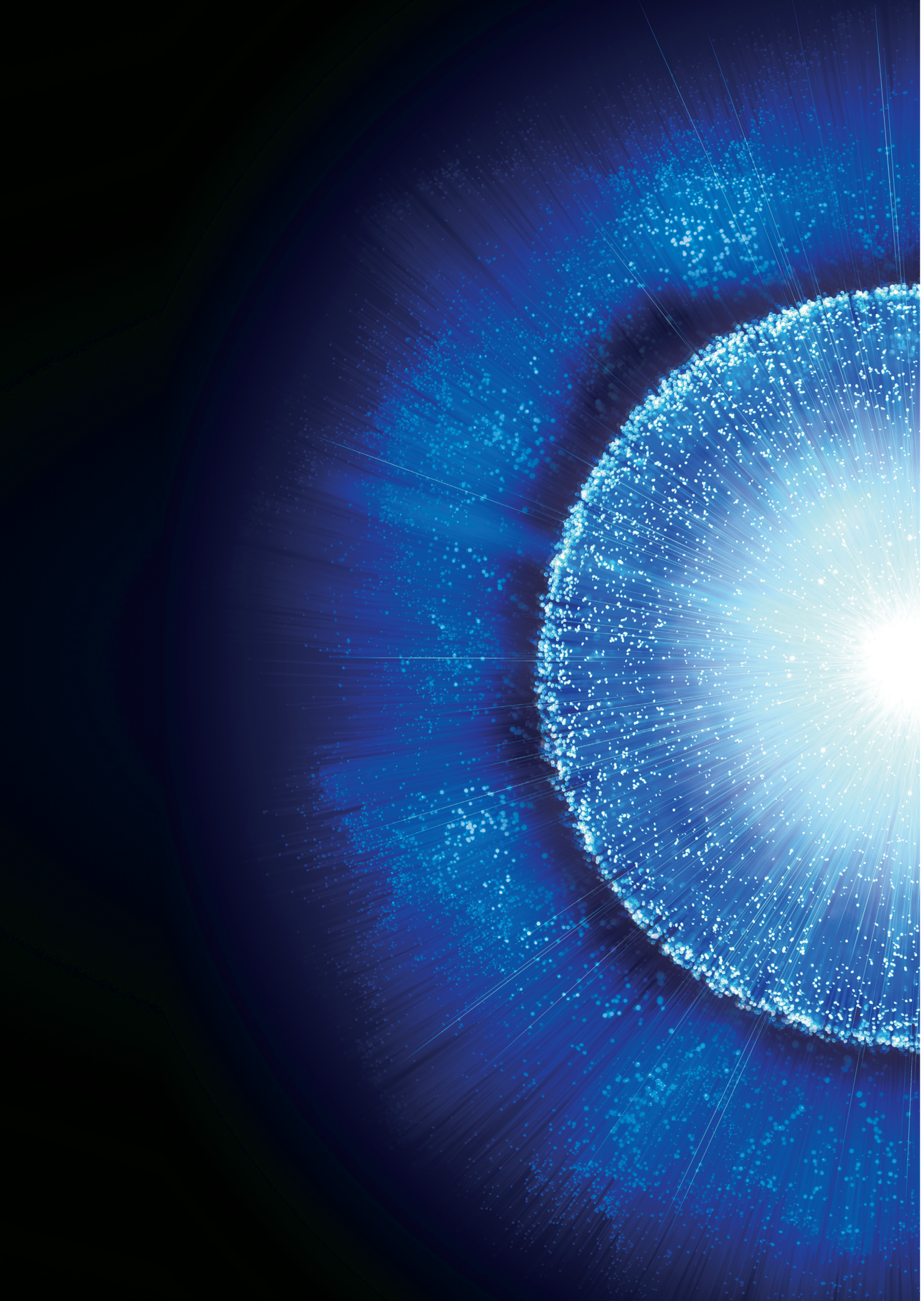
Study & Evidence on **MegaGen** Implants

Dental Implant / Surface Treatment / Bone Materials



Over the past decade, Megagen has gone from being a follower to a leader in the implant market. Our company, founded in 2002 by a group of dental surgeons seeking to improve their option in implant dentistry and to offer better solutions for their patients, has gone from making implants with simple improvements to a basic design to making innovative products that have changed the way implant dentistry is approached worldwide. With the narrow body Intermezzo and the short & extra wide Rescue, Megagen led the way to new surgical approaches. Never fully satisfied however, Megagen continued a vigorous programme of Research & development with the resulting AnyRidge, AnyOne implants as well as the phenomenal new Xpeed surface treatment.

To ensure that the concepts we were searching to achieve were practical, clinically better and safe, we have been working with esteemed collaborators around the world to test our solutions scientifically and clinically. Megagen has always focused on clinical excellence, but with a strong scientific basis. Following earlier publications of our clinical studies, this book gathers together some of the recently published articles regarding our most innovative products and technology.

Our clinical and scientific work continues and we are currently involved in prospective studies, multicenter controlled randomized studies as well as receiving constant updates to clinical studies and retrospectives. We hope you will find the evidence we present here interesting & we look forward to presenting continuing studies and updated information in our future publications.

Please contact us for any additional information or queries – both with regards to science or cases presented here & to details of our Megagen systems. We would also love to hear from you if you wish to propose further studies.

We look forward to hearing from you!

MegaGen Team

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01.
Rehabilitation with AnyRidge implants in poor density bone - a case report.

- Journal: Quintessenza Internazionale Speciale 2012

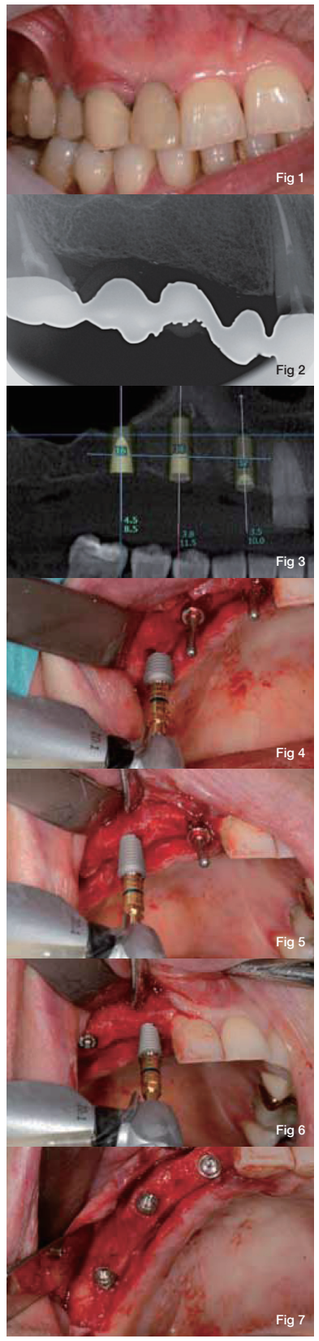
Abstract:

Thanks to new systems of diagnosis like the cone beam CT it is possible to evaluate more accurately the quantity & quality of bone before the implant is inserted. In the case of poor quality bone, opinion nowadays suggests the use of an implant with a thread shape that favours a better engagement with the cancellous bone. This case report presents an implant/prosthetic solution in the first quadrant of the upper maxilla in a 62 year old patient using AnyRidge.

