under water of 37℃ and the temperature was maintained throughout the procedure. The coping was connected above it and it was isolated by the rubber dam. In the first experimental group, the two impression copings were tied with the dental floss and autopolymerizing acrylic resin was applied above them connecting the impression coping at once.

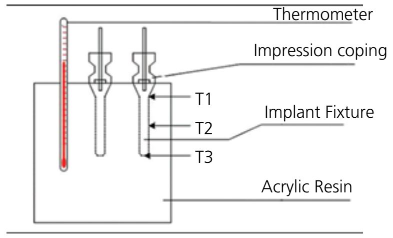

Fig 1. Illustration of experimental setup. T1= cervical thermocouple wire; T2=middle thermocouple wire; T3= apical thermocouple wire; R= rubber dam

In the second experimental group, the acrylic resin was applied to the impression coping prior to the insertion of the fixture and additional resin was applied in between the spaces(1.5mm).
The data was gathered using the K-type thermocouple was used as the temperature measuring sensor, the LabView(National Instrument , Texas , US) as the software in the monitoring system, PXI 6259(National Instrument , Texas , US)as the hardware. Each experiment group was read through the thermocouple wire every 0.5sec 10 times each.

Results

The two experimental groups showed lots of heat transfer. The cervical area had the most temperature increase. There was a mean of 43.1oC in the first experimental group in the cervical area. In the second experimental group, there was an increase up to 40.4oC. The temperature decreased after maintaining the high temperature for about 5 minutes. It was possible to see the great amount of heat being transferred to the implant-bone interface through connecting the impression coping with the autopolymerizing resin. But when the acrylic resin was applied to the impression coping prior to the insertion of the fixture and additional resin was applied in between the spaces(1.5mm), the temperature increased at slight. So it cannot be concluded that there may be some side effect to the bone.

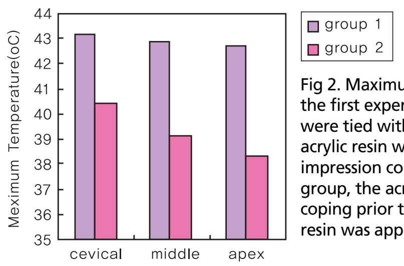

Fig 2. Maximum mean temperature value at each sites, In the first experimental group, the two impression copings were tied with the dental floss and autopolymerizing acrylic resin was applied above them connecting the impression coping at once. In the second experimental group, the acrylic resin was applied to the impression coping prior to the insertion of the fixture and additional resin was applied in between the spaces(1.5mm).

Table 1. Mann Whitney rank sum test

Area	Experiment group	Mean	SD	p value
Cervical	2	40.4	0.9914529	0.0002
	1	43.1	0.7993636	
Middle	2	39.1	0.5560785	0.0002
	1	42.9	0.7904991	
Apex	2	38.3	0.4044049	0.0002
	1	42.7	0.7532566	

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Temperature Measurement During Implant-Site Preparation

Yong-Suk Cho[1)], Hyeon-Cheol Jeong[2)], Tae-Soo Kim[2)], Dong-Hun Jang[2)], Tae-Gwan Eom[2)*]

Introduction

There are various factors for successful dental implant preparation. Particularly, it is a broadly known fact that heat generation during implant site preparation by drilling is one of the main factors of bone necrosis. In order to present basic data to verify surgical procedures which can minimize bone loss owing to thermal necrosis, we examined the difference of temperature according to the bone density and drill length during drilling. The temperature difference was measured dependent on rpm alteration and the changes of drilling temperature was measured below from 500 to 1,500rpm in order to find out appropriate rpm condition. In addition, the temperature change according to the drill diameter was measured after drilling with initial and middle drill to investigate
proper drilling procedure.

Test Method

During drilling, temperature measurement was performed by means of a infra-red thermal camera (IRI1001, IRISYS Ltd.,UK) to detect temperature at wider point and D1 to D4 laminated test blocks - polyurethane foams (SAWBONES INC.) were used for the experiment with maintenance of 36.5℃ at the waterbath. Drill systems made in OSSTEM Implant Co., Ltd. (S. Korea) were used for tests.

