Volume 2 2006

OSSTEM Implant Documentations

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Content Osstem Documentation Summaries

Implant Science- Biomechanics

Retrospective multicenter cohort study of the clinical performance of 2-stage implants in South Korean populations

Seok-Min Ko, DDS, MS, PhD [1], Jeong-Keun Lee, DDS, MS, PhD [2], Steven E. Eckert, DDS, MS [3], Yong-Geun Choi, DDS, MPH, MPH [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.

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).

Conclusion
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)

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

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 2 Implat 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
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 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

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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)]

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

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.
4. 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.
5. 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 95.8% 6-year cumulative survival rate. One case failed after 2.5 years, and the other case after 4 years.
6. Major causes of early failure were detected as lack of initial stability (4 patients).

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.

Key words: Osstem implant, cumulative survival rate

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 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

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

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GS II fixture implant placement ; review of the factors affecting failure

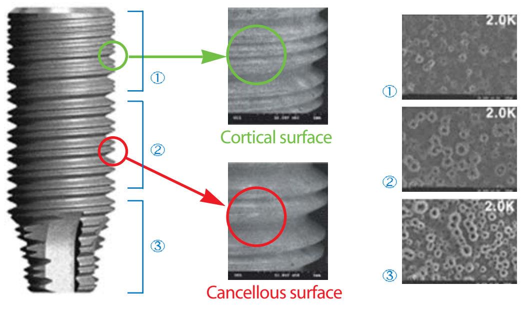
Kyung-Hwan Kwon [1)], Jung-Goo Choi [1)], Seung-Ki Min [1)], Seung-Hwan Oh [1)], Moon-Ki Choi [1)], Jun Lee [1)]

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 GSII fixture (Osstem Implant Co., Korea) implant placement.

Background

GSII Fixture Properties



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

We research the 185 fixtures of 74 patients who have been implanted with GSII fixture by the implant clinic center at Wonkwang university dental hospital.

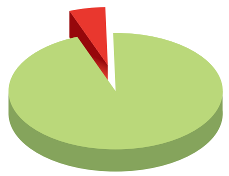
129 fixtures were placed in male patient and 56 fixtures were placed in female patient.

11 fixtures were immediately implanted on post-extraction socket.

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

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

Success rate

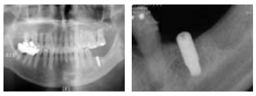


178 fixture has been success and 7 fixture were failure.
(The success rate; 96.22%)

Case 1

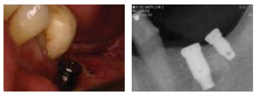
Pt. : Kim O O (48/M)
2005.08.22 : Implantation on #36,#37
2005.08.25 : Explantation on #37
2005.12.21 : Explantation on #36
and Re-implantation #36,#37
Symptom : Postoperative numbness (#37)
Peri-implant bone loss (#36)
Fixture mobility (#36)
Soft tissue inflammation

Pre-operative X-ray view



Explantation After 4M; peri-implant bone loss

Implantation and fixture affect the inferior alveolar nerve



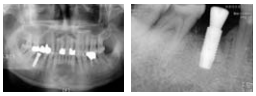
Explantation -Soft tissue inflammation

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

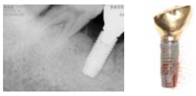
Symptom : Pain when mastication
(two weeks ago)
Mobility on Prosthetics
Sign : No loosening of screw.
Mobility of fixture.
Factors affecting failure :
Fixture structure
-Primarily initial stability is depend on upper third of fixture
Inappropriate prosthetics -Mesial cantilever
Bad habit - Bruxism

Implantation on #46 : Post-extraction immediate implantation



Incomplete osteointegration; after 6M

Final Prosthesis was set and no sign and symptom for 6weeks



X-ray view when explantation & explanted fixture

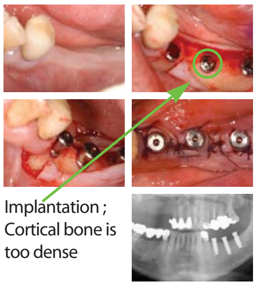
Case 3

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

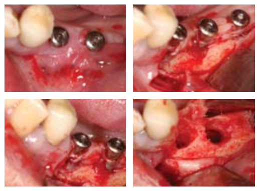
Sign : Mobility on #35,#36
Failure of osteointegration.

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

Pre-operative X-ray view



Implantation ; Cortical bone is too dense



Explantation; No evidence of osteointegration

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.1)2)3)
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.4)

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Retrospective study of osstem dental implants : clinical and radiographic results of 2.5 years

Jung-Won Hwang [1), Ji-Yeon Yang [1), Taek-Ga Kwon [1), Young-Kyun Kim [2)

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.

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 I). 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 II).

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 III). Submerged implants (USII) showed significantly more marginal bone loss than non-submerged implants (SSI and SSII) (P<0.001).

Table 1 Failures of Implants

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

* Delayed implantation, ** Simultaneous implantation

Table 2 Prosthetic Complications

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

Table 3 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	0.20 (0.34)

Conclusions

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

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A retrospective study on the clinical success rate of osstem implant

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

By referring to the examination record and radiographs of 247 patients (male: 144 patients, female: 103 patients) received 479 Ossetem implant operation at the dental clinic, Chosun University, from 2002 to December 2005, their information was collected and examined, and the following result could be obtained. The success rate of patients received implant treatments by surgeons in the Department of Oral and Maxillofacial Surgery at our hospital was 93.1 %. In this study, the failure rate of Osstem implant performed in our department was shown to be 6.9 %, which was relatively low, nevertheless, the failure rate of the maxillary molar tooth was 9.95 %, which was shown to be slightly high. This is thought to be the result that the bone quality of the maxillary molar tooth area is lower than other areas, and the shortage of the osteoid volume caused by the pneumatization of the maxillary sinus. Therefore, the accurate determination of bone quality and bone volume as well as appropriate treatments for it are thought to be required, and for them, it should be solved by CT and implant placement programs, by precise plans prior to surgery, and through the experience of technique.

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Implant placement with maxillary sinus augmentation : an up-to-3-year clinical study

Kook Min-Suk [1)], Gu Hong [1)], Yu Min-Gi [1)], Park Hong-Ju [1)], Oh Hee-Kyun [1)],
Hong Suk-Jin [2)], Choi Choong-Ho [2)], Ohk Seung-Ho [2)]

IProtocol of Sinus Elevation 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

OSFE: Osteotome Sinus Floor Elevation
BAOSFE: Bone Added Osteotome Sinus Floor Elevation

Donor Sites 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

Lateral Window Technique


Preoperative photo(#16,17)

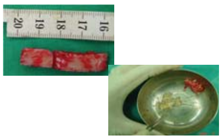

Trapdoor window by round bur


Tapping the trapdoor


Sinus membrane elevation by elevation curette


Preoperative photo(#16,17)


Trapdoor window by round bur


Tapping the trapdoor


Sinus membrane elevation by elevation curette

Patients

- 59 patients (male:37, female:22) who received sinus bone grafts with the lateral window technique from January,2003 to February,2006
- Mean age : 52.5 years (24-71 years in range)
- Mean follow-up periods : 17.2 months (2-37 months in range)

Results

Types of Graft Materials

	Bone graft material	Total
Bilateral	Iliac bone + DFDB : 4	
	Iliac bone : 4	
	Chin bone + DFDB(Bio-oss) : 6(1)	
	Ramal bone + DFDB(Bio-oss) : 3(4)	25
	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(10)	34
	Chin bone + Ramal bone : 1	
	Tuberosity bone + Bio-oss : 1	
	Torus bone + DFDB : 1	

Simultaneous vs Delayed Installation

	No. of sinus graft	No. of implants (mean number)	No. of failure
Simultaneous	61	167 (2.7)	2
Delayed	23	69(3.0)	0
Total	84	236(2.8)	2

Timing of Implant Installation

Residual bone height	Simultaneous installation	Delayed installation
>7mm	32	3
7-3mm	27	14
<3mm	2	6
Total	61	23

Survival Rate of Implants

Simultaneous Installation

Residual bone height	No. of fixture	No. of failure	Survival rate
>7mm	98	2	98%
7-3mm	62	0	100%
<3mm	8	0	100%
Total	167	2	99%

Delayed Installation

Residual bone height	No. of fixture	No. of failure	Survival rate
>7mm	8	0	100%
7-3mm	42	0	100%
<3mm	19	0	100%
Total	69	0	100%

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	13.2mm

Surface Type of Implants

Surface type	Simultaneous installation (%)	Delayed installation (%)	Total(%)
HA (Replace®)	89 (38)	40 (17)	129 (55)
RBM(Osstem®)	78 (33)	29 (12)	107 (45)
Total	167(71)	69 (29)	236(100)

RBM : Osstem®, Osstem Inc., Korea
HA : Replace®, Nobel Biocare., Sweden

Mean Period of Implant Installation in Delayed Installation

Residual bone height	Timing of installation (months)
>7mm(n=8)	6.0(5-7)
7-3mm(n=42)	5.4(3-6)
<3mm(n=19)	5.7(4-7)
Total	5.6(3-7)

Mean Healing Period of 2° Uncovering Surgery

Residual bone height	Mean healing period (months)
>7mm(n=8)	7.0(6-8)
7-3mm(n=42)	6.9(5-11)
<3mm(n=19)	7.6(6-11)
Total	7.1(5-11)

Complications of Recipient Site

Complication	Number of sinus (%)
Exposure of cover screw	5(6)
Infection of sinus	2(2)
Sinus membrane tearing	3(4)
Ecchymosis	26(31)
Swelling	65(77)

Summary

- Protocol of sinus elevation procedure was determined by residual bone height and initial stability of implant.
- Delayed implant installation was performed in case of Mx sinusitis, deficient residual bone, and combined onlay bone graft.
- In delayed installation, mean healing period after subantral bone graft was 5.6 months (3-7months in range).
- Autogenous bone or autogenous bone mixed with allografts or xenografts were used as graft material.
- No membrane was used on the bony window site and Greenplast® was applied to the grafted bone.
- Temporary prosthetic restoration was used for 2-4 months before final restoration.

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Vertical ridge augmentation and implant placement in severe bone loss area with autogenous bone and bovine bone

Jin-hwan Kim DDS, MSD [1], Dong uk Jung DDS [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.


Radiograph before the surgery


Occlusal view after the tooth extraction (severe bone loss)


Lateral view after the tooth extraction


Severe bone loss area


Collecting autogenous bone


Implant placement (AVANA external type)


Autogenous bone and Bio-Oss


Absorbable membrane (fixing the membrane with cover screw)


FGG and suture (filling in to make up for deficient soft tissue)

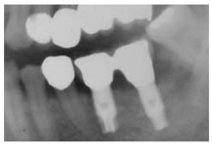

10 days after the surgery (graft soughing)


Healing part 6 months after the surgery


Healing abutment after the second surgery


Occlusal surface of the final prosthesis in place


Lateral view of the final prosthesis in place (vertically augmented bone)


Radiograph after the insertion of the final prosthesis in place

Ccnclusion

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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Scanning electron microscopic study of implant surface after Er,Cr:YSGG laser irradiation

Pil-Kwy Jo [1)], Seung-Ki Min [1)], Kyung-Hwan Kwon [1)], Young-Jo Kim [1)]

Introduction

Today, there is considerable evidence to support a cause-effect relationship between microbial colonization and the pathogenesis of implant failures. The presence of bacteria on implant surfaces may result in an inflammation of the peri-implant mucosa, and if left untreated, it may lead to a progressive destruction of alveolar bone supporting the implant, which has been named as peri-implants have been suggested. Recently, in addition to these conventional tools, 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. It is introduced that Er,Cr:YSGG laser, operating at 2780nm, ablates tissue by a hydrokinetic process that prevents temperature rise.