The use of implants with a reduced core diameter with respect to the dimensions of the thread, opens a new way to look at the planning of implant / prosthetic treatments.

Key words

poor bone density, primary stability, dental implants



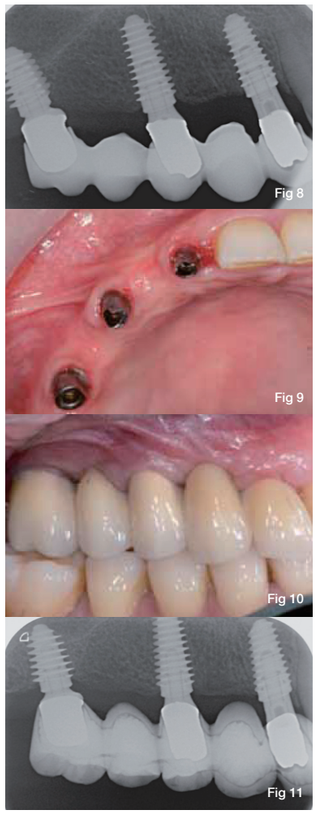


Fig1. Initial clinical situation: upper right area
Fig2. Initial intra-oral radiograph
Fig3. Image of the planning with CBCT
Fig4. Insertion AnyRidge implant in 16: 5.0(D) X 8.5(L)mm
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Fig11. Intra-oral radiograph at 6 month follow up

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02.
Microscopic examination of two MegaGen implant systems with conical connections.

- Journal: Quintessenza Internazionale Speciale 2011

Abstract:

Implantology research in recent years has been directed notably at the development in two areas: implant surfaces and the interface between the implant and the abutment. Improvements in the surface of implants have led to rapid and efficient osseointegration, permitting among other advantages, the clinical success of the immediate loading concept.

The perfecting of the implant-prosthetic connection, both structurally and functionally, on the other hand has led to an improvement over time of the stability of the soft and hard peri-implant tissues guaranteeing the long term success of the treatment.

The fixture-abutment connection is considered an area of "strategic" importance for the long term success of the implant/prosthetic rehabilitation because it is here that biological and mechanical complications can be found. Biological complications manifest in the build up of micro-infiltrations, gingivitis, and crestal bone loss that can all be traced back to the poor fit between the implant and the abutment. Mechanical complications such as increasing incidence of rotation or breakage of the abutment, screw loosening and the reduction of preloading can also be traced back to the poor connection between the implant components.

The scope of this study is to analyse microscopically the difference at the implant/abutment connection between two Megagen Implants with different technical & geometrical specifications.

Key words

Platform switching, tapered connection, microgap

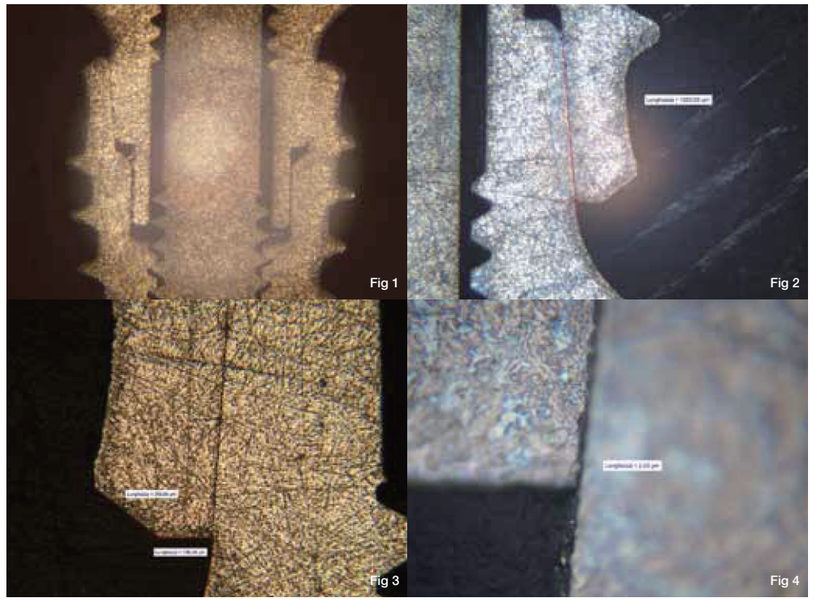

Fig 1. MegaGen AnyRidge implant
Fig 2. AnyRidge length= 1223,02 µm
Fig 3. AnyRidge platform switching
Fig 4. Anyridge n.1 Microgap 2,04 µm

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03.
New guidelines in implant-prosthodontics: The tapered connection and the biological tissue preservation (BTP).

- Journal: Quintessenza Internazionale Speciale 2011

Abstract:

Modern implantology is changing direction turning scientific attention towards the development of new biologically modified surfaces able to interact with the surrounding tissue & to the development of new fixture/abutment connections with high level physico-mechanical characteristics, that can offer a level of assurance of the mid to long term success of the treatment not only surgically but also from a prosthetic point of view.

This article – with a rapid but attentive review of the literature on the subject – would like to propose a guideline and the parameters to be taken into consideration in order to preserve the biological tissues and to maintain stability that is long lasting.

Key words

Implant surface, conical connection, level of bone, soft tissue, Platform switching