Test Conditions

- Temperature
  - Waterbath: 36~37°C
  - Environment : 25°C
- Constant Load
  - Handpiece & Jig weight 0.9kg + Scale weight 1.1kg = 2.0kg

Test Specimens

Grade	Cortical Layer Density	Cortical Layer Thickness	Sponge Layer Density	Sponge Layer Thickness
D1	0.80g/cc	3mm	0.48g/cc	27mm
D2	0.80g/cc	2mm	0.32g/cc	28mm
D3	0.80g/cc	2mm	0.16g/cc	28mm
D4	-	-	0.16g/cc	30mm

Test Protocols

- Temperature measurement according to Bone Density (with irrigation) : D1, D2, D3, D4
- Temperature Measurement according to rpm (with irrigation) : 500, 700, 800, 1000, 1200, 1500rpm
- Temperature Measurement according to Drill Length (with irrigation) : 7, 8.5, 10, 11.5, 13, 15mm
- Evaluation of the effect of next drill diameter on heat generation
- Evaluation of the effect of previous drill diameter on heat generation
- Real time comparative evaluation of Temperatures both with and without Irrigations during drilling

Test Equipment

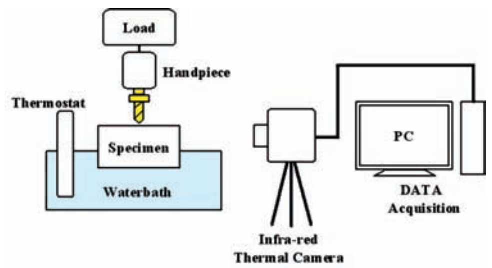


Fig 1. Schematic of Test Equipment


Fig 3. OSSTEM Implant Drill Systems
(2.0, 2.7, 3.0, 3.3, 3.6, 3.8, 4.1, 4.3 & Ø4.6mm)

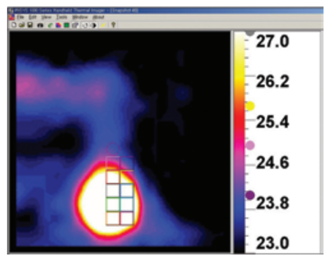


Fig 2. Display of Thermal Distribution

[1)] Absun Dental Clinic, Seoul, South Korea
[2)] Implant R&D Center, OSSTEM Implant Co. Ltd., Busan, South Korea

Implant Research
Biomechanics

Test Protocols

Temperatures vs. Bone Density

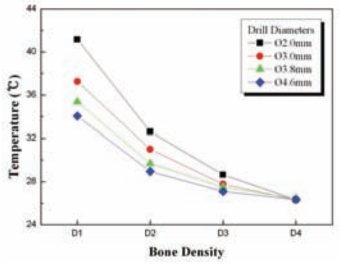


Fig 4. Temperatures according to Bone Density

When the bone density is increased, an increase in temperature occurs.

Temperatures vs. RPM

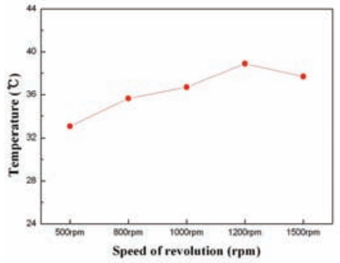


Fig 5. Temperatures according to Speed of Revolutions

When the speed of the drill is increased, an increase in temperature occurs.

Temperatures vs. Drill Length

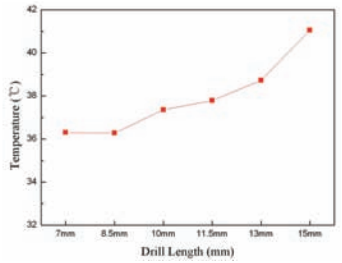


Fig 6. Temperatures according to Drill Lengths

When the drill length is increased, greater heat is generated.