Methods

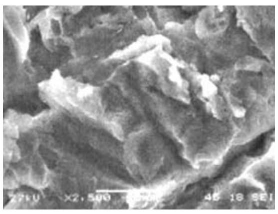
We studied the change of the titanium implant surface under scanning electron microscopy after according to implant surface.

* Implant
-TPS surface with RBM(GS II, Osstem)
-VTPS surface with Ca_3P coating(Pitt-Easy Bio-oss FBR, Oraltronics)

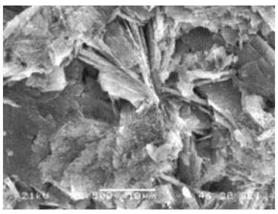
Each implant is irradiated by water laser for 10, 20, 30sec at power settings of 2, 3, 4W on 1st thread, 4th thread, 8th thread of implant.
Er,Cr:YSGG laser is set in 20% air and 20% water.
Every specimens were examined under a scanning electron microscope and analyzed by energy dispersive x-ray spectrometer.

Results

Er, Cr:YSGG laser irradiation of implant fixture showed different effects according to implant surface. Er,Cr:YSGG laser in TPS surface with RBM not alter the implant surface under power setting of 4Watt(W) and irradiation time of 30sec. But in Ca_3P coating surface alter above power setting of 2W and irradiation time of 10sec. RBM surface showed microfracture in 4W, 30sec and Ca_3P coating surface showed destruction of fine crystalline structure, melting in excess of 2W, 10sec.

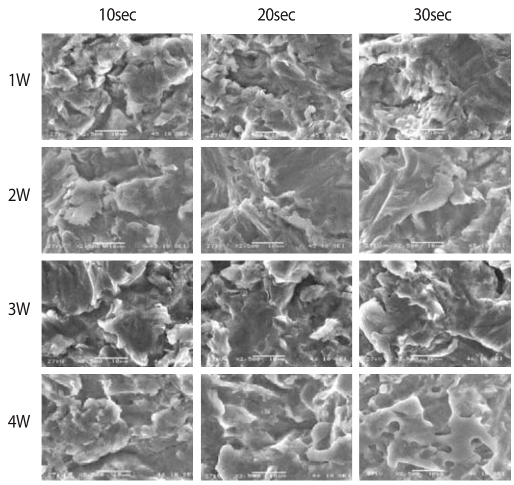


RBM surface

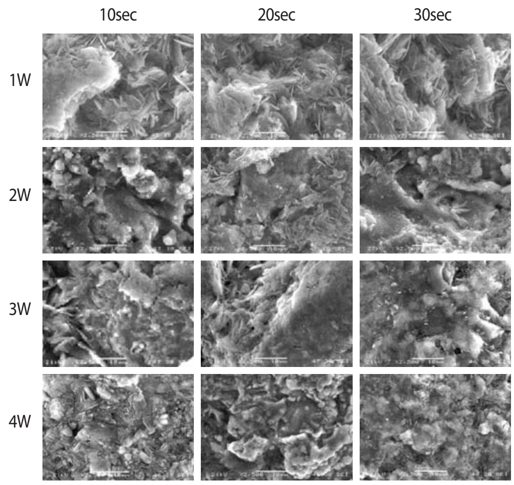


Ca_3P coating surface

Implant Science- Biology



RBM surface



Ca_3P coating surface

Table 1 Implant surface change according to irradiation energy and time

	GS II implant (RBM surface)			Pitt-Easy implant (Ca_3P coating surface)		
	10sec	20sec	30sec	10sec	20sec	30sec
1W	No change	No change	No change	No change	No change	No change
2W	No change	No change	No change	melting	melting	melting
3W	No change	No change	No change	melting	melting	melting
4W	No change	No change	microfracture	melting	melting	melting

Conclusions

RBM surface showed microfracture in 4W, 30sec and Ca_3P coating surface showed destruction of fine crystalline We concluded that proper power setting, air, water of each implant surface must be investigated and implant surface must be irradiated under the damaged extent.

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The effects of exposing dental implants to the maxillary sinus cavity on sinus complications

Jae-Hyung Jung, DDS [1], Byung-Ho Choi, DDS, PhD [2], Shi-Jiang Zhu, MD [3], Seoung-Ho Lee, DDS, PhD [4],
Jin-Young Huh, DDS [1], Tae-Min You, DDS [1]

Objective

The aim of this study was to investigate whether dental implant exposure to the maxillary sinus cavity increases the risk of maxillary sinus complications.

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 macillary sinus.

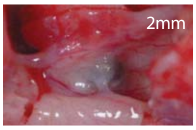
Study design

- Animal: Adult female mongrel dog
- Implant: SS I (Osstem)
- Height of exposing dental implant: 2, 4, 8mm

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.

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. This study showed that titanium implants, more than 4 mm in length, exposed to the sinus cavity were not covered by the growing antral membrane and showed the accumulation of debris on their exposed surfaces. However, the presence of debris did not make the maxillary sinus vulnerable to sinusitis during the 6-month observational period. Since a short time interval was used in this experiment, further studies involving a longer time interval may be necessary to determine whether the accumulating debris can become a source of inflammation.

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KAP 2005;35(4):1073-1079
Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006;02:602-605

Treatment of experimental peri-implantitis using autogenous bone grafts and platelet-enriched fibrin glue in dogs

Tae-Min You, DDS [1], Byung-Ho Choi, DDS, PhD [2], Shi-Jiang Zhu, MD [3], Jae-Hyung Jung, DDS [1], Seoung-Ho Lee, DDS, PhD [4] Jin-Young Huh, DDS [1], Hyun-Jung Lee, DDS [1]. and Jingxu Li, DDS [3]

Objective

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.

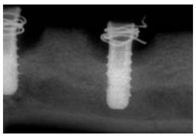

Fig. 1. Radiographic appearance of the bone loss around the implants 2 months after placing the gauze and wire.

Study design

- Animal: Adult female mongrel dog
- Implant: SS I (Osstem)
- Groups
    - Control
    - Autogenous particulate bone
    - Autogenous particulate bone+platelet-enriched fibrin glue

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.

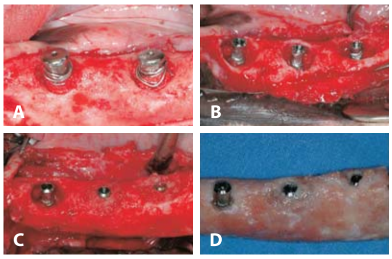

Fig. 2. Clinical features after ligature placement (A), after elevation of full mucoperiosteal flaps and granulation tissue removal (B), after treatment (C), and after animal was killed (D).

Results

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.

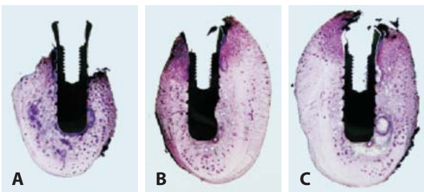

Fig. 3. Histologic features of the implants with the adjacent peri-implant tissues. A, Implant treated with a conventional flap procedure only. B, Implant treated with autogenous particulate bone. C, Implant treated with autogenous particulate bone mixed with platelet-enriched fibrin glue. Toluidine blue staining, original magnification 25X.

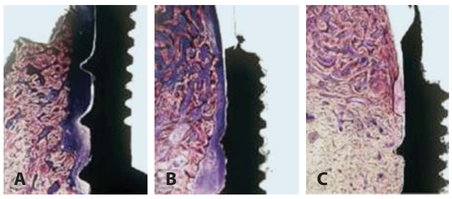

Fig. 4. Higher magnificatioin of the implants with the adjacent peri-implant tissues. A, Implant treated with a conventional flap procedure only. B, Implant treated with autogenous particulate bone. C, Implant treated with autogenous particulate bone mixed with platelet-enriched fibrin glue. Toluidine blue staining, original magnification 100X.

Conclusions

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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Implant Science- Biology

Expression of TGF-β and IGF-I during osseointegration of titanium implant

In-Woong Lee [1], Hyun-Chul Song [2], Yu-Jin Jee [3]

Introduction

Many of the molecular and genotypic events taking place at the osteoblast cell level during bone-implant integration are still largely unknown. The objective of this study was to examine expression patterns of TGF-β and IGF-I related genes during bone-implant integration.

Materials & Methods

Titanium implants with machined surface were placed into 8 rabbit tibias. At 3rd, 7th, 14th, 28th day after implantation, the expression pattern of TGF-β and IGF-I genes in bone with or without implant was examined using reverse transcriptase-polymerase chain reaction (RT-PCR). At the same time, histomorphometric analysis was evaluated, respectively.

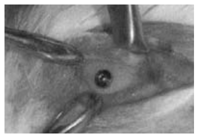

Fig. 1. Operation

Results

The bone-to-implant contacts (BIC) of experimental groups were 5.2%, 6.2%, 6.6%, 24.6% at 3rd, 7th, 14th, 28th day. This indicated that newly formed bone increased at the implant surface in bone marrow space after implantation. The expressions of TGF-β and IGF-I were higher in implantation groups than untreated control groups during all experimental days.

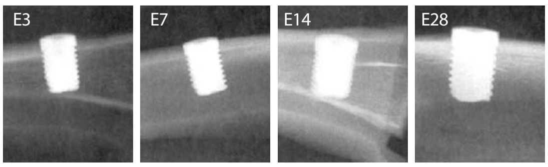

Fig. 2. Radiographic features of 3rd, 7th, 14th, 28th day after implantation.

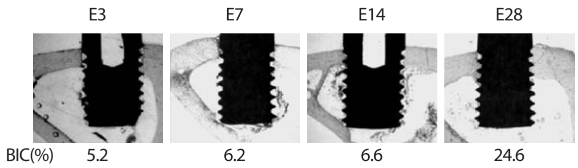

Fig. 3. Histomorphometric features and percentage of bone-to-implant contact (BIC)

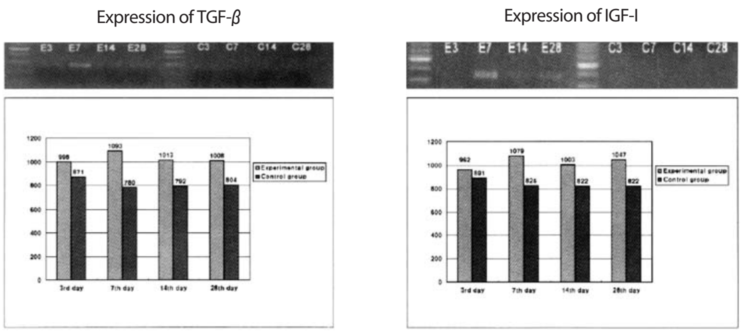

Fig. 4. Expression of TGF-β and IGF-I by RT-PCR at 3rd, 7th, 14th, 28th day after implantation.