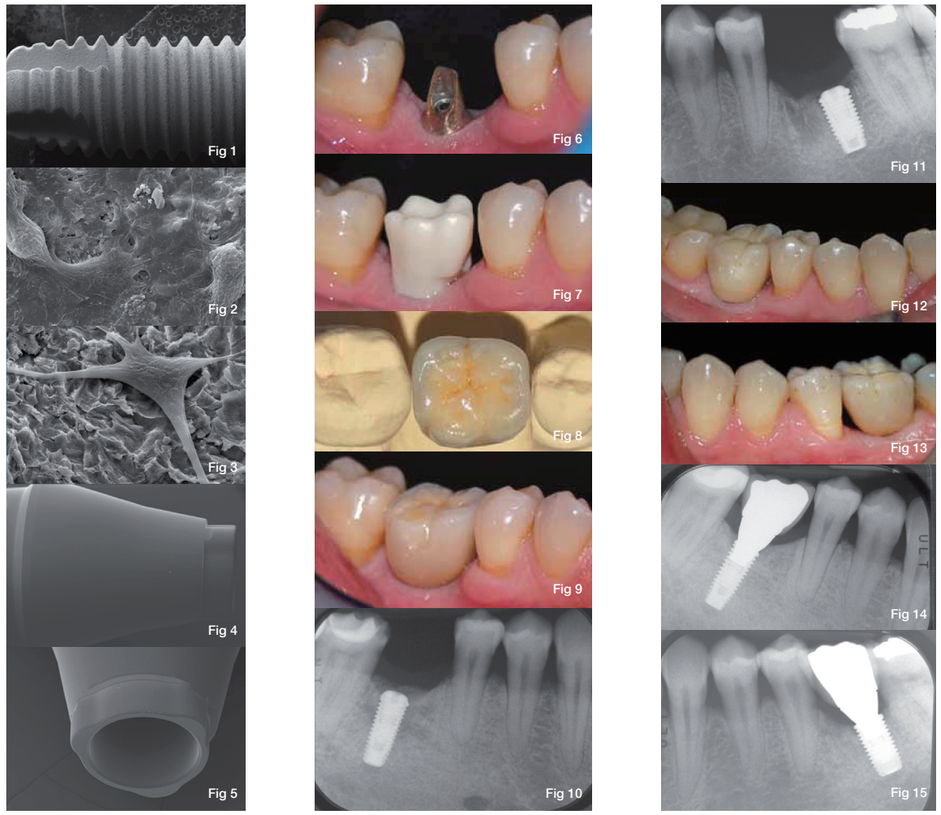

Fig 1. EZ-Plus Internal, RBM surface, macrostructure of the lower half (SEM 35x). Note the quality of the surface with no residual impurities from the manufacturing process
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04.
Posterior atrophic jaws rehabilitated with prostheses supported by 5 x 5 mm implants with a novel nanostructured calcium-incorporated titanium surface or by longer implants in augmented bone. Preliminary results from a randomised controlled trial.

- Journal: Eur J Oral Implantol 2012;5(2):149-161

Abstract:

PURPOSE: To evaluate whether 5x5 mm dental implants with a novel nanostructured calcium-incorporated titanium surface could be an alternative to at least 10x5 mm long implants placed in bone augmented with bone substitutes in posterior atrophic jaws.

MATERIALS AND METHODS: Forty patients with atrophic posterior (premolar and molar areas) mandibles having 5-7 mm bone height above the mandibular canal and 40 patients with atrophic maxillas having 4 to 6 mm below the maxillary sinus, were randomised according to a parallel group design to receive one to three 5x5 mm implants or one to three at least 10x5 mm long implants in augmented bone at 2 centres. Mandibles were vertically augmented with interpositional bovine bone blocks and resorbable barriers and implants were placed after 4 months. Maxillary sinuses were augmented with particulated porcine bone via a lateral window covered with resorbable barriers and implants were placed simultaneously. All implants were submerged and loaded after 4 months with provisional prostheses. Four months later, definitive screw-retained of provisionally cement metal-ceramic or zirconia prostheses were delivered. Outcome measures were: prosthesis and implant failures as well as any complication.

RESULTS: Patients were followed to 4 months post-loading with the exception of one patient subjected mandibular augmentation who had a multiple complications at and after grafting and subsequent graft failure who did not want to go ahead with the treatment. This case was considered a complete failure. There were no statistically significant differences in prostheses and implant failures. In mandibles, apart the complete graft failure, one 10x5 mm implant, failed at placement of the provisional prosthesis. In maxillas one 5x5 mm implant failed with its provisional crown 3 months after loading. All complications occurred before loading. Significantly more intra- and post-operative complications occurred at both mandibular and maxillary grafted sites: 16 augmented patients were affected by complications versus 8 patients treated with short implants in the mandible and 5 sinus lifted patients versus none treated with maxillary short implants.

CONCLUSIONS: Short-term data (4 months after loading) indicate that 5x5 mm implants with achieved similar results than longer implants placed in augmented bone. Short implants might be a preferable choice to bone augmentation especially in posterior mandibles since the treatment is faster, cheaper and associated with less morbidity, however 5-10 years post-loading data are necessary before making reliable recommendations.

Key words

inlay graft, bone substitutes, short dental implants, sinus lift, vertical augmentation

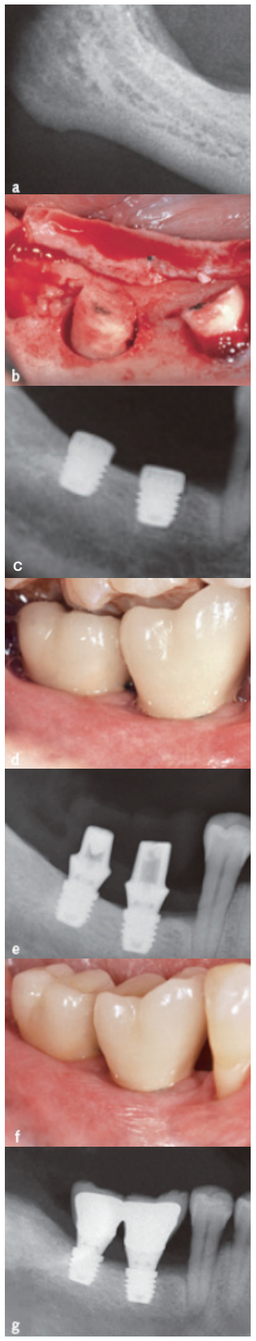

Fig 1. Treatment sequence of a patient with posterior mandibular edentulism randomly allocated to 5 mm-long implants: a) preoperative orthopantomograph; b) a trephine with a stop was used to prepare both implant sites; c) postoperative baseline periapical radiographs showing the two implants in place; d) the provisional acrylic crown was delivered 4 months after implant placement; e) radiograph taken at delivery of the provisional fixed dental prosthesis; f) 4 months after initial loading the definitive fixed dental prosthesis was delivered; g) periapical radiograph taken just after delivery of the definitive fixed dental prosthesis.

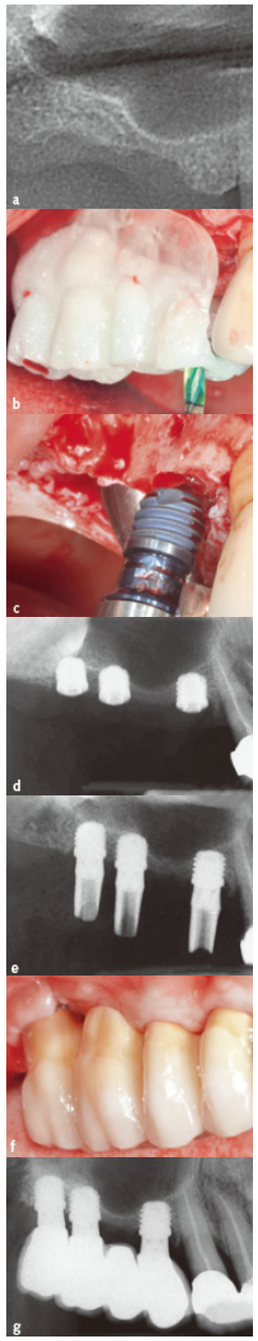

Fig 2. Treatment sequence of a patient with posterior maxillary edentulism randomly allocated to 5 mm short implants: a) preoperative periapical radiograph; b) a surgical stent was used to guide drilling; c) one of the 3 short implants to be placed; d) postoperative baseline periapical radiograph showing the three short implants in place; e) periapical radiograph taken at delivery of the provisional fixed dental prosthesis 4 months after implant placement; f) 4 months after initial loading the definitive fixed dental prosthesis was delivered; g) periapical radiograph taken just after delivery of the definitive fixed dental prosthesis.