Temperatures vs. Irrigation & Non Irrigation

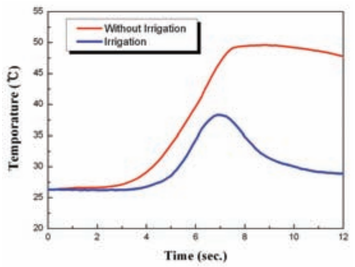


Fig 7. Real time comparative Result of Temperatures both with and without rrigations (∅2.7 drill after using ∅2.0 drill)

When preparation of implant site without irrigation as compare to with irrigation, the difference of temperature was over 13°

Evaluation of the effect of next drill diameter on heat generation

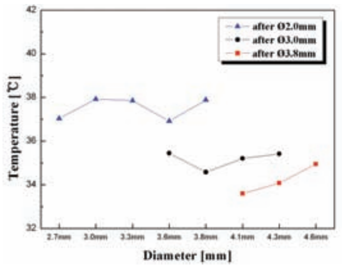


Fig 8. Temperature during ∅4.3mm Drilling according to previous Drill Diameters.

When the previous drill diameter is decreased, there is not remarkable difference of temperature. However after using ∅3.8 drill, the larger the next dill diameter is, the more temperature increases.

Evaluation of the effect of previous drill diameter on heat generation

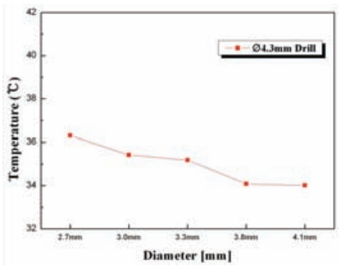


Fig 9. Temperature during ∅4.3mm Drilling according to previous Drill Diameters.

When the previous drill diameter is decreased, an increase in temperature occurs. This test was accomplished to propose surgical procedures during insertion of wide fixture(dia.∅4.3)

Conclusions

It is concluded that the measurement of heat distribution using thermal imager is useful methodology around dental implant site. When the speed of drills is kept at 1,200 rpm, greater heat is generated. When the drill length is increased, greater heat is generated. There seems to be a remarkable temperature difference because of the effect of the increase in drill length on drilling time. There is significant temperature difference during implant site preparation between with and without irrigation. There is no significant difference in temperature changes with drilling procedure, however, we can confirm the effect of previous drill diameter on heat generation during drilling final drill. In conclusion, the smaller the previous dill diameter is, the more temperature increases when preparing implant site with final drill. Further studies should be conducted to determine the ideal surgical protocols in vivo.

Correlation Between Insertion Torque and Primary Stability of Dental Implant by Block Bone Test

Byung-Kook Kim[1)*], Tae-Gwan Eom[1)], Gyu-Ok Choi[1)], Gwang-Hoon Lee[2)]

Purpose

The purpose of the present study was to investigate the correlation between insertion torque and primary stability of dental implant through insertion test in artificial block bone.

Materials andMethods

Materials

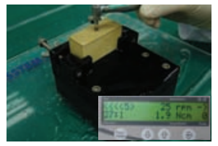
- Implant : SS II Fixture ∅4.1,L11.5 (OSSTEM Implant Co., Korea)
- Block Bone : Polyurethane foam (Sawbones, USA)
- Stability Tester : Osstell Mentor (Osstell, Sweden)
- Surgical Engine : IntraSurg300 (KaVo, Germany)

SS II Fixture

Block Bone

Test Method

1.Making holes in block bone by surgical engine.
2.Placement fixture and measurement insertion torque
3.Measurement ISQ value by Osstell Mentor
4.Analysis the correlation of insertion torque and ISQ value



Fixture Placement and Torque Measurement

ISQ Value Measurement

Test Protocol

1. Correlation between insertion torque and implant stability according to bone density
   - Block bone density (homogeneous bone): #10, #20, #30, #40
   - Final drill diameter:∅3.6
2. Correlation between insertion torque and implant stability according to final drill diameter (homogeneous bone)
   - Block bone density (homogeneous bone) : #20
   - Final drill diameter : ∅2.7, ∅3.0, ∅3.3, ∅3.6
3. Correlation between insertion torque and implant stability according to thickness of cortical bone
   - Cortical bone thickness : 0.5mm, 1.0mm, 1.5mm, 2.0mm
   - Block bone density: cortical bone(#50), cancellous bone (#20)
   - Final drill diameter : ∅3.6
4. Correlation between insertion torque and implant stability according to cancellous bone density with cortical bone
   - Cortical bone thickness : 1.5mm
   - Block bone density : cortical bone(#50),cancellous bone (#10, #20, #30)
   - Final drill diameter : ∅3.6
5. Correlation between insertion torque and implant stability according to final drill diameter with cortical bone
   - Cortical bone thickness : 1.5mm
   - Block bone density : cortical bone(#50),cancellous bone (#20)
   - Final drill diameter : ∅3.0, ∅3.3, ∅3.6, ∅3.8

1)Implant R&D Center, OSSTEM Implant Co. Ltd., Busan, South Korea
2)Lee Dental Clinic, Seoul, South Korea

Results

Result 1.