Conclusions

The increased expression of TGF-β and IGF-I genes may be associated with the in bone-to-implant contact. This result provided the evidence for existing biologic difference in tissue response after implantation and helped us to understand molecular biologic processes in tissue-implant integration.

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Expression of osseointegration-related genes round titanium implant: BMP2, BMP4

Cheong-Hwan Shim [1)], Yu-Jin Jee [2)], Hyun-Chul Song [3)]

Introduction

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 & Methods

We randomly used 8male and female house rabbit amd used diameter 5mm height spiral shaped implants(Osstem, Korea) for animal use handled as a resorbable blast machined(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.

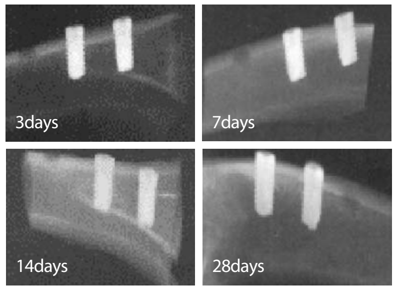


Fig. 1. Radiographic features of 3rd, 7th, 14th, 28th day after implantation.

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.

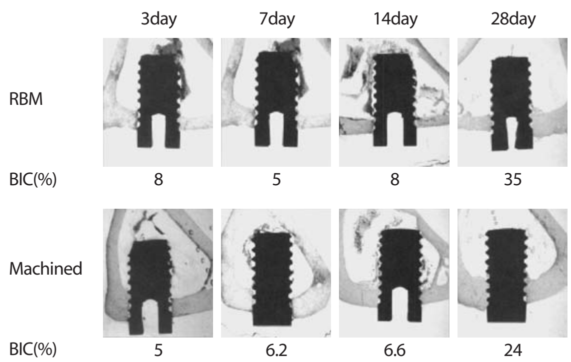
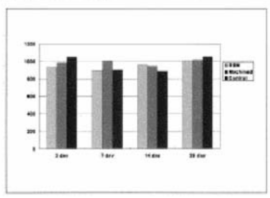


Fig. 2. Histomorphometric features and percentage of bone-to-implant contact (BIC)

Expression of BMP2

RBM	935	897	958	1009
Machined	985	1007	946	1014
Control	1050	903	889	1053



Expression of BMP4

RBM	726	722	707	751
Machined	750	713	665	621
Control	726	633	697	679

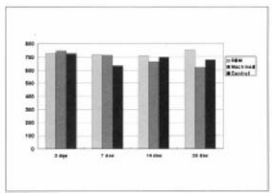


Fig. 3. Expression of BMP2 and BMP4 by RT-PCR at 3rd, 7th, 14th, 28th day after implantation.

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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Implant Science- Biology

Histologic and histomorphometric evaluation of immediately and early loaded implant in dogs

Su-Gwan Kim [1], Seong-Yong Moon [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.

Material & Method

For this experiment, we used the five, 10 to 15 kg weighed, 6-month-old dogs, and for implant products, the fifty US III(Osstem) RBM surface implants of 4mm 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.

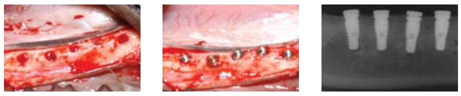
US III Fixture   US III Fixture   US III Fixture Simple

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

12 weeks after extraction



Implant installation   Post installation radiograph

Fixed provisional restoration   Post installation radiograph

Result

1)Clinical examination

*Three bridges in 3 dogs
 - Unilateral (left 2, right 1)
 - Partially lost at 8 weeks and 16 weeks
*All implant -no mobile and no infection sign
*Success & failure
*Zablosky protocol (1980)
 - Implant stability
 - Retention of adequate bone level in X-ray
 - No infection sign

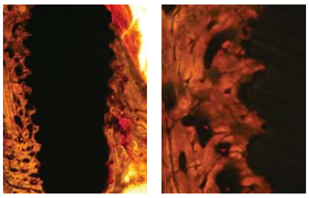
	N	Failed implant	Periotest (Installation)	Periotest (16weeks)
Test 1	20	0	-3.8(-6~-1)	-3.4(-6~+1)
Test 2	20	0	-3.6(-5~-1)	-3.1(-6~+1)
Control group	10	0	-3.1(-5~-1)	-3.6(-6~-1)

2)Histologic examination

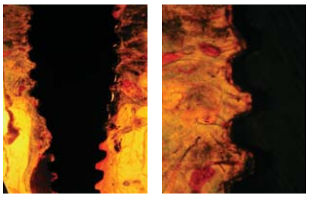
Experimental group 1 is the group of early loaded implants and shows that the bone was mature compared to the control group and the peri-implant bone had lamellar structure.

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.

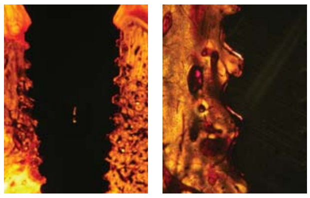
The bone of control was immature compared to the experimental groups. Histologic images of the control group and experimental group 1 and 2, showed fair bone contact between the implant and the bone, and there was seen no bone resorption.



Experimental Group1



Experimental Group2



Control Group

	Mean	SD	Min	MAX
Test 1	0.79	0.61	0	2.1
Test 2	1.65	1.16	0.5	4.5
Control group	1.11	0.98	0	3

Distance between the implant top and the first implant-to-bone contact

Conclusion

*Clinical implant success rate
 - Control and experimental group : 100%
*New Bone Formation rate
 - Significant difference between Control and experimental group at 16 weeks
*Distance between implant top and the first bone to implant contact
 - No significant difference between Control and experimental group at 16weeks
*Early and immediate loading in partially edentulous state → **Expect good prognosis**
 - RBM surface implant
 - Good initial stability
 - Fixed provisional bridge
*Further evaluation
 - Long-term period

1) Department of Oral and Maxillofacial Surgery, College of Dentistry, Chosun University, South Korea

Poster presentation, the Academy of EAO 2006, no.187
Poster presentation, Pan-Pacific Implant Society 2006:80 Oral presentation, KAO 2006:10

Histometric analysis of immediate implantation and immediate loading of CMP and RBM surface implant after tooth extraction in dogs

Kye-Joon Yi [1], Su-Gwan Kim [1]

Purpose

This study sought to apply early loading by immediately placing CMP (Chemical Mechenical Polishing) -processed and RBM (Resorbable Blast Media) -processed implants in the extraction sockets of adult dogs and histologically and histomorphometrically evaluating the results.

Material & Method

1)Experimental Materials

(1)Experimental animals: 5 hybrid adult dogs 8~9 months old and weighing about 10kg

(2) Implant: 20 RBM-processed implants and 20 CMP-processed implants, both with length of 10mm and diameter of 3.5mm; a total of 4 implants were used per dog; cemented-type abutments were used following implant placement.

Table 1. Experimenal Schedule

Group	Schedule				
Experimental	extraction	Immediate implantation	Immediate loading	Osteointegration 16 weeks	Sacrifice
Control	extraction	Immediate implantation	Submerged	Osteointegration 16 weeks	Sacrifice

Experimental 1 and control 1 : RBM surface implant
Experimental 2 and control 2 : RBM surface implant

2)Experimental Methods

(1)Anesthesia

After general anesthesia was performed on each dog by applying an intramuscular injection of 2cc Xylazine (Rompun, Bayer Vetchem-Korea Co.) and Ketamine (Ketara, Yuhan Corporation) to the femoral region, infiltration anesthesia was administered on the implant placement area using 2% lidocaine (containing 1:100,000 epi).

(2) Tooth Extraction

#1, 2, 3, and 4 premolar teeth were extracted from each side of the lower jaw of each dog.

(3)Implant Placement and Loading

After the extraction of 4 premolar teeth from each side of the lower jaw, 4 CMP-processed implants were inserted on the left side, and 4 RBM-processed implants, on the right side. Abutments were then mounted on the posterior with 3 implants on each side; temporary resin was used for the trial placement of prostheses in this region. The one of anterior implants was fitted with a cover screw and submerged as a control group. To prevent post-surgery infection following implant insertion, an intramuscular injection of 3cc gentamicin was administered for 3 days followed by 1cc for 2 days. A liquid diet was prepared (Figs. 1, 2).

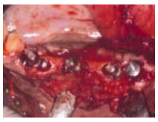


Fig. 1.

Fig. 2.

(4) Radiograph

Radiographs were taken following implant insertion and sacrifice (Figs. 3, 4).

Fig. 3.

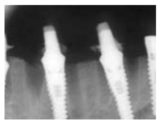


Fig. 4.

(5) Histomorphological Evaluation

Slides were made for implant samples removed 16 weeks after the insertion and observed with an optical microscope (Olympus BX50, Tokyo, Japan) after the Villanueva osteochrome bone staining (San Clemente, CA, USA) was performed.

(6) Statistical Analysis

The filling rates of implants and bones as tissue samples were measured, and statistical analyses, performed for student t-tests. Radiographs were then taken immediately and 16 weeks after the implant insertion. The height of the bones attached to the implant apex was also measured, with statistical analyses performed for independent sample t- tests.

Oral presentation, KAO 2006:6-7
Poster presentation, Pan-Pacific Implant Society 2006:95

Results

1) Findings on Tissues

Experimental group 1: The complete deposition of new bones between screw threads was observed; ditto for mature bones. Likewise, no inferior proliferation of epithelium was found in the lower 1/3 part of the implant image (Fig. 5).

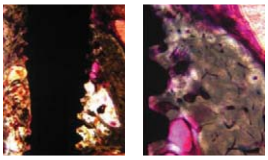


Fig. 5. A B

Experimental group 2: Same findings as those for Experimental group 1 (Fig. 6).

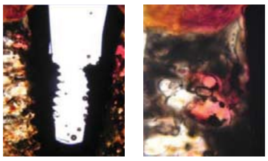


Fig. 6. A B

Control group for Experimental group 1: Active bone formation was observed in each implant. Furthermore, no inferior proliferation of epithelium was noted (Fig. 7).

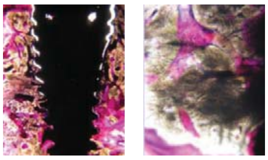


Fig. 7. A B

Control group for Experimental group 2: Same findings as those for the control group for Experimental group 1 (Fig. 8).

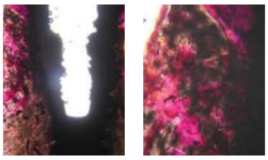


Fig. 8. A B

2) Survival Rate of Implants

Out of the 40 implants placed in the lower jaws of 5 dogs for clinical tests, 1 in Experimental group 1 and 1 in its control group failed. Note that any implant showing bone contact rate of less than 10% during the histological examination was considered a failure.

The survival rate of implants for Experimental group 1 and that for Experimental group 2 were 87% and 67%, respectively. When immediate loading was applied, RBM-processed implants showed a 20% higher survival rate than CMP-processed implants for both groups. Experimental group 1 and Experimental group 2's control group showed survival rates of 87% and 80%, respectively; the same survival rate was noted in both RBM-processed implants to which immediate loading was applied and those to which immediate loading was not applied. On the other hand, Experimental group 2 and its control group showed survival rates of 67% and 80%, respectively, with the survival rate of CMP-processed implants to which immediate loading was not applied slightly higher than the survival rate of those to which immediate loading was applied for both groups. Both control groups of Experimental group 1 and Experimental group 2 showed a survival rate of 80%; the same survival rate was observed when immediate loading was not applied after the placement of CMP-processed and RBM-processed implants in both groups.