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05.
Treatment of the atrophic edentulous maxilla: short implants versus bone augmentation for placing longer implants. Five-month post-loading results of a pilot randomised controlled trial.

- Journal: Eur J Oral Implantol. 2011 Autumn;4(3):191-202.

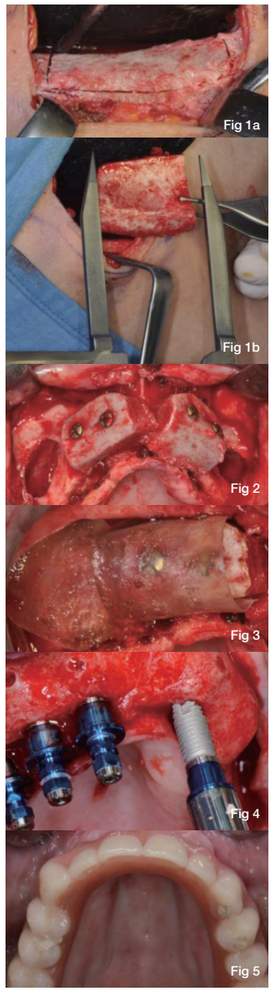
Abstract:

PURPOSE: To evaluate whether short (5 to 8.5 mm) dental implants could be a suitable alternative to longer (>11.5 mm) implants placed in atrophic maxillae augmented with autogenous bone for supporting dental prostheses.

MATERIALS AND METHODS: Twenty-eight patients with fully edentulous atrophic maxillae having 5 to 9 mm of residual crestal bone height at least 5 mm thick, as measured on computerised tomography scans, were randomised into two groups either to receive 4 to 8 short (5 to 8.5 mm) implants (15 patients) or autogenous bone from the iliac crest to allow the placement of at least 11.5 mmlong implants (13 patients). Bone blocks and the windows at maxillary sinuses were covered with rigid resorbable barriers. Grafts were left to heal for 4 months before placing implants, which were submerged. After 4 months, provisional reinforced acrylic prostheses or bar-retained overdentures were delivered. Provisional prostheses were replaced, after 4 months, by definitive screw-retained metal-resin cross-arch fixed dental prostheses. Outcome measures were: prosthesis and implant failures, any complications (including prolonged postoperative pain) and patient satisfaction. All patients were followed for 5 months after loading.

RESULTS: All patients could be rehabilitated with implant-supported prostheses and none dropped out. One bilateral sinus lift procedure failed due to infection, though short implants could be placed. One implant failed in the augmented group versus 2 short implants in 2 patients. All failures occurred before loading. Significantly more complications occurred in augmented patients: 8 complications occurred in 5 augmented patients (all complained of pain 1 month after bone harvesting from the iliac crest). No complications occurred in the short implant group. All patients were fully satisfied with the treatment and would do it again.

CONCLUSIONS: This pilot study suggests that short implants may be a suitable, cheaper and faster alternative to longer implants placed in bone augmented with autogenous bone for rehabilitating edentulous atrophic maxillae. However, these preliminary results need to be confirmed by larger trials with follow-ups of at least 5 years.



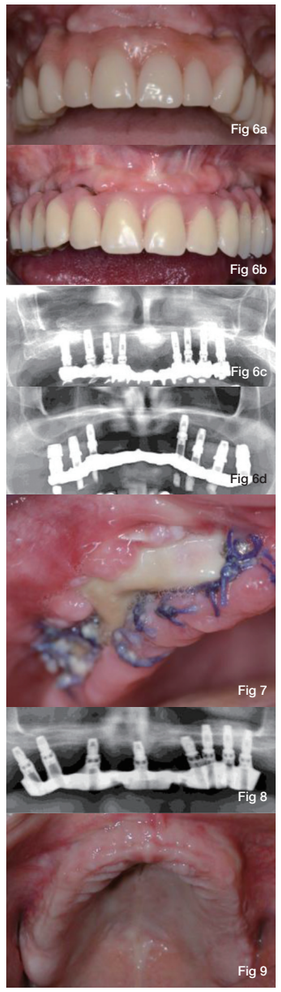


Fig 1a-b: a) A monocortical cancellous rectangular block of bone is prepared and b) harvested from the iliac crest and divided in smaller blocks as required.
Fig 2: Both sinuses were opened using a lateral widow technique to be filled with particulated autogenous bone from the iliac crest and, when needed, onlay cortical blocks were fixated with 2 titanium screws.
Fig. 3: The maxillary windows and the bone blocks were covered rigid synthetic resorbable barriers.
Fig. 4: After 4 months of healing, flaps were elevated, the fixating screws were removed from the blocks, and 11.5 mm long or longer implants were placed in the augmented group.
Fig. 5: Occlusal view of one of the provisional fixed bridge delivered about 3 weeks after implant exposure.
Fig. 6a-d: Definitive cross-arch screw-retained prostheses: a) augmented group; b) short implant group; c) ortopantomograph showing a prosthesis supported by 8 implants at least 11.5 mm long placed in augmented bone; d) ortopantomograph showing a prosthesis supported by 7 short implants (5 to 8.5 mm long).
Fig. 7: One of the bilateral dehiscence which developed 2 weeks after sinus lifting.
Fig. 8: Ortopantomograph of the patient who develop a bilateral sinus infection. Five 7 mm and 3 10-mm long implants could be placed and were used to retaine a cross-arch fixed bridge.
Fig. 9: During the implant submerged periods both dehiscence healed.

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06.
Bone augmentation versus 5-mm dental implants in posterior atrophic jaws. Four-month post-loading results from a randomised controlled clinical trial.