Table 1. Correlation between insertion torque and implant stability according to bone density

Bone Density	No.	Insertion Torque (Ncm)		p-value (Anova)	ISQ Value		p-value (Anova)	Correlation
		Average	SD		Average	SD		
#10	5	3.9	0.36	0.00	32.4	2.93	0.00	C.Q=0.82 p=0.00
#20	5	16.2	2.59		52.5	0.74		
#30	5	41	3.94		60.0	0.7		
#40	5	90.8	7.15		65.6	0.59		

Result 2.

Table 2. Correlation between insertion torque and implant stability according to final drill diameter

Bone Density	No.	Insertion Torque (Ncm)		p-value (Anova)	ISQ Value		p-value (Anova)	Correlation
		Average	SD		Average	SD		
Ø2.7	5	39.2	2.77	0.00	52.1	0.85	0.00	C.Q=0.07 p=0.77
Ø3.0	5	35.4	1.95		53.9	0.64		
Ø3.3	5	26.0	2.0		54.4	1.67		
Ø3.6	5	16.2	2.59		52.5	0.74		

Result 3.

Table 3. Correlation between insertion torque and implant stability according to thickness of cortical bone

Bone Density	No.	Insertion Torque (Ncm)		p-value (Anova)	ISQ Value		p-value (Anova)	Correlation
		Average	SD		Average	SD		
0.5mm	5	9.2	1.63	0.00	54.4	1.34	0.00	C.Q=0.84 p=0.00
1.0mm	5	12.0	1.58		55.7	1.68		
1.5mm	5	24.8	2.86		57.9	0.51		
2.0mm	5	25.4	3.97		57.9	0.45		

Result 4.

Table 4. Correlation between insertion torque and implant stability according to cancellous bone density with cortical bone

Bone Density	No.	Insertion Torque (Ncm)		p-value (Anova)	ISQ Value		p-value (Anova)	Correlation
		Average	SD		Average	SD		
#10	5	19.6	1.14	0.00	59.8	1.59	0.015	C.Q=0.45 p=0.09
#20	5	24.8	2.86		57.9	0.51		
#30	5	51.0	5.34		60.8	1.56		
Bone Density	No.	Insertion Torque (Ncm)		p-value (Anova)	ISQ Value		p-value (Anova)	Correlation

Conclusions

1. In test for bone density, the insertion torque and the initial stability increase according to bone density goes up and they have a strong plus correlation. It shows that the dependency of initial stability for bone density is very high.
2. In test for final drill size, insertion torque decreases according to drill size expands but initial stability shows no change. It shows that the change of insertion resistance appears by difference of removal volume and does not contribute to stability.
3. In test for thickness of cortical bone, the insertion torque increase according to the thickness of cortical bone grow thick and the initial stability weakly increase. It shows that the volume of high dense cortical bone affects to initial stability
4. Finally the initial stability is not acquired by insertion torque changing drill size but the bone density or the thickness of cortical bone. The estimation of bone density and the optimal selection of drill size are important. Overload of insertion torque badly affects to bone healing.

The Effect of Implant Abutment Length, Surface and Cement Type on the Prosthesis Retention

Mun-Ji Hyun[1)], Cheol-Won Lee[1)*], Mok-Kyun Choie[1)]

Introduction

When implant abutment length is short, cement retained prosthesis is not designed because of it's low retention. There are many ways to increase retention force such as change of angle taper, surface treatment and cement selection. However there is no clinical guidelines about them.

The purpose of this study is to evaluate the effect of surface characteristics of the abutment and cement type on the retention of implant prosthesis when the abutment length is decreased.

Materials and Methods

Abutments & Cements

45 cement type abutments (OSSTEM Implant Co.Ltd, Seoul, Korea) were divided into 9 groups according to the several conditions.