Table 2. Implant survival rate(mean%)

Group	Survival rate(%)
Experimental 1	87
Experimental2	86
Control 1	80
Control 2	80

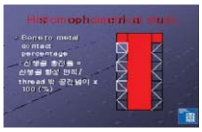


Fig. 9.

3) Bone Filling Rate of Implants

The filling rate of new bones inside the implant threads was examined for histomorphometric evaluation and defined as: Filling rate of new bones = Area of new bone formation/Area of space outside the thread x 100% (Fig. 9).

The failed implants were excluded in the calculation. An average bone filling rate of 51.86% was noted in a total of 13 implants in the case of Experimental group 1; in the case of Experimental group 2, however, an average bone filling rate of 52.9% was observed in a total of 10 implants. The control groups of Experimental group 1 and Experimental group 2 s howed an average bone filling rate of 58.5% and 58%, respectively, for a total of 4 implants (Table 3).

Table 3. Implant to bone contact percentage	
Group	**Implant to bone contact(%)**
Experimental 1	51.86±2.63
Control 1	58.50±7.79
Experimental 2	52.90±3.18
Control 2	58.00±4.35

Experimenal 1, 2 : immediate loading, control 1, 2 : submerged. Group 1 : RBM surface implant, Group 2 : CMP surface implant.

The bone filling rate of Experimental group 1 and that of Experimental group 2 were 51.86% and 52.9%, respectively; RBM-processed and CMP-processed implants showed similar bone filling rates for both groups. Experimental group 1 and Experimental group 2's control group showed bone filling rates of 51.86% and 58.50%, respectively, with a slightly higher bone filling rate found in RBM-processed implants to which immediate loading was not applied compared to those to which immediate loading was applied. Similarly, Experimental group 2 and its control group showed bone filling rates of 52.9% and 58%, respectively. A slightly higher bone filling rate was noted in CMP-processed implants to which immediate loading was not applied compared to those to which immediate loading was applied. On the other hand, the control group for Experimental group 1 and that for Experimental group 2 showed similar bone filling rates at 58.5% and 58%, respectively. Similar bone filling rates were also found between both groups when immediate loading was not applied following the placement of CMP-processed and RBM-processed implants.

4) Height of Attached Bones

Radiographs were taken immediately and 16 weeks after the implant placement. The height of the bones attached to the implants was then measured at the implant apex. To measure the bone height, the extraction socket areas were divided into defect and non-defect areas during the implant placement. The independent surface t-test method was used for statistical analysis.

Table 4. Vertical bone height on implant (mm)		
Group	**Vertical bone height(mm) of defect side**	**Vertical bone height(mm) of non-defect side**
Experimental 1	9.46±1.52	10.02±0.46
Control 1	9.58±0.48	9.79±0.42
Experimental 2	9.16±1.18	10.07±1.06
Control 2	8.95±1.05	10.13±0.25

Experimenal 1, 2 : immediate loading, control 1, 2 : submerged. Group 1 : RBM surface implant, Group 2 : CMP surface implant. P value of defect side group : p>0.05. P value of non-defect side group : p>0.05.

The final bone heights of the implant surfaces on the defect side were found to be 8.95~9.58mm, although no statistically significant difference was noted between and among all experimental and control groups; neither was there a difference between those to which immediate loading was applied and those to which immediate loading was not applied after immediate implant placement following dental extraction. No significant difference was also found in RBM-processed or CMP-processed implants, i.e., whether or not immediate loading was performed. On the other hand, the final bone heights of the implant surfaces on the non-defect side were found to be 9.79~10.13mm; there was no statistically significant difference between and among all experimental and control groups, however (Table 4). The average final bone height of implants was found to be 9.31mm in the case of the implant surface areas on the defect side, whereas that of the implant surface areas on the non-defect side was 10.02mm. Such difference was statistically significant.

The implant surface areas on the defect side after immediate placement in the extraction sockets tended to show bone formation with an average height of 1.61mm, whereas those on the non-defect side tended to show average bone absorption of 0.5mm. Such difference was statistically significant (Table 5).

Conclusion

In this study, implant placement was performed immediately following tooth extraction. In terms of stability, no difference was observed between those to which immediate loading was applied and those to which immediate loading was not applied. Whether RBM-processed implants or CMP-processed implants were used did not cause any significant difference between the groups to which immediate loading was applied and those to which immediate loading was not applied.

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Histomorphometric evaluation of immediately loaded implants with various coatings in dogs

Min-Seok Oh [1)], Su-Gwan Kim [1)]

Purpose
This study compared splint and non-splint methods of immediate-loading implants and examined the implant success rate for different surfaces : smooth, oxidized, and resorbable blast media (RBM)

Material and Method
The first through fourth mandibular premolars were extracted from eight young adult dogs. Twelve weeks after extraction, implantion was performed at the extraction sites. The implants had one of the following surface treatments : smooth, oxidized, or RBM. Sixteen weeks after implantation, the dogs were sacrificed ; the hemi-mandibles were obtained and processed histologically to obeain non-decalcified sections. Longitudinal sections were made for each implant and analyzed using light microscopy.

Result
The impalnt success rate in all the groups was 83.3% in this study. Radiographically, 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.

Conclusion
The immediate-loading implant showed results similar to those of the two-stage implant method. For the immediate liading of implants, the results were for implants with a smooth surface.

Introduction

Purpose

This study sought to examine how the differences between and among the smooth surface, oxidation surface, and RBM (Resorbable Blast Media) surface affected the success rate of implants by conducting experiments on adult dogs both in the case of immediate loading using the splint method and in the case of implants using the non-splint method.

Material & Method

1) Experimental Materials

(1) Experimental Animals
Six hybrid adult dogs 6 months old, weighing 12kg; sex not a factor

(2) Implants
Three kinds of implants (Osstem, SSII, Busan, Korea) with length of 10mm and diameter of 3.5mm and classified according to the surface treatment methods (smooth surface, oxidation surface, resorbable blast media surface) were used.

Table 1. Experimental design ( ):Number of implants

	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)

(3) Experimental Instruments
For the purpose of clinical observation, radiographs were taken immediately after loading and animal sacrifice. Histological sections were made out of the tissues buried after the animal sacrifice and observed using a microscope.

Oral presentation, KAO 2006:11-12
Poster presentation, KAOMI 2006:59

2) Experimental Methods

(1) Anesthesia

General anesthesia was administered to each dog by applying an intramuscular injection of 2cc Xylazine (Rompun®, Bayer Vetchem-Korea Co.) and Ketamine (Ketar®, Yuhan Corporation).

Table 2. Experimental Schedule

Ectraction	→	Healing Periods 12weeks	→	Implantation & Immediate loading	→	Osseointegration 16weeks	→	Sacrifice

(2) Tooth Extraction

The 2nd, 3rd, and 4th premolar teeth were extracted from each dog. After the tooth extraction, absorbable sutures were used to close the extraction sites. The healing period was set to 12 weeks. To prevent infection, an intramuscular injection of 2cc gentamicin was administered to the dogs for 3 days.

(3) Implant Placement and Loading

After anesthetizing each dog in the same manner, incision was performed. The periosteum was then elevated using a periosteal elevator. A total of 48 implants were placed in 6 dogs (Table 1, Fig. 1). After the insertion of implants, temporary resin was used for the immediate loading for each dog. Occlusal adjustment was also performed (Figs. 2, 3). Radiographs of the root apex were taken immediately after the implant placement (Fig. 4). All the animals were sacrificed 16 weeks after the implant placement, with the mandibles where the implants were placed excised to collect tissue slices (Fig. 5). Radiographs of the excised tissue slices were also taken (Fig. 6).

Fig. 1. Implantation. Shortly after implantation after 12 weeks figure

Fig. 2. Temporary restoration. Prosthesis is made of temporary resin

Fig. 3. Immediate loading Ocdusion check ; non-functional immediate loading

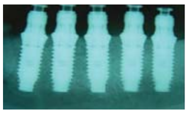


Fig. 4. Radiograph obtained after implantation.

Fig. 5. After sacrifice, the immediate-loaded prosthesis is well maintained.

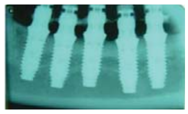


Fig. 6. Radiograph at sacrifice after 16 weeks of immediate loading.

3) Experimental Evaluation

(1) Clinical Evaluation

The Zablosky (1980) method was used for clinical evaluation, i.e., ① maintaining the stability of implants; ② maintaining the appropriateness of the radiological bone height; ③ no findings on infection.

(2) Radiological Evaluation

The Romanos (2005) method was used for the radiological evaluation (Fig 7).

0: marginal bone level = implant top level

m: marginal bone level = polished collar level

1: marginal bone level = 1/4 of the implant length

2: marginal bone level = 2/4 of the implant length

3: marginal bone level = 3/4 of the implant length

4: marginal bone level = apical 1/4 of the implant length

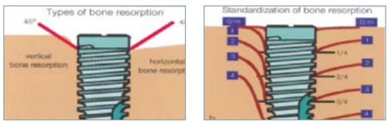


Fig. 7. Romanos protocol

0 : marginal bone level = top of implant. M : marginal bone level = level of the polished collar. 1 : marginal bone level = 1/4 implant length. 2 : marginal bone level = 1/2 implant length. 3 : marginal bone level = 3/4 implant length. 4 : marginal bone level = apical 1/4 implant length.

(3) Histomorphometric Evaluation

The samples were fixed with 70% alcohol for 6 days. Afterward, they were cleaned using alcohol, dehydrated, and subsequently embedded in glycolmetacrylate resin (spurr Low-Viscosity Embedding media, Polyscience, Warrington, PA, USA). The polymerized samples were cut 200um toward the major axis using a high-precision diamond disc (Low-speed diamond wheel saw 650, SBT, San Clemente, CA, USA) and polished using a lapping and polishing machine (OMNLAP 2000, SBT, San Clemente, CA, USA). Each slide was observed using an optical microscope (Olympus BX50, Tokyo, Japan) after the Villanueva osteochrome bone staining (San Clemente, CA, USA). The new bone filling rates inside the implant threads were then checked for the histomorphometric evaluation (Fig. 8).

New bone filling rate = Area of new bone formation/Area of space outside the thread x 100%

(4) Statistical Analysis

After implants and bone filling rates were measured using tissue samples, statistical analysis was performed using a student t-test ($P<0.05$). The height of the attached bones from the implant apex was measured after radiographs were taken immediately and 16 weeks after the implant placement (independent sample t-test).

Experimental Results

1) Clinical Results

Out of a total of 60 implants, 5 showed severe perturbation and radiologically obvious osteoclasia at the time of animal sacrifice. All the failed 5 implants were found to be smooth surfaces. Control group 1 and Experimental group 1 showed a success rate of 75%, whereas the other groups all exhibited a success rate of 100%.

2) Radiological Results

Four of the implants used for Experimental group 1 showed marginal bone absorption up to 1/4 of the total length. One of the implants used for Experimental group 2 and three of those used for Experimental group 3 exhibited mandibular bone absorption up to 1/4 and 2/4 of the total length, respectively. In the case of Experimental group 3, one implant showed mandibular bone absorption up to 1/4 of the total length (Table 3).