- Journal: Eur J Oral Implantol 2009 Winter;2(4):267–81

Abstract:

PURPOSE: To evaluate whether short (5 mm) dental implants could be a suitable alternative to augmentation and placement of longer implants (10 mm) in posterior atrophic jaws.
MATERIALS AND METHODS: Thirty partially edentulous patients with bilateral posterior edentulism were included: 15 patients having 5 to 7 mm of residual crestal height above the mandibular canal, and 15 patients having 4 to 6 mm of residual crestal height below the maxillary sinus and bone thickness of at least 8 mm measured on a CT scan. The patients were randomised either to receive one to three submerged 5-mm-long Rescue implants (Megagen) or 10-mm-long Rescue implants placed in augmented bone according to a split-mouth design. Mandibles were augmented with interpositional anorganic bovine bone blocks (Bio-Oss) and maxillae with granular Bio-Oss placed through a lateral window under the lifted sinus membrane. Resorbable barriers were used to cover the grafted sites. Grafts were left to heal for 4 months before placing the implants using a submerged technique. Four months after implant placement, provisional reinforced acrylic prostheses were delivered and replaced 4 months later by definitive screw-retained metal-ceramic prostheses. Outcome measures were: prosthesis and implant failures, any complications, time needed to fully recover mental nerve function (only for mandibular implants) and patient preference assessed 1 month after loading. All patients were followed up to delivery of the final restorations (4 months after loading).
RESULTS: A systematic deviation from the research protocol occurred: the operator used another implant system (EZ Plus, Megagen) 10 mm or longer with a diameter of 4 mm at the augmented sites. No patients dropped out. In 5 patients of the augmented group (all mandibles) there was not enough height to place 10-mm-long implants as planned and shorter implants (7 and 8.5 mm) were used instead. In each group, one prosthesis could not be placed when planned because an implant was found to be mobile at abutment connection: one 5 mm maxillary implant and one 8.5 mm mandibular implant in the augmented group. Five complications occurred: two in the augmented group (one maxillary sinus perforation and one mandibular wound dehiscence after implant placement possibly associated with the failure of one implant) versus three maxillary sinus perforations in the 5-mm-long implant group. The difference was not statistically significant. No patient suffered from permanent disruption of alveolar inferior nerve function, however, significantly more patients had a paraesthesia up to 3 days in the augmented group. There was no statistically significant difference in patient preference with the majority of patients expressing no preference for which treatment they received, finding both of them acceptable.
CONCLUSIONS: With residual bone height of 5 to 7 mm over the mandibular canal, short 5 mm implants might be preferable to vertical augmentation since the treatment is faster, cheaper and associated with less morbidity. In the presence of 4 to 6 mm of bone height below the maxillary sinus it is still unclear which procedure could be preferable. These preliminary results must be validated by a follow-up of at least 5 years.

Key words

bovine anorganic bone, inlay graft, short dental implants, sinus lift, vertical augmentation

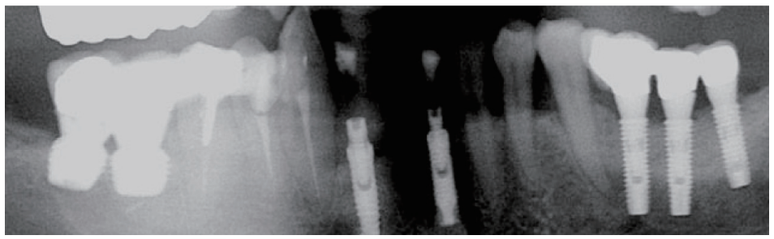

Fig 1.Panoramic radiograph of a patient randomised according to a split-mouth design to receive 5 mm long and 6 mm wide Rescue implants on one side and longer EZ Plus implants in bone vertically augmented with an interpositional Bio-Oss block on the other side of the mandible.

Fig 2. Panoramic radiograph of a patient randomised according to a split-mouth design to receive 5 mm long and 6 mm wide Rescue implants on one side and longer EZ Plus implants in the maxillary sinus augmented with 100% granular Bio-Oss on the other side.

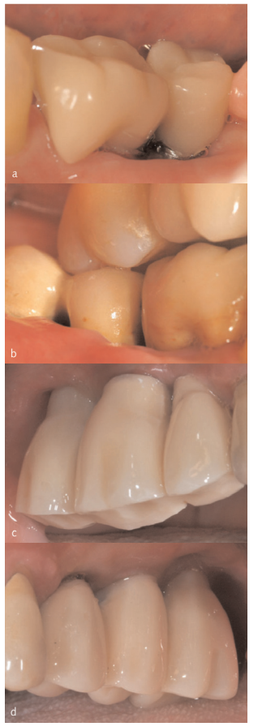

Fig 3. Four months after delivery of the provisional prostheses, definitive screw-retained metal-ceramic restorations rigidly joining the implants with occlusal surfaces in ceramic were delivered: a) prosthesis on short mandibular implants, b) prosthesis on long implants in vertically augmented mandible, c) prosthesis on short maxillary implants and d) prosthesis on long implants in augmented sinus.

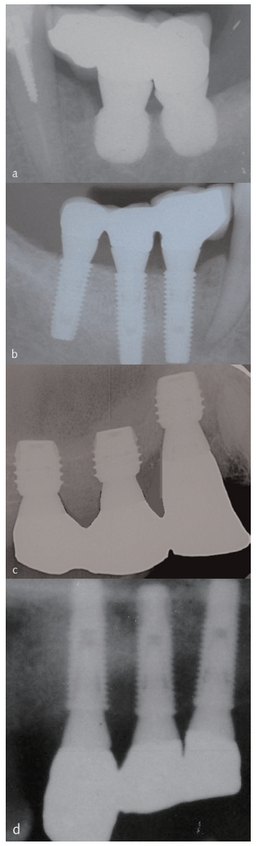

Fig 4. Intraoral radiographs of the study implants at delivery of the definitive restorations: a) short implants in mandible, b) long implants in augmented mandible, c) short maxillary implants and d) long implants in augmented sinus.

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07.
Rehabilitation of posterior atrophic edentulous jaws : prostheses supported by 5mm short implants or by longer implants in augmented bone? One-year results from a pilot randomised clinical trial.

- Journal: Eur J Oral Implantol 2011;4(1:21-30)

Abstract:

PURPOSE: to evaluate whether 5mm short dental implants could be an alternative to augmentation with anorganic bovine bone and placement of at least 10mm long implant in posterior atrophic jaws.

MATERIALS AND METHODS: Fifteen patients with bilateral atrophic mandibles (5-7mm bone height above the mandibular canal), and 15 patients with bilateral atrophic maxillae (4-6mm bone height below the maxillary sinus) and bone thickness of at least 8mm, were randomised according to a splitmouth design to receive one to three 5mm short implants or at least 10mm long implants in augmented bone. Mandibles were vertically augmented with interpositional bone blocks and maxillary sinuses with particulated bone via a lateral window. Implants were placed after 4months, submerged and loaded, after 4months, with provisional prostheses. Four months later, definitive provisionally cemented prostheses were delivered. Outcome measures were: prosthesis and implant failures, any complication and peri-implant marginal bone level changes.