1) Surface treatment :
   a) Smooth (no treatment)
   b) Sandblasting (Sand storm® 3.5kPa,50㎛ Alumina particle, 1mm away, 1 min)
   c) Diamond bur preparation (201R, Shofu Co., Japan, 3~4 times, evenly)
2) Cement type :
   a) Zinc oxide-eugenol cement (ZOE - Temp-bond®)
   b) Zinc phosphate cement (ZPC - Fleck's®)
   c) Resin cement (Panavia 21®)
3) Abutment length : 3mm, 5mm, 7mm(7mm tested in ZOE only)

Table 1. Experimental group and condition

Abutment		Cement
Length	Surface treatment	
3mm	Smooth surface	ZOE , ZPC, Resin
	Sandblasting	ZOE , ZPC, Resin
	Diamond bur preparation	ZOE , ZPC, Resin
5mm	Smooth surface	ZOE , ZPC, Resin
	Sandblasting	ZOE , ZPC, Resin
	Diamond bur preparation	ZOE , ZPC, Resin
7mm	Smooth surface	ZOE
	Sandblasting	ZOE
	Diamond bur preparation	ZOE

Methods

1) Measuring of retention :Tensile strength of prosthesis was measured by universal testing machine (Instron Engineering Co., U.S.A) (Velocity : 5mm/min)
2) Statistics : The Mean and SD from each specimen, and using One way Analysis of variance

Fig 1. Implant abutments and crowns
Upper is crown and loop
Lower is abutment with analogue
Surface was treated that none (left), sandblasting (middle), and diamond bur preparation (right)

Fig 2. Measurement of tensile strength
Instron Universal Test Machine, which was used to measure the tensile strength

[1)]Dept. of Prosthodontics & Implantology, St. Mary's Hospital. The Catholic Univ. of Korea, South Korea

Implant Research
Biomechanics

Results

Table 2. Retention strength of cementation between abutment and crown (Unit : newton, N)

Cement / Abutment	ZOE	ZPC	Resin
3mm Smooth surface	35.24±22.77	66.16±16.36	407.57±59.33
3mm Sandblasting	79.63±30.44	152.68±19.92	450.31±94.07
3mm Diamond bur preparation	98.25±29.67	161.53±25.35	504.15±117.81
5mm Smooth surface	67.74±14.05	170.73±40.77	420.53±118.53
5mm Sandblasting	142.63±28.62	245.85±43.91	612.53±66.11
5mm Diamond bur preparation	177.28±10.45	289.36±37.58	688.55±13.04
7mm Smooth surface	80.44±19.46		
7mm Sandblasting	209.83±19.46		
7mm Diamond bur preparation	232.24±29.07		

Analyze

When abutment length was increased, we could get higher retention value of the implant prosthesis. Retentive value of diamond bur preparation group was higher than that of the other group, sandblasting was higher than smooth group. Retentive value of resin cement group was higher than that of the other group, ZPC was higher than ZOE group.

Conclusions

1. In the 7mm abutment groups, retention of surface treated groups were statistically higher than that of smooth surface group. ($P<0.05$)
2. In the 5mm abutment groups, retention of surface treated groups were statistically higher than that of smooth surface group when ZPC and resin cement were used. ($P<0.05$)
3. In the 3mm abutment groups, retentive value was statistically increased only when the type of cement is changed. ($P<0.05$)

In conclusion, surface treatment of implant abutment and change of cement type are good method to increase the retention of prosthesis when the length of abutment is short.

Three-Dimensional Finite Analysis of Functional Stresses in Varied Width of Crestal Bone, Implant Diameter and Buccal off Center Position

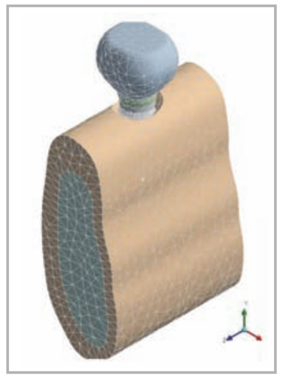
Ki-Deog Park[1)], Sang Un Han[2)], Hong-So Yang[3)*], Ju-Suk Kim[4)]

Introduction

The cumulative success rate of wide implant is still controversial. Some previous reports have shown high success rate, and some other reports shown high failure rate. The aim of this study was to analyze, and compare the biomechanics in wide implant system embeded in different width of crestal bone under different occlusal forces by finite element approach.