Table 3. Radiographic result

	0, m	1	2
Control group 1	3	0	0
Control group 2	3	0	0
Control group 3	4	0	0
Experimental group 1	8	4	0
Experimental group 2	12	1	3
Experimental group 3	15	1	0

3) Histomorphometric Results

In each group, new bone filling rates, standard deviations, and significance probability 16 weeks after the implant placement were measured (Table 4).

Table 4. Results of bone to metal contact rate

after 16	Non-Splinting			Splinting		
week	Con1	Con2	Con3	Exp 1	Exp 2	Exp 3
BTMR	45.53±2	64.57±5.9	64.72±5	46.2±11.2	67.4±8"	68.2±6.06"

Con : control group, Exp : experimenral group, BTMR : bone to metal contact rate
* statistically significant difference relative to Exp 1, P<0.05.

A statistically significant difference was observed when the control groups and experimental groups were compared; in particular, the result of the histomorphometric evaluation showed that Experimental groups 1 and 2 showed better results than the control groups.

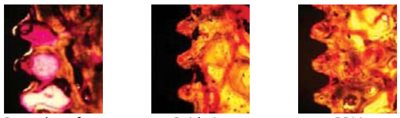
4) Histological Results

Experimental groups 1 and 2 showed good bone contact rates and good bone formation together with high bone filling rates. A slightly denser bone deposition was noted in Experimental group 2, although no statistically significant difference was found between groups 1 and 2 (Figs. 8, 9). The histological photos of the failed implants (Fig. 10) showed bone absorption around the implants. Likewise, bone absorption up to about 1/3 of the tooth and neck and infiltration of epithelial tissue were noted in implants exhibiting vertical bone absorption in the radiographs (Fig. 11).

Fig. 8. Bone to metal contact

Smooth surface Oxidation RBM

Fig. 9. Histology.(x15) Experimental Groups 1, 2, and 3. Experimental Group 1 : smooth surface. Experimental Group 2 : oxidized surface.



Smooth surface Oxidation RBM

Fig. 10. Histology.(x40) Experimental Groups 1, 2, and 3 for the middie 1/3 in Fig.

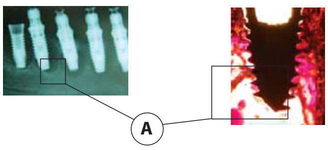


Fig. 11. Failed implant.
A : Surrounding soft tissue.

Conclusion

In this study, the success rate of implants was found to be 83.3%; the failed implants were all smooth surfaces. On the other hand, as a result of radiological measurement, excessive vertical bone absorption was noted in the three oxidation-treated implants.

1) There was a statistically significant difference between the control groups and experimental groups when they were compared.
2) The comparison of smooth surfaces and oxidation surfaces as well as smooth surfaces and RBM surfaces showed statistically significant differences, with the oxidation surfaces and RBM surfaces yielding better results than smooth surfaces.
3) No statistically significant difference was observed in the comparison of oxidation surfaces and RBM surfaces and histological and histomorphological results.

Considering the study results and references, immediately loaded implants were found to show results similar to those obtained from the existing two-stage implant surgery procedure. Moreover, surface-treated implants produce better results for immediate loading than smooth surface implants. Further research tackling various conditions is recommended; ditto for studies on the usefulness of immediate loading to long-term patients.

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Scanning electron microscopial and energy dispersive X-ray spectrometer analysis of dental implant surface after Er,Cr:YSGG laser treatment

Pil-Kwy Jo [1], Kyung-Hwan Kwon [1], Seung-Ki Min [1], Sung-Hwan Oh [1], Moon- Ki Choi [1], Jun lee [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 favorable 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

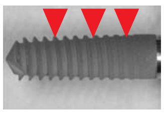
Scanning electron microscopy (SEM) coupled with an energy dispersive X-ray spectrometer analyzer (EDS) were used to study the morphology (shape and size) and elemental composition of material surfaces. Lately, these techniques have been increasingly used in areas other than material sciences. In 1980, 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).

Methods

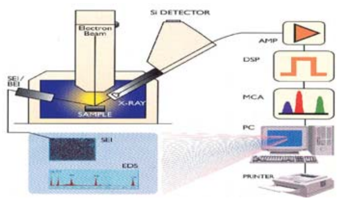
This study used 2 Puretex(NANO surface) implants(experimental group, control group), 2 Osstem(RBM surface) implants(experimental group, control group) and 2 DIO(RBM surface) implants(experimental group, control group) .

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

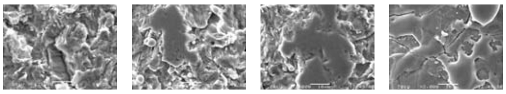


Atomic weight% change

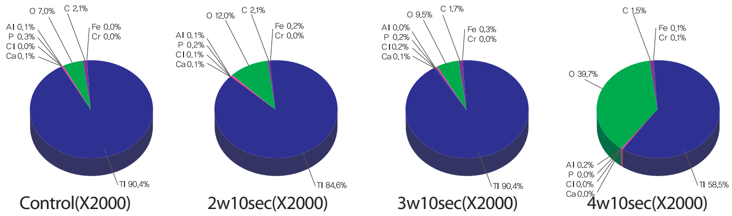
	C	O	Al	P	Cl	Ca	Ti	Cr
RBM surface(Osstem)	-	↑	-	↓	-	-	↓	-
RBM surface(DIO)	-	↑ ↑	-	-	-	↓	↓ ↓	-
NANO surface(Pure-tex)	-	↑ ↑	-	↓	-	-	↓ ↓	-

Results

RBM surface(Osstem)

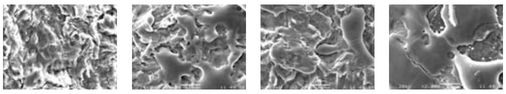


Control(X2000) 2w10sec(X2000) 3w10sec(X2000) 4w10sec(X2000)

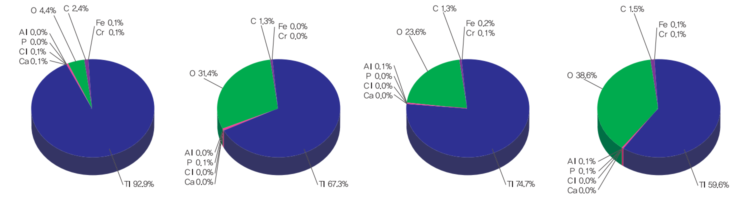


Control(X2000) 2w10sec(X2000) 3w10sec(X2000) 4w10sec(X2000)

RBM surface(DIO)

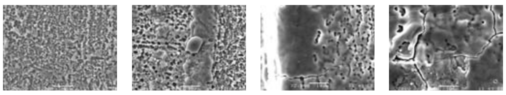


Control(X2000) 2w10sec(X2000) 3w10sec(X2000) 4w10sec(X2000)

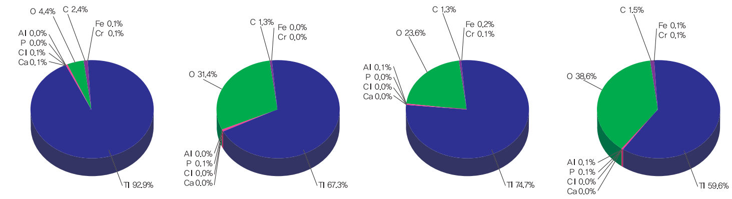


Control(X2000) 2w10sec(X2000) 3w10sec(X2000) 4w10sec(X2000)

NANO surface(Puretex)



Control(X2000) 2w10sec(X2000) 3w10sec(X2000) 4w10sec(X2000)



Control(X2000) 2w10sec(X2000) 3w10sec(X2000) 4w10sec(X2000)

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(Puretex) 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.

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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.

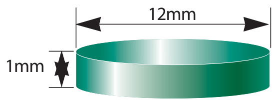
Objective

In this study, we observed the influence of micro thread structure on attachment, proliferation and differentiation of osteoblast-like cell MG-63 in vitro. The micro thread structure can provide a potential of improving cellular activities, eventually osseointegration.

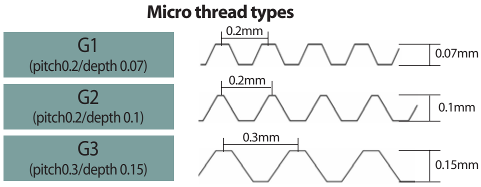
Materials & Methods

1) Design of titanium discs
- cp Ti Gr4
- Ø12x1mm disk
  (Carpenter Technology corp, USA)

Machined type (turned surface)



Micro thread types



2) Cell culture
- Osteoblast like-cell line MG63
- Medium : Minimum Essential Medium (α-MEM, Gibco), 10% fetal bovine serum
- Cell concentration : $1x10^5$ cells/disc
- Incubation condition : 37˚C, CO_2 incubator, 2hr attachment ➞ removing of unattached cells with PBS buffer (pH7.2)
- Culture condition : 1~14days, medium change period-2days

3) Characterization & 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

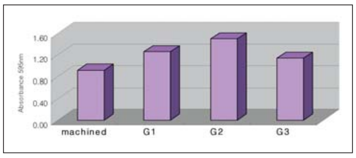


Figure 1. Cell adhesion assay. MG63 were incubated at 37℃, CO_2 incubator, unattached cells were removed with PBS buffer (pH 7.2) after 1hr.

2) SEM observation

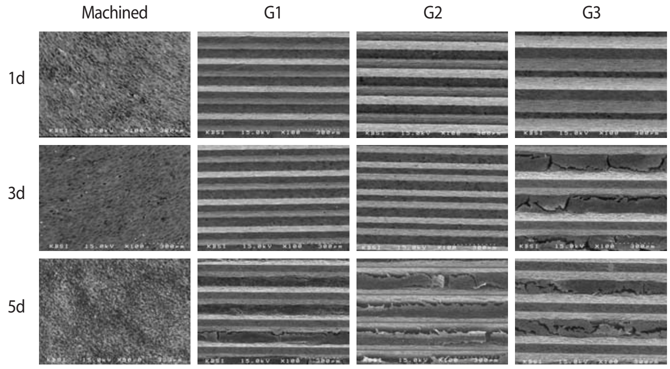


Figure 2. Scanning electron micrographs of experimental micro thread titanium surface.

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

(1) 1-day

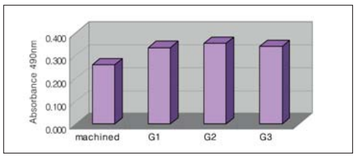


Figure 3. a. Cell proliferation assay. (a) show MG63 after a 1-day culture on machined, G1,G2 and G3 micro thread structure

(2) 3-day

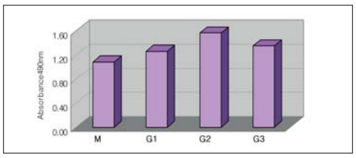


Figure 3. b. Cell proliferation assay. (b) show MG63 after 3-day culture on machined, G1,G2 and G3 micro thread structure

(3) 5-day

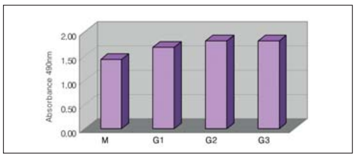


Figure 3. c. Cell proliferation assay. (c) show MG63 after 5-day culture on machined, G1,G2 and G3 micro thread structure

4) ALP assay

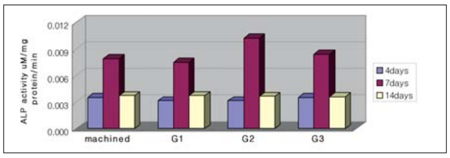


Figure 4. Cell differentiation assay. MG63 were cultured on various micro thread discs for 4, 7 and 14 days.