RESULTS: In 5 augmented mandibles, the planned 10mm long implants could not be placed and shorter implants(7 and 8.5mm) had to be used instead. One year after loading no patient dropped out. Two long (8.5mm in the mandible and 13mm in the maxilla) implants and one 5mm short maxillary implant failed. There were no statistically significant differences in failures or complications. Patients with short implants lost on average 1mm of peri-implant bone and patients with longer implants lost 1.2mm. This difference was statistically significant

CONCLUSIONS: This pilot study suggests that 1 year after loading, 5mm short implants achieve similar if not better results than longer implants placed in augmented bone. Short implants might be a preferable choice to bone augmentation since the treatment is faster, cheaper and associated with less morbidity, however their long-term prognosis is unknown.

Key words

bovine anorganic bone, inlay graft, short dental implants, sinus lift, vertical augmentation

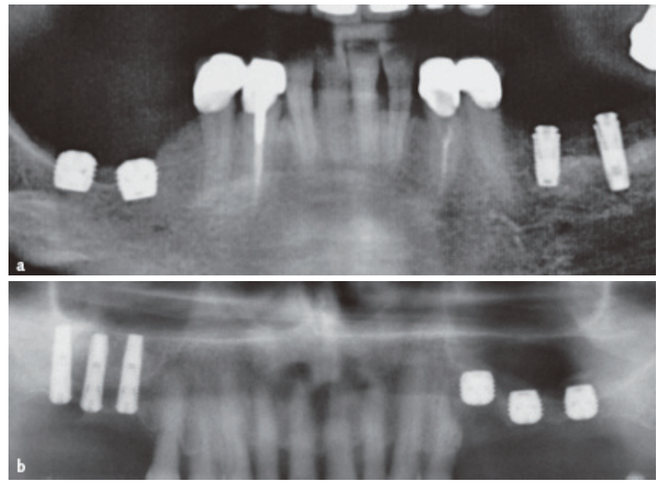

Fig 1. Panoramic radiographs after implant placement of two patients having their edntulous sites randomized to receive 5 mm-long implants or 10 mm or longer implants in augmented bone: a) mandible, b) maxilla

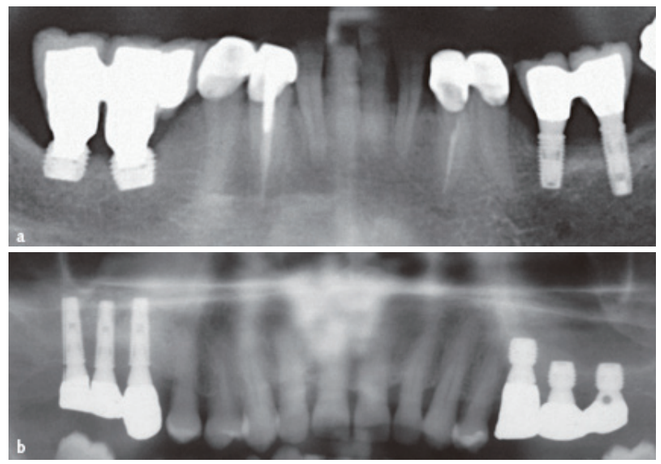

Fig 2. Panoramic radiographs of the same patients 1 year after prosthetic loading: a) mandible, b) maxilla

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08.
Short implants: an alternative treatment option.

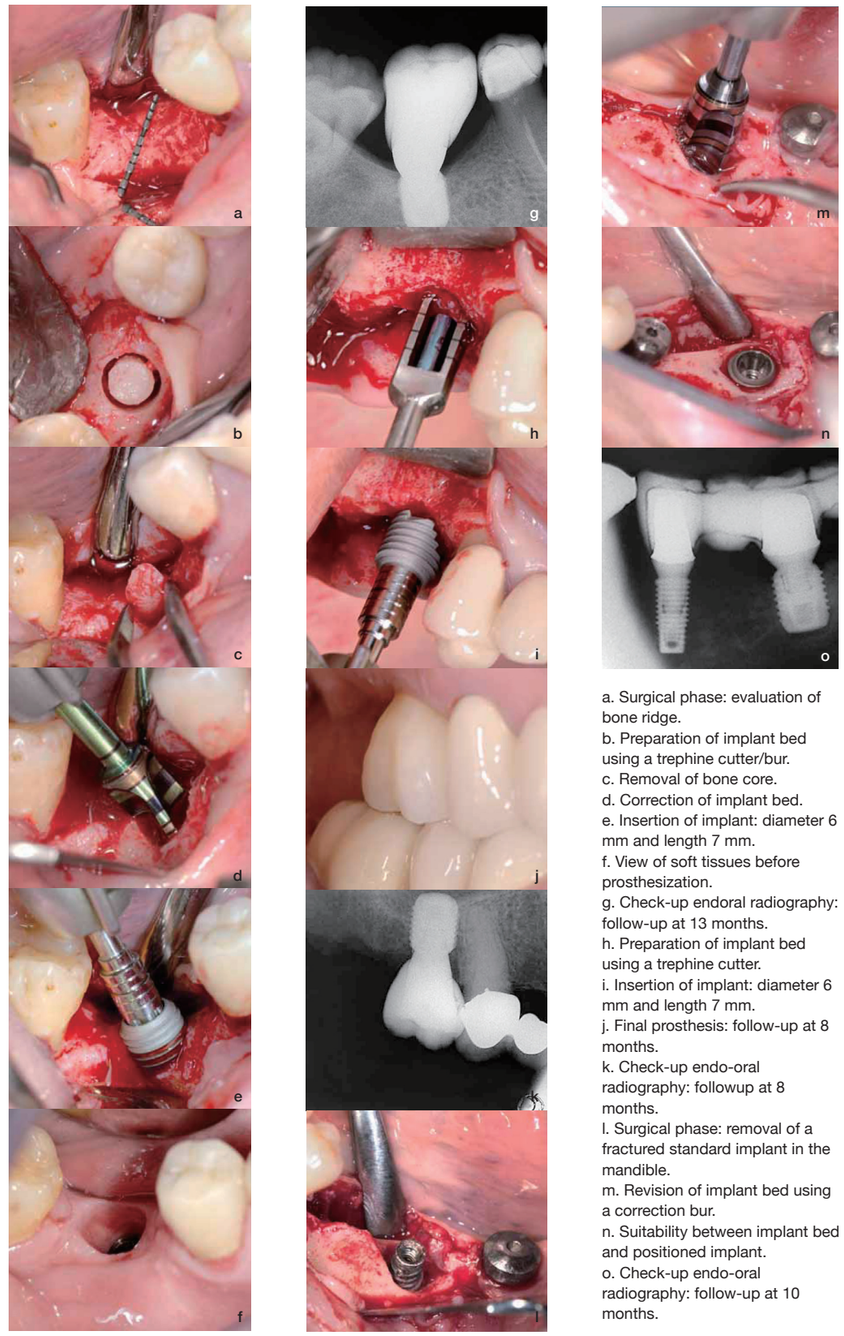
- Journal: YEAR24 • ISSUE 5 bis • IMPLANTOLOGY SPECIAL-QUINTESSENCE INTERNATIONAL 2008 (110-116)

Abstract:

The increased use of short dental implants is an emerging trend in the literature today. The aim of this study is to assess a number of articles to be able to draw conclusions for our own day to day clinical use. Twenty patients were selected and 32 implants were placed in both maxillary and mandibular bone. Single crowns or part bridges were the planned prostheses. The implant survival rate was about 97%. A single implant, placed in the maxillary tuberosity area, failed during the second stage surgery.