Materials and Methods

Three-dimensional finite element models were created based on tracing of CT image of second premolar section of mandible with one implant embedded. One standard model (6mm-crestal bone width, 4.0mm implant diameter, central position) was created. Varied crestal dimension(4, 6, 8 mm), different diameter of implants(3.3, 4.0, 5.5, 6.0mm), and buccal position implant models were generated. A 100-N vertical(L1) and 30 degree oblique load from lingual(L2) and buccal(L3) direction were applied to the occlusal surface of the crown. The analysis was performed for each load by means of the ANSYS V.9.0 program.



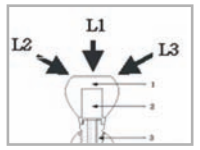


Table 1. Material properties of the each components of model

Material	Young's modulus (GPa)	Poisson's ratio
Implant & Abutment	110	0.35
Cortical Bone	13.7	0.3
Cancellous Bone	1.37	0.35
Gold alloy	170	0.35

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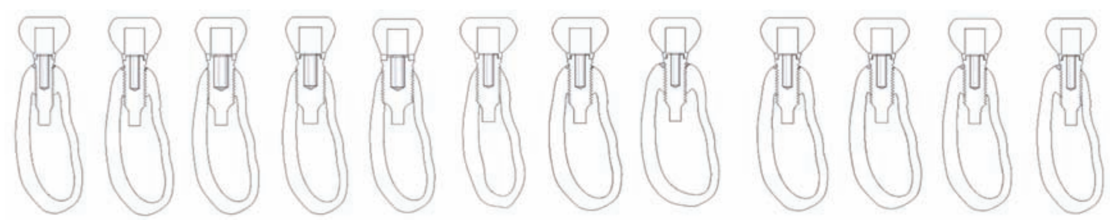
Lewinstein I, Banks-Sills L, J Prosthet. Dent, 10:355, 1995
Yalcin Ciftci, Int, J, of Oral & Maxillofacial Implants, 15: 571, 2000

Model number	1	2	3	4	5	6	2	7	2	8	9	10
Fixture diameter	3.3	4.0	5.0	5.5	6.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Crestal bone width	6.0	6.0	6.0	6.0	6.0	4.0	6.0	8.0	6.0	6.0	6.0	6.0
Buccally offset from center	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	1.5



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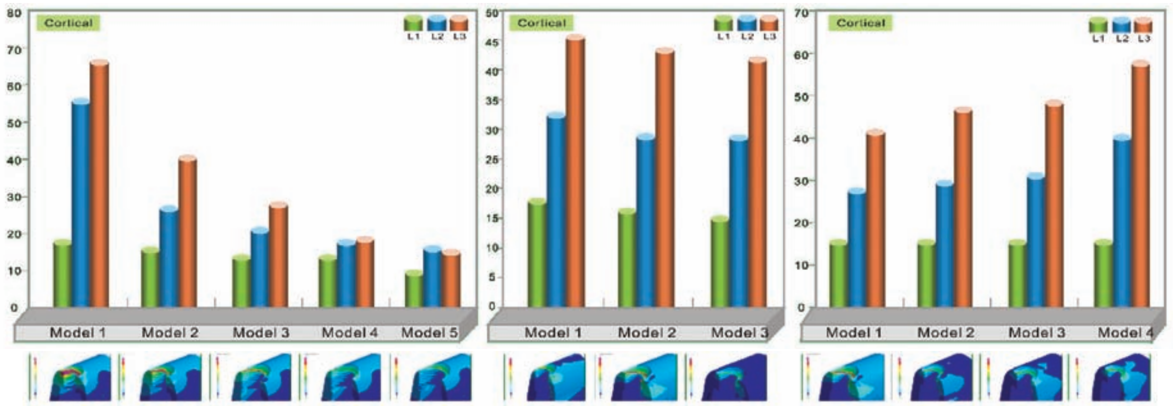
3)College of Dentistry Chonnam National University, Gwangju, South Korea.
4)Implant R&D Center, OSSTEM Implant Co. Ltd., Busan, South Korea.