Conclusion

In the results, G2 (pitch0.2/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.

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The investigations of alkali treated titanium after anodic oxidation

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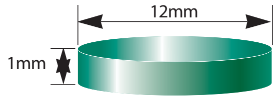
Purpose

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 MG-63 cells to the changes of the surface characteristics resulting from the alkali treatment on the anodic oxidized titanium surface.

Materials & 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 MG-63:

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

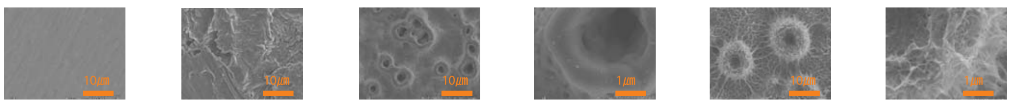


CP Ti Gr3 Ø12 x 1 mm disk
(Carpenter Technology Corp, USA)

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 MG-63 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 TiO2 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 ±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).

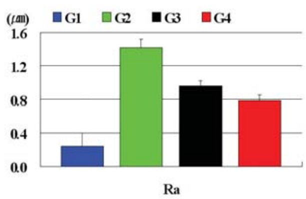
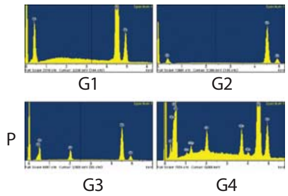


Fig. 2. The measurements(Cut-off length 0.025mm, Gaussian filtering) of surface roughness (FTSS S5, Taylor Hobson Ltd, UK) showed that Group 2 has higher average values of Ra (arithmetical mean deviation of the profile)

Table 1. Compositions(EDX-EMAX, Horiba, Japan, at%) on the surfaces: G1. polishing, G2. RBM, G3. anodic oxidation, G4. alkali treatment after anodic oxidations

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



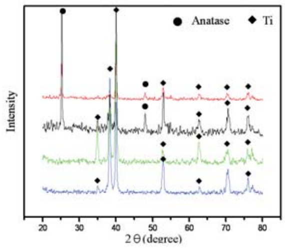


Fig. 3. Studies of the crystal phases(D/max 2100II, RIGAKU Co., Japan) showed that the only phase Ti was detected in both Group 1 and Group 2, while Ti and TiO_2 in a form of anatase were detected in Group 3.

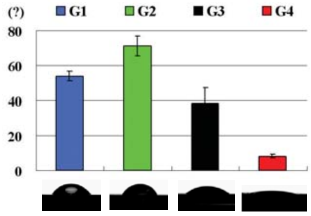


Fig. 4. The contact angle(OCA15+, Datahysics Int., Germany) was measured least in Group 4 (8.1 ± 1.3°).
G4 > G3 > G1 > G2 (n=6)

Reactions of MG-63 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.

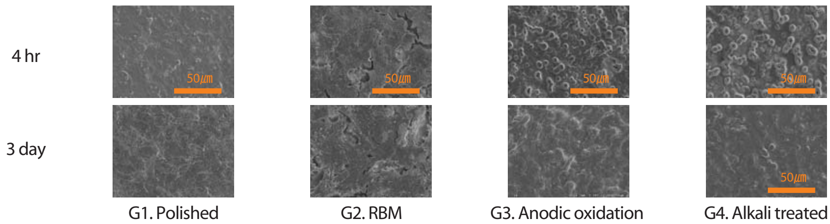
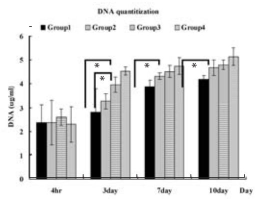
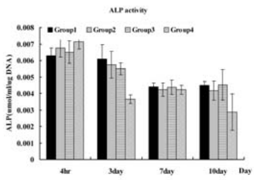


Fig. 5. Reactions of MG-63 cells to each group were also evaluated for 4 hrs, 3, 7 and up to 10 days.





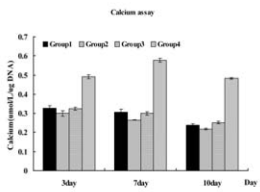


Fig. 6. Reactions of MG-63 cells to each group were also evaluated for 4 hrs, 3, 7 and up to 10 days.

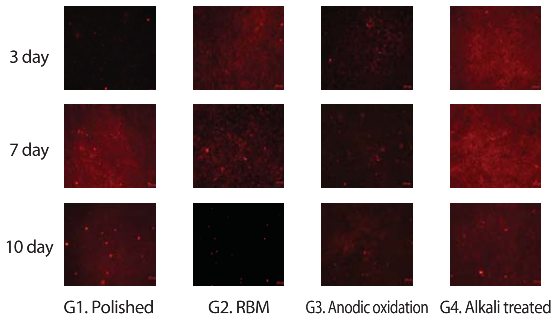


Fig. 7. The osteocalcin staining results

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.

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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.

Methods

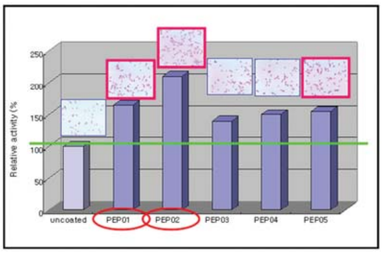
1) Cell culture
- Osteoblast like-cell line MG63
- Medium : Minimum Essential Medium (α-MEM, Gibco) contained 10% FBS
- Cell loading density : 1×10^5 cells/disc
- Incubation condition : 37℃, CO_2 incubator, 2hr attachment in serum free media
- Culture condition : 1~14days, α-MEM contained 10% FBS media changed period-2days

2) Preparation of surface-modified titanium disks
- The synthetic peptides were attached to the surface by the immobilization method (Osstem confidential).

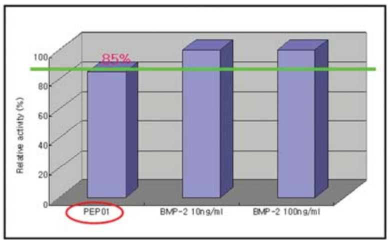
3) Characterization & Assays
- SEM (Scanning Electron Microscopy, JEOL Japan)
- Cell adhesion assay (0.04% cresyl violet staining, Sigma)
- MTS assay (CellTiter 96 Aqueous Non-radioactive proliferation assay. Promega)
- Alkaline phosphatase (ALP) assay (Sigma)

Results

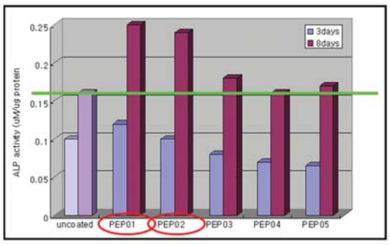
Cell adhesion assay on culture plate



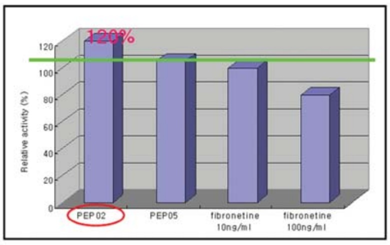
Cell adhesion assay on culture plate



ALP assay (3, 8days) on culture plate

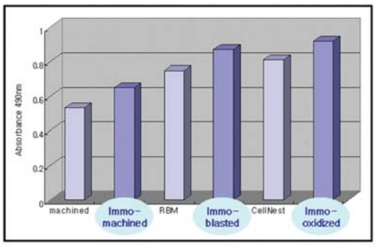


Cell adhesion assay on culture plate

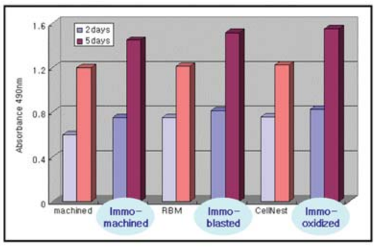


PEP01, 02 showd the effective differences among various peptides in cell adhesion assay, ALP assay.

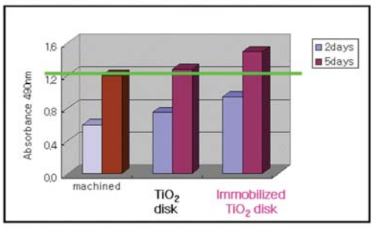
Cell adhesion assay on immobilized disks



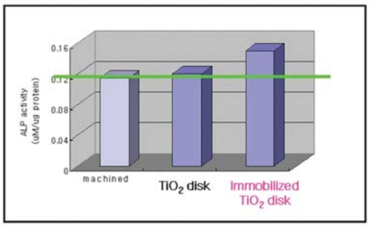
MTS assay on immobilized disks



MTS assay - TiO_2 disk + PEP01

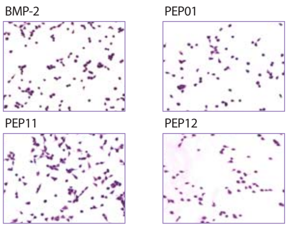


ALP assay (7days) - TiO_2 disk + PEP01

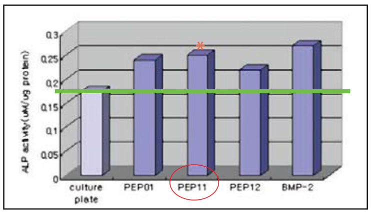


TiO_2 disk (anidic oxidation) was chosen as the basal surface to immobilize synthetic peptides.

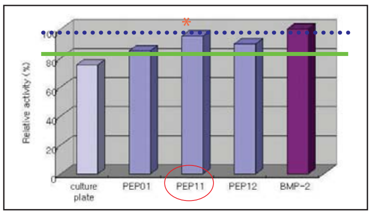
Cell adhesion assay on culture plate



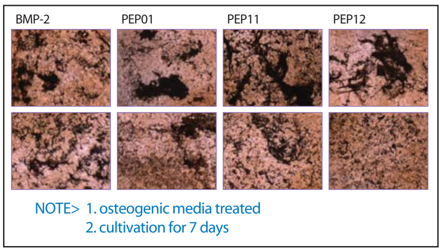
ALP assay (7days) on culture plate



Cell adhesion assay on culture plate



Von kossa stain on culture plate



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.

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Heat transfer to the implant-bone interface during setting of autopolymerizing acrylic resin applied to impression copings for USII 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 dental implant, Pusan, South Korea), with diameter of 4mm, length of 13mm of the USII(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°C 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
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.

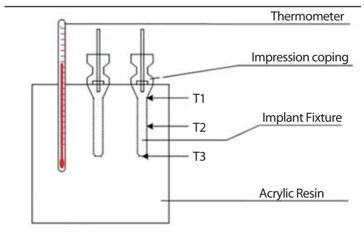

Fig. 1. llustration of experimental setup. T1= cervical thermocouple wire; T2=middle thermocouple wire; T3= apical thermocouple wire; R= rubber dam

Results

The two experimental groups showed lots of heat transfer. The cervical area had the most temperature increase. There was a mean of 43.1°C in the first experimental group in the cervical area. In the second experimental group, there was an increase up to 40.4°C. 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.