Key words

Short implants, alternative to regeneration, crown-root ratio.



a. Surgical phase: evaluation of bone ridge.
b. Preparation of implant bed using a trephine cutter/bur.
c. Removal of bone core.
d. Correction of implant bed.
e. Insertion of implant: diameter 6 mm and length 7 mm.
f. View of soft tissues before prosthesization.
g. Check-up endoral radiography: follow-up at 13 months.
h. Preparation of implant bed using a trephine cutter.
i. Insertion of implant: diameter 6 mm and length 7 mm.
j. Final prosthesis: follow-up at 8 months.
k. Check-up endo-oral radiography: followup at 8 months.
l. Surgical phase: removal of a fractured standard implant in the mandible.
m. Revision of implant bed using a correction bur.
n. Suitability between implant bed and positioned implant.
o. Check-up endo-oral radiography: follow-up at 10 months.

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09.
Survival analysis of wide-diameter implants in maxillary & mandibular molar regions; a retrospective study.

- Journal: THE JOURNAL OF KOREAN ACADEMY OF PERIODONTOLOGY Vol. 37, No. 4, PP. 825-838, 2007

Abstract:

Endosseous implants are used in the treatment of various types of tooth loss, and numerous long-term studies have demonstrated the excellent reliability of this method of treatment. However, the increase of implant failure are associated with inadequate quality and/or height of bone. At the end of the 1980s, Wide(>3.75mm) implants were initially used for managing these difficult bone situations. The recommended indications for its use included poor bone quality, inadequate bone height, immediate placement in fresh extraction sockets, and immediate replacement of failed implants. At the 2000s, wider implant (6.0mm and 6.5mm) were used in a few studies. Although good clinical outcomes have been reported in recent years, there is still a controversy on this topic. Therefore, the purpose of this study was to estimate the survival rate of wide-diameter implants(6.0-8.0mm) in molar regions, evaluating the clinical outcome.

In this study, 1135 RBM surfaced wide-diameter implants (RescueTM, MEGAZEN Co., Korea/ 595 maxillary, 540 mandibular) were placed in 650 patients (403 male, 247 female/age mean: 51.2±11.1 years, range 20 to 83 years). Of the total, 68.3% were used to treat fully or partially edentulous situations, including single-tooth losses and 31.7% were placed immediately after teeth extraction or removal of failed implants, of which all were in the molar regions. Implant diameter and length ranged from 6.0 to 8.0mm and from 5.0 to 10.0mm, respectively. The implants were followed for up to 42 months(mean: 14.6±9.5 months). Of 1135 placed implants, 58 implants were lost. Among them, 53 implants were lost within 12 months after implant placement. The survival rate was 93.6% in the maxilla and 96.3% in the mandible, yielding an overall survival rate of 94.9%, for up to 42 months. As the result of Cox regression model, prosthetic type, sinus graft, and patient gender have an statistical significance on the implant survival rate in this study.

This study suggests that the use of wide-diameter implants would provide a predictable treatment alternative in posterior areas.

Key words

Wide-diameter implant, Retrospective study, Survival rate

Table 1. Survival Rate of Implants According to Variables of Significance(Each Location)

				n	failed(%)	survived%)	p value
Maxiila	1st molar	Prosthesis	multiple	201	6(3.0)	195(97.0)	0.000
			single	72	5(6.9)	67(93.1)	
		Implant diameter	6.0mm	42	2(4.8)	4(95.2)	0.013
			6.5mm	60	7(11.7)	53(88.3)	
			7.0mm	153	7(4.6)	146(95.4)	
			8.0mm	29	6(20.7)	23(79.3)	
	2nd molar	Prosthesis	multiple	230	5(11.8)	225(97.8)	0.000
			single	76	6(7.9)	70(921.1)	
		Gender	male	216	15(6.9)	201(93.1)	0.028
			female	95	1(1.1)	94(98.9)	
Mandible	1st molar	Prosthesis	multiple	132	1(0.8)	131(99.2)	0.000
			single	78	2(2.6)	76(97.4)	
	2nd molar	Prosthesis	multiple	165	0(0.0)	165(100.0)	0.000
			single	149	1(0.7)	148(99.3)	
		Gender	male	198	10(5.1)	188(94.9)	0.008
			female	125	0(0.0)	125(100.0)	

Table 2. Life table method

Time	Implant at start of interval	No. of failed implant	Survived implant	Survival rate in the interval	Cumulative survival rate(%)
Placement to loading	1135	32	1103	97.2	97.2
Loading to 1 y	1103	17	1086	98.5	95.7
1 to 2 y	1086	7	1079	99.4	95.1
2 to 3 y	1079	2	1077	99.8	94.9
3 y -	1077	0	1077	100.0	94.9

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10.
A clinical investigation of the RESCUE™ internal implant.

- Journal: Compendium of Continuing Education in Dentistry. 2012 Jun;33 Spec No 2:17-24.

Abstract:

INTRODUCTION: Immediate implant placements in molar sites have been problematic. This report describes the use of a novel dental implant placed immediately in first and second molar sites.

METHODS: Implants were inserted for 19 patients in molar sites immediately after tooth extraction. Patients were followed for 1 year post-insertion, with radiographs obtained and periodontal parameters recorded every 6 months.

RESULTS: The implant success rate was 95.24%. Esthetics generally was acceptable in the posterior quadrants. Crestal bone die-back in most cases only extended to the crest of the implant. The periodontal parameters recorded at the 6- and 12-month recalls were consistent with periodontal health.

CONCLUSIONS: Use of this novel implant system can be successful if the guidelines for its use are followed. It is best utilized by experienced implantologists.

Key words

implant, immediate placement, wide-diameter implant, osseointegration, platform-switching

Fig 1. Rescue implant carride for insertion into osteotomy site.
Fig 2. Rescue implant inserted into a molar immediate extraction site.
Fig 3. Radiograph of a Rescue implant immediately inserted into a molar site sith a healing abutment in place.
Fig 4. Implant-supported maxillary crown No.14, inserted onto a Rescue implant.
Fig 5. Radiograph of the restoration shown in Figure 4.

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11.
Crestal approach sinus augmentation with simulataneous super-wide implant placement in pneumatized maxilla.