Results

Model number		1	2	3	4	5	6	2	7	2	8	9	10
	Load 1	18.6	16.7	11.2	8.8	11.5	18.1	16.7	14.0	16.7	15.6	15.1	14.9
Cortical	Load 2	56.7	27.6	23.0	17.9	16.2	32.5	27.6	29.0	27.6	29.8	31.6	42.8
	Load 3	66.9	41.8	27.1	17.4	14.6	46.0	41.8	40.7	41.8	46.7	49.1	57.4
	Load 1	1.2	1.4	2.0	1.6	1.0	1.2	1.4	1.4	1.4	1.4	1.5	1.5
Cancellous	Load 2	1.1	1.2	1.1	1.7	1.2	1.8	1.2	1.2	1.2	1.3	1.4	1.5
	Load 3	1.1	1.6	2.6	2.2	1.7	1.3	1.6	1.7	1.6	1.5	1.7	1.6



1. In all cases, maximum equivalent stress, that applied 30° oblique load around the alveolar bone crest was larger than that of the vertical load. Especially the equivalent stress that loaded obliquely in buccal side was larger.
2. In study of implant fixture diameter, stress around alveolar bone was decreased with the increase of implant diameter. In the vertical load, as the diameter of implant increased the equivalent stress decreased, but equivalent stress increased in case of the wide implant that have a little cortical bone in the buccal side. In the lateral oblique loading condition, as the diameter of implant increased the equivalent stress decreased, but in the buccal oblique load, there was not significant difference between 5.5mm and 6.0mm as the wide diameter implant.
3. In study of alveolar bone width, equivalent stress was decreased with the increase of alveolar bone width. In the vertical and oblique loading condition, as the width of alveolar bone increased 6.0mm, the equivalent stress decreased. But in the oblique loading condition, there was not much difference in equivalent stress at more than 6.0mm of alveolar bone width.
4. In study of implant fixture position, there was a small difference, but in the case of little cortical bone in the buccal side, value of the equivalent stress was most Unfavourable.
5. In all the cases, it was shown high stress around the top of fixture that contact cortical bone, but there was little stress on the bottom of fixture that play the role of stress dispersion.

Conclusion

This present study intended to search for the reason of high failure rate of wide diameter implant. However, If the peri-implant cortical bone is more than 1 mm, there appeared to be a similar stress distribution with in the cortical stress.
These results demonstrated that by obtaining the more contact from the bucco-lingual cortical bone with installing wide diameter implant plays an most important role in biomechanics.

Study on the Adaptation to the Investment Water-Powder Ratio by the Abutment and Casting Crown

Tae-Hee Byun[1)*], Kwang-Hoon Kim[2)]

Introduction

Casting is a simple method for making dental restorations that require complicated, precise work for features such as inlay, crown & bridge, partial work, implants, and abutments. Nonetheless, it may also cause various casting defects such as deformation, bubble holes, shrinking, and imprecision. Casting shrinkage in particular occurs on most metals. Casting using wax of an original size makes the casting body different from the desired size. Unlike general casting, dental casting work requires expanding the investing material to let the mold expand alongside the shrinkage of the alloy during the melting and casting of alloy. This main dental feature is an important issue. This study seeks to examine the change of the fit depending on the water-mixing rate of the investing material among many other factors of casting defects and examine how the fit of an implant abutment and the casting body changes depending on the water-mixing rate of the investing material.

Methods

To examine the fit of an implant abutment and the casting body, an abutment 5.5㎜ high (GS Rigid Abutment: OSSTEM implant Co. Ltd., Korea) was connected to a plastic coping with the snap-on cut. The rotary angle was then measured (Fig 1. Rotary angle tester). The reason for the use of the plastic coping is to reduce errors during the creation of a super-structure and to ensure the same degree of shrinkage during casting. After the measurement of the rotary angle of the plastic coping, 16%, 18%, and 20% mixing rates were used for the phosphate investing material (CB30). Casting was done with ceramic gold alloy and Ni-Cr metal. Afterward, the rotary angles of the cast plastic coping was measured for the abutment whose rotary angle was first measured. The difference in the fit before and after casting was compared.