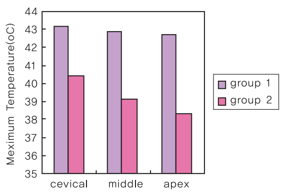

Fig. 2. Maximum mean temperature value at each sites, In the first experimental group, the two impression copings were tied with the dental floss and autopolymerizing acrylic resin was applied above them connecting the impression coping at once. In the second experimental group, the acrylic resin was 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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Implant Science- Biomechanics

Correlation between insertion torque and primary stability of dental implant by block bone test

Byung-Kook Kim[1], Tae-Gwan Eom [1], Kyoo-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 & Methods

Materials

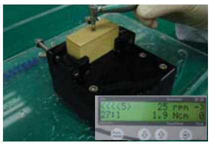
- Implant : SS II Fixture ∅4.1,L11.5
  (Osstem Implant Co., Korea)
- Block Bone : Polyurethane foam
  (Sawbones, USA)
- Stability Tester : Osstell Mentor
  (Osstell, Sweden)
- Surgical Engine : IntraSurg300
  (KaVo, Germany)

SS II Fixture

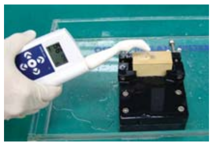
Block Bone

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 : 0.5^{mm}, 1.0^{mm}, 1.5^{mm}, 2.0^{mm}
   - 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 : 1.5^{mm}
   - 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 : 1.5^{mm}
   - Block bone density : cortical bone(#50),cancellous bone (#20)
   - Final drill diameter : ∅3.0, ∅3.3, ∅3.6, ∅3.8

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		32.4	2.93		
#20	5	16.2	2.59	0.00	52.5	0.74	0.00	C.Q=0.82
#30	5	41	3.94		60.0	0.7		p=0.00
#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		52.1	0.85		
Ø3.0	5	35.4	1.95	0.00	53.9	0.64	0.00	C.Q=0.07
Ø3.3	5	26.0	2.0		54.4	1.67		p=0.77
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		54.4	1.34		
1.0mm	5	12.0	1.58	0.00	55.7	1.68	0.00	C.Q=0.84
1.5mm	5	24.8	2.86		57.9	0.51		p=0.00
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		59.8	1.59		C.Q=0.45
#20	5	24.8	2.86	0.00	57.9	0.51	0.015	
#30	5	51.0	5.34		60.8	1.56		p=0.09
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.

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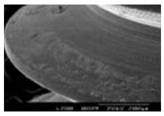
2) Lee Dental Clinic, Seoul, South Korea

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

Jin-Uk Choi [1], Chang-Mo Jeong [1], Yong-Duk Kim [2], Ji-Hoon Yoon [3], Tae-Gwan Eom [3]

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.

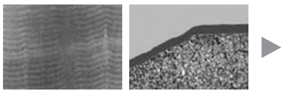


Robb TT, Porter SS. J Dent Res 1998;77(special issue):837 [abstract 1641, 1642]
Vigolo P. Int J Oral Maxillofac Implants 2004;19:260-265
Martin WC, Woody RD, Miller BH, Miller AW. J Prosthet Dent 2001;86:24-32

Purpose

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

Armorphous metal carbon coation
Multilamellar structure



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

Materials

Features of Experimental Implant Abutment Systems (Osstem Imolant, Korea)

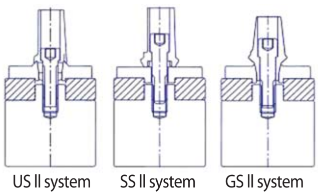
Implant system	Implant ① mm	Abutment/implant interface	Abutment	Abutment screw
US II	4.1	External butt joint (external hexagon)	Cemented	Ta WC/CTa
SS II	4.8	8° Morse taper (internal octagon)	ComOcta	Ta WC/CTa
GS II	4.5	11° Morse taper (internal hexagon)	Transfer	Ta WC/CTa

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.



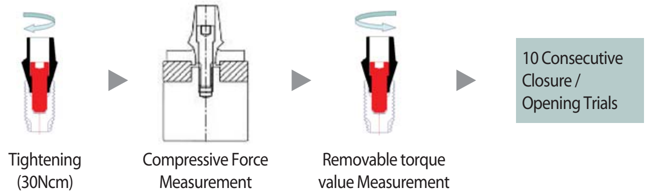
Schematic Diagram of Measurement Apparatus

Force sensor connection

Digital indicator for measuring compressive force

Consecutive Trial Test

To evaluate the stability and the alteration of coating screw, GS system assemblis (n=5) were examined by comparison of the compressive force and the surface change were observed.

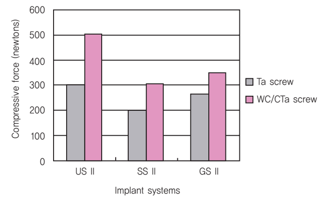


Preload Test Results

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

Meen Values ± SDs of Compressive Force (N)

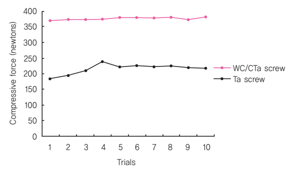
Implant system	Ta screw	WC/CTa screw	Percentage of increased compressive force
US II	303.8±12.7^{c}	503.8±13.9^{C}	65.8
SS II	199.6± 7.8^{a}	306.4± 8.6^{C}	53.5
GS II	266.6±11.0^{b}	350.0±15.0^{d}	31.3

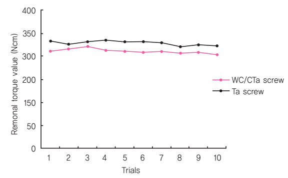


Consecutive Trial Test Results

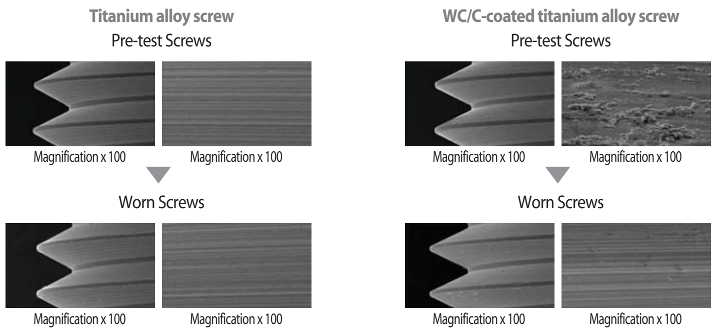
Coated screw showed insignificant variations in the compressive forces during 10 consecutive trials (P<.05). Removable torque values were greater with non-coated screw than that with coated screw (P<.05).

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



Conclusion

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

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3) Osstem Implant Co., Ltd. Busan, South Korea

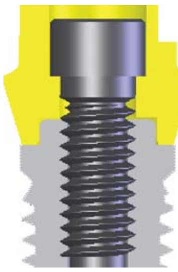
The study of dynamic behavior about implant system with tungsten-carbide coating

Ji-Hoon Yoon [1],Sung-Geun Lee [1], Chang-Mo Jeong [2], Tae-Gwan Eom [1]

Purpose

This study was conducted to evaluate the influence of tungsten carbide/carbon coating, which has the low friction coefficient and good wear resistance, on dynamic behavior of implant system after cyclic loading.

Theoretical Approach

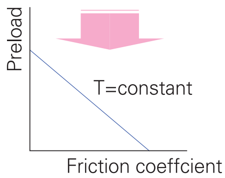


$$\sum E_{in} = \sum E_{out}$$

$$T = \frac{F}{2}\left(\frac{P}{\pi} + K_1 \mu D\right)$$

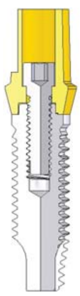
T : Tightening Torque
F : Preload
P : Pitch
K1 : Constant
μ : Friction coefficient
D : Screw diameter

If tightening torque is fixed.
What the relationship between
Preload & friction coefficient

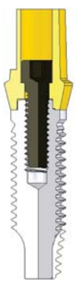


Materials

Implant assemblies in Osstem Implant (Korea) are USII system with external butt joint type.



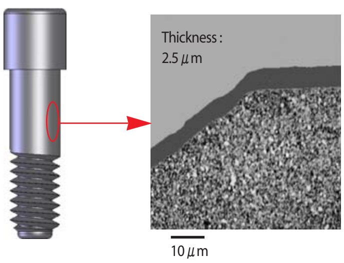
Group I



Group II

	Fixture	Abutment	Abutment Screw
Group I	US II -D4.0*L11.5 (BFR411)	Cemented Abutment (CAR525)	Ti Screw (ASR200)
Group II	US II -D4.0*L11.5 (BFR411)	Cemented Abutment (CAR525)	WCC Screw (ASR200W)

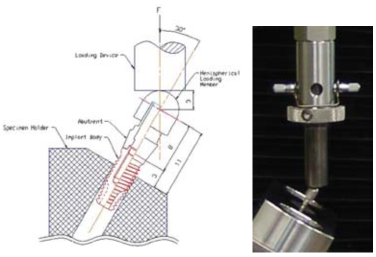
• Characteristics of Abutment screw with WC/C Coating



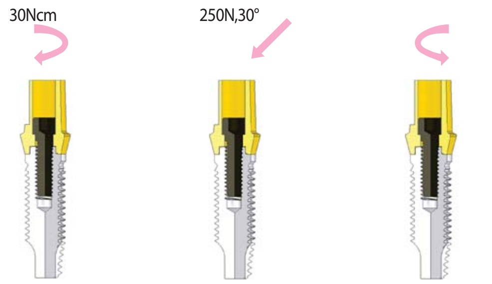
Property	WC Coating
Hardness(HV)	1500
Adhesion	HF1
Friction coefficient	0.1-0.2
Coating Temperature	200~250℃
Internal Stress	Low

Fatigue Test

To confirm the influence of dynamic behavior of implant system according to the effect of the WC/C coating screw, each assembly (n=5) was loaded by fatigue tester(250N, 30°, 2Hz). Each screw was tightened to 30Ncm. Removal Torque (RT) was recorded before and after loading(10^5 , $5x10^5$, 10^6 cycles) and each test compared titanium alloy screw with WC/C coating screw.



Test Condition(ISO14801)



Tightening | Loading | Measurement of Removal torque

Fatigue Test Results

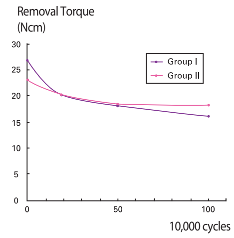
As a cyclic loading proceed, Removal Torque was reduced at all types (p<.05).