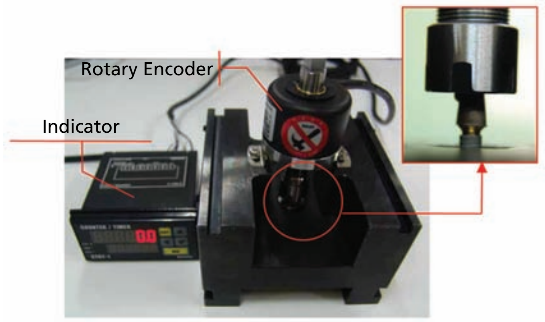


Fig 1. Rotary Angle Tester

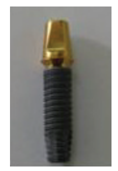


Fig 2. Rigid Abutment


Fig 3. Plastic Coping Before/ After Casting

Results

Using plastic copings with the snap-on area cut, the difference of the fit was compared based on the changes in rotary angles depending on the mixing rate of investing material.

1. When casting was done with Ni-Cr Metal and Ceramic Gold Alloy, and investing material was mixed at an 18% mixing rate (producer-guided), Ni-Cr shrank (2° →1°) and gold expanded (2.5° →3.5°).
2. When casting was done with Ni-Cr Metal and Ceramic Gold Alloy, and investing material was mixed at a 20% mixing rate, both Ni-Cr (2.2° →1°) and gold (3° →2.8°) shrank.
3. When casting was done with Ni-Cr Metal and Ceramic Gold Alloy, and investing material was mixed at a 16% mixing rate, Ni-Cr shrank (3° →2.5°). Gold expanded (2° →3.2°), however.

1) Implant R&D Center, OSSTEM Implant Co. Ltd., Busan, South Korea

Table 1. Changes in the rotary angle depending on the mixing rate of phosphate investing material (CB30)

Powder	100		100		100	
Liquid	16		18		20	
	Pre-casting	Pre-casting	Pre-casting	Pre-casting	Pre-casting	Pre-casting
Ni-Cr Metal	3°	-0.5	2°	-1	2.2°	-1.2
Ceramic Gold	2°	+1.2	2.5°	+1	3°	-0.2

Conclusions

Casting is a very useful method of creating a complicated, precise superstructure. Considering the possible various casting defects, however, careful use is required. In this study, a comparison was made by examining the difference of the fit in accordance with the mixture rate of the investing material as one of the factors of casting defects.

Table 2. Linear shrinkage rate of alloy and expansion rate of investing materials

Alloy Type	Linear Shrinkage Rate (%)
Gold alloy for coating deposition	1.40
Non-precious metal alloy for coating deposition	2.10
Expansion rate of phosphate investing material: 1.5-2%	

(*Table 2. Reference for the linear shrinkage rate of alloy and expansion rate of investing material)

1. When investing material was mixed at a water-mixing rate of 18%, the rotary angle shrank because it failed to compensate the shrinkage rate of Ni-Cr perfectly. The rotary angle also increased because the expansion rate of the investing material was higher than the shrinkage rate of ceramic Gold Alloy.
2. When investing material was mixed at a water-mixing rate of 16%, the change of rotary angle through the compensation of the shrinkage rate of Ni-Cr increased. Since the expansion rate of investing material was much higher than the shrinkage rate of ceramic gold alloy, the rotary angle became bigger than the 18% rate of investing material.
3. When investing material was mixed at a 20% rate, the rotary angle of Ni-Cr shrank since its expansion rate dropped by more than the 18% rate. Nonetheless, the shrinkage rate of ceramic gold alloy became equal to the expansion rate of the investing material. Consequently, there was almost no change of the rotary angle.0

This test result reveals that the water-mixing rate of the investing material affects the difference of the fit of a superstructure. For the creation of a dental superstructure, adhering to the water-mixing rate specified by the manufacturer is recommended. Note, however, that a user's precise knowledge of the shrinkage rate of casting metal and the expansion rate of the investing material will ensure the creation of a superstructure with a perfect fit.

The "OSSTEM IMPLANT Research Project" for the promotion of implantology may support clinical and laboratory research at the discretion of its research committee.

Further information concerning conditions can be obtained from the following address:

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