Means of Removal Torque (Ncm)

		100,000 cycles	500,000 cycles	1,000,000 cycles
Group I	Before loading	26.8±0.495	26.18±0.327	25.78±0.517
	After loading	21.12±0.680	18.08±0.438	16.22±0.856
Group II	Before loading	23.78±0.390	22.10±0.300	22.86±0.472
	After loading	21.22±0.390	18.60±0.529	18.08±0.390

Condition : 0 / 100,000 cycles
Removal Torque value of Type II (WC/C screw) is smaller than Type I (Ti screw)

Condition : 500,000 / 1,000,000 cycles
Removal Torque value of Type I (Ti screw) is smaller than Type II (WC/C screw)

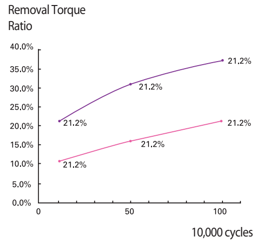


Variation of removal torque value

Application of coating on implant abutment screw resulted in significant increase of Removal Torque ratio in all cyclic conditions (p<.05). After loaded, the surface layer of coated screw was maintained relatively well.

$$\text{Removal torque ratio} = \frac{(RT_{beforeloading} - RT_{beforeloading})}{RT_{beforeloading}}$$

cycles	Type I	Type II
100,000	21.2%	10.8%
500,000	30.9%	15.8%
1,000,000	37.1%	20.9%



Conclusion

WC/C Coating screw showed smaller change rate of removal torque ratio value than Ti screw after loading. WC/C coating screw seems to be very useful for reducing the coefficient of friction and contribute to the prevention of screw loosening.

1) Osstem Implant Co., Ltd. Busan, South Korea
2) The department of Prosthodontics, Pusan National University Hospital, South Korea

A comparative analysis of the accuracy of impression technique

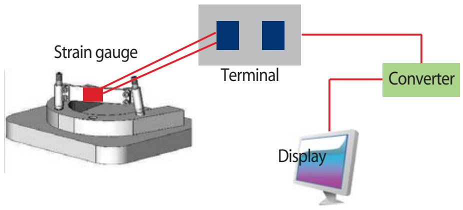
Ji-Hoon Yoon [1)], Kwang-Hoon Kim [1)], Chang-Mo Jeong [2)], Tae-Gwan Eom [1)], Sang-Hoon Eom [3)], Gye-Rok Jeon [3)]

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 (GSCPI480-1)	non splitting
Group II	0 degree	Transfer type(GSCTI480)	non splitting
Group III	0 degree	Pick-up type (GSCPI480-2)	non splitting
Group IV	0 degree	Pick-up type (GSCPI480-1)	splitting

	Fixture Angulation	Impression Coping	Method
Group V	22 degree	Pick-up type (GSCPI480-1)	non splitting
Group VI	22 degree	Transfer type(GSCTI480)	non splitting
Group VII	22 degree	Pick-up type (GSCPI480-2)	non splitting
Group VIII	22 degree	Pick-up type (GSCPI480-1)	splitting


GSCPI480-1


GSCPI480-1


GSCPI480-2


GSCTI480


Group I


Group II


Group III

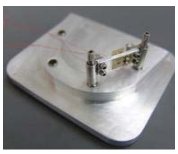

Group IV

Method

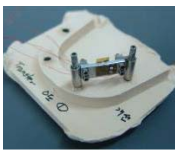
Master cast was fabricated common method. For comparison of difference between base model and master cast, we measured base model and master cast. Four groups of 5 specimens each were made with different impression techniques. The above process was repeated by another tester.

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    254850        (-------*-------)
Group  VIII   37.3183                (------*------)
                       --+----------+----------+----------+------
                       16.0   24.0      32.0    40.0
```

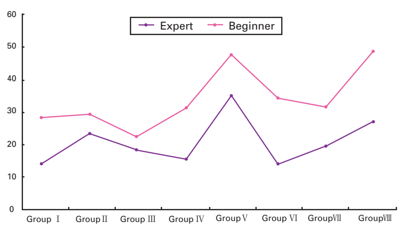
Individual 95% CI about Tester level

```
              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

	Method	Method
Group I	15.013	27.777
Group II	23.55	28.713
Group III	18.153	21.893
Group IV	15.173	30.593
Group V	34.577	47.117
Group VI	13.437	33.653
Group VII	19.643	31.327
Group VIII	26.557	48.08



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<.05).

1) Osstem Implant Co., Ltd. Busan, South Korea
2) The department of Prosthodontics, Pusan national University Hospital, South Korea
3) Center for medical informatics, Pusan National University, Busan, South Korea

Three-dimensional finite analysis of functional stresses in varied width of crestal bone, implant diameter and buccal off center position

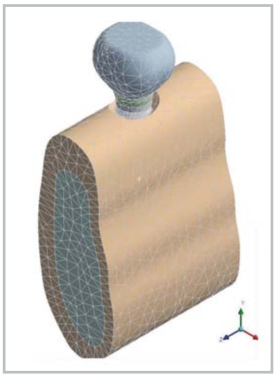
Ki-Deog Park [1], Sang-Un Han [2], Hong-So Yang [3], Ju-Suk Kim [4]

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 & Method

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.



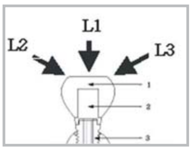
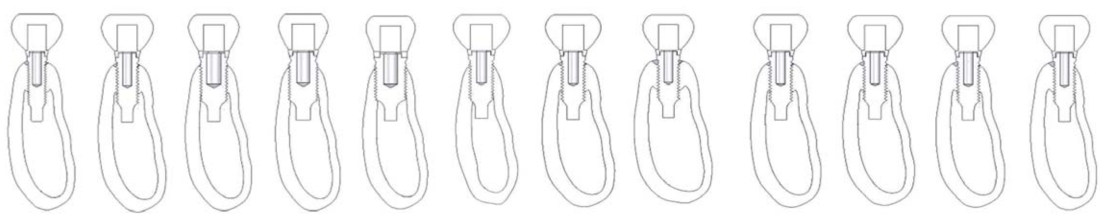


Table 1. Material properties of the each components of model

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

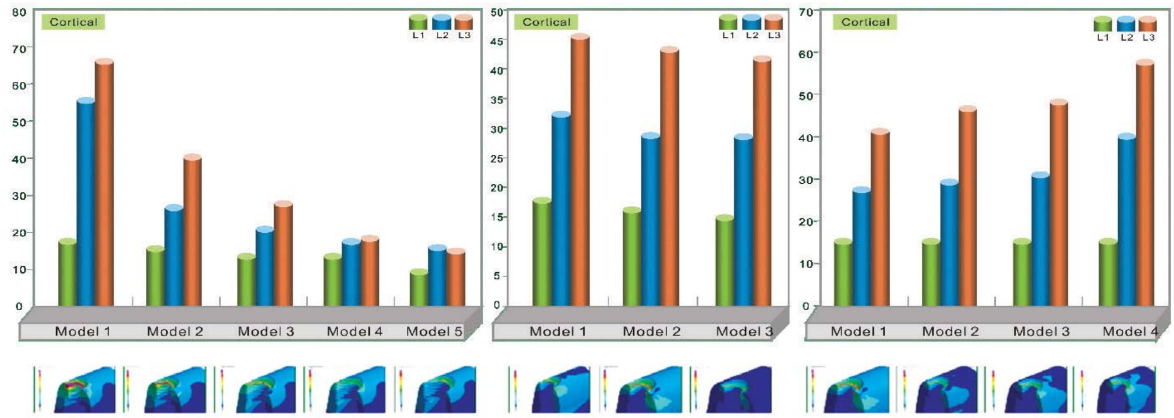
R G. Craig and J.W. Farah, J. Prosthet. Dent, 39:274, 1978
Lewinstein I, Banks-Sills L, J Prosthet. Dent, 10:355, 1995
Yalcin Ciftci, Int, J, of Oral & Maxillofacial Implants, 15: 571, 2000

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



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.

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The effect of implant abutment length, surface & 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 Co., 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)

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

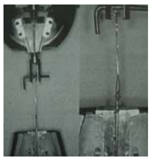

Fig. 2 Measurement of tensile strength Instron Universal Test Machine, which was used to measure the tensile strength

Results

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.

Conclusion

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.

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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)] and Tae-Kwan 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°C 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

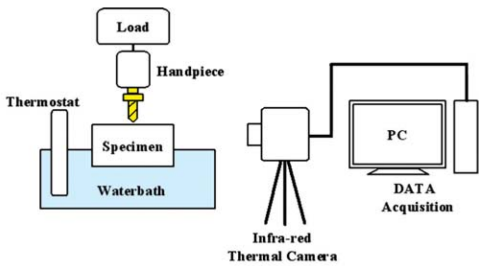

Fig. 1 Schematic of Test Equipment

Fig. 3 Osstem Implant Drill Systems
(2.0, 2.7, 3.0, 3.3, 3.6, 3.8, 4.1, 4.3 & Ø4.6mm)

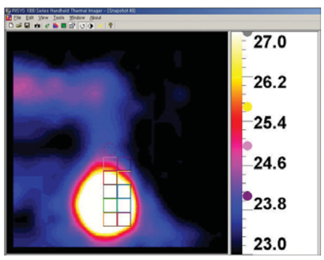

Fig. 2 Display of Thermal Distribution

Test Results

Temperatures vs. Bone Density

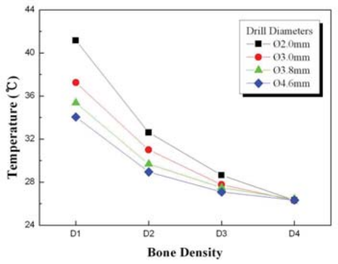

Fig. 4 Temperatures according to Bone Density

When the bone density is increased, an increase in temperature occurs.

Temperatures vs. RPM

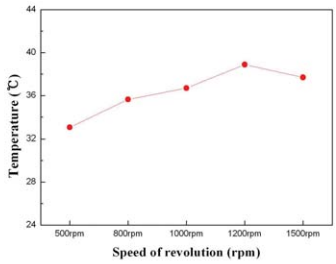

Fig. 5 Temperatures according to Speed of Revolutions

When the speed of the drill is increased, an increase in temperature occurs.

Temperatures vs. Drill Length

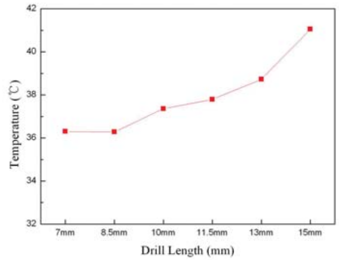

Fig. 6 Temperatures according to Drill Lengths

When the drill length is increased, greater heat is generated.

Temperatures vs. Irrigation & Non Irrigation

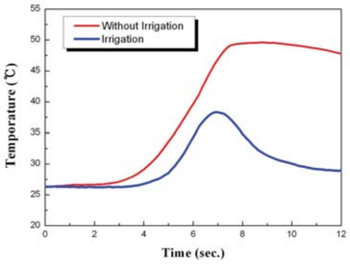

Fig. 7 Real time comparative Result of Temperatures both with and without rrigations (∅2.7 drill after using ∅2.0 drill)

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

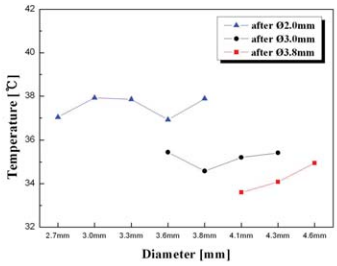

Fig. 8 Temperature during ∅4.3mm Drilling according to previous Drill Diameters.

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

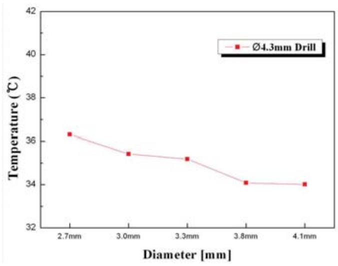

Fig. 9 Temperature during ∅4.3mm Drilling according to previous Drill Diameters.

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)

Conclusion

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.

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