- Journal: 2008 AO poster

Abstract:

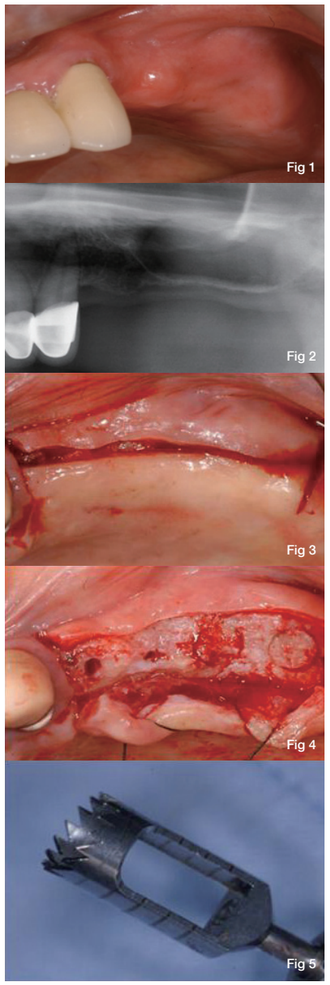
INTRODUCTION: In the posterior maxilla, poor quality of remaining alveolar bone, and pneumatization of the sinus frequ-ently need the hard tissue augmentation for implant therapy. Fugazzotto (1999) have introduced the utilization of modified osteotomes at the time of maxillary molar extraction. Such a technique is applicable when 4 to 5 mm, even less than 4 mm of alveolar bone remains coronal to the sinus floor. And also a technique which would lessen the trauma to the patient would be the selection of the short wide implant. The aim of this study was to introduce and evaluate simultaneous super-wide implant placement with crestal approach sinus augmentation in pneumatized maxillary molar region.

METHODS:

1. Patient selection : One hundred seventy seven sites in 149 patients were treated. These patients were 51 women and 98 men. Patient's age ranged from 22 to 83 years.
2. Surgical technique Fig 1,2. Initial view. Panoramic radiograph showed the severe pnematizatioon and about 3mm residual bone in left maxillary molar area.
Fig 3. Crestally incised and buccal and palatal flaps were reflected. Fig 4,5. Six mm diameter trephine bur was placed crestally at the anticipated site of implant placement and used to prepare the site to within approximately 1 to 2 mm of the sinus membrane. Fig 6,7. The osteotome was utilized under gentle malleting forces, to implode the trephine bone core. And then, sinus membrane was elevated. Fig 8,9. Particulate bone was grafted under the elevated sinus floor. Fig 10,11. Super wide diameter implants (RescueTM, MEGAGEN co., South Korea) were placed in sinus augmented area and submerged.

RESULTS: We placed 177 implants in pneumatized maxilla by crestallly sinus elevation utilizing osteotome technique, and total CSR (cumulative survival rate) was 95.5% for up to 4 years.

CONCLUSION: In this study, super-wide short implants were placed simultaneously with modified trephine and osteotome approach even if alveolar bone height was lesser than 3-4mm. Wide-diameter of implant could compensates short-length, so it was possible to use implants shorter than 10mm. And, the coronal portion of super-wide implants was designed to increase the primary stability. This technique provided good clinical outcomes, and allowed for shorter post-treatment waiting times. If this surgical technique will be used in adequate indication according to preoperative patient evaluation (maxillary sinusitis, residual bone volume, etc), it may be a simple and predictable treatment method in pnematized maxilla.



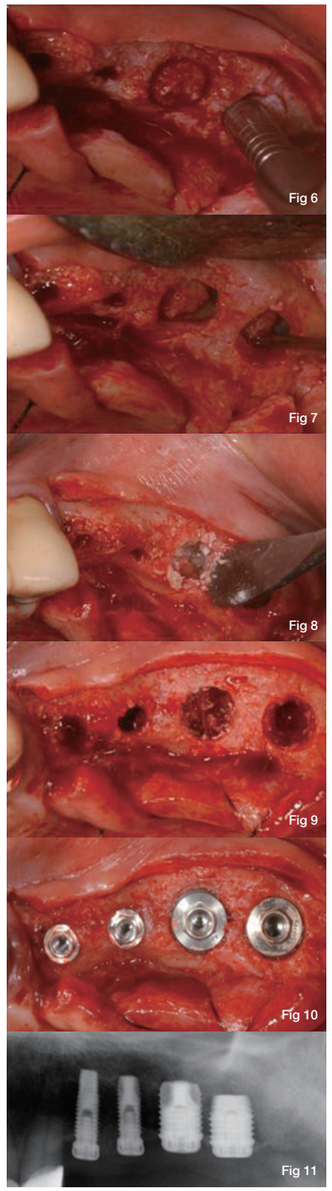


Fig 1,2. Initial view. Panoramic radiograph showed the severe pnematizatioon and about 3mm residual bone in left maxillary molar area.
Fig 3. Crestally incised and buccal and palatal flaps were reflected.
Fig 4,5. Six mm diameter trephine bur was placed crestally at the anticipated site of implant placement and used to prepare the site to within approximately 1 to 2 mm of the sinus membrane.
Fig 6,7. The osteotome was utilized under gentle malleting forces, to implode the trephine bone core. And then, sinus membrane was elevated.
Fig 8,9. Particulate bone was grafted under the elevated sinus floor.
Fig 10,11. Super wide diameter implants (RescueTM, MEGAGEN co., South Korea) were placed in sinus augmented area and submerged.

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12.
Immediate implant placement with super-wide implants on the molar area.

- Journal: 2008 AO poster

Abstract:

INTRODUCTION: Dental implants have become a predictable treatment option for the completely, partially, or single edentulous patient. (1-4) A technique of immediate implant placement after tooth extraction has been developed in order to reduce the treatment time and the preservation of the width and height of the alveolar bone. And the use of immediate implantation for teeth replacement has been well documented and substantiated by numerous studies. However, most of reports have been published about anterior or premolar teeth replacement. (5-7) Immediate implantation in molar area has been very difficult with existing implant system because of multiple roots (2-3) and wide width at cemento-enamel junction (7-10 mm). However, recent super-wide implants (6-8 mm diameter) development have enabled immediate implantation in molar area. The advantages of this system are shorter treatment time, simpler surgery, lesser surgical time, better emergence profile and better maintenance.

MATERIALS AND METHODS:

*Patients selection: The retrospective study includes patients who came to the Mir dental hospital in Daegu Korea during 2003-2007.

1. Age 18 years or older
2. The controlled DM and hypertension patients
3. Presence of failing molar teeth by trauma, severe periodontitis ,root caries or fracture, failure of endodontic treatment in molar area.
4. Presence of adequate and harmonious gingival architecture
5. Adequate bone volume to accommodate an implant with minimized the necessity of bone grafting.

*Exclusion criteria were as follows:

1. Presence of active infection around the failing tooth
2. Severe labial bone defect following tooth removal and/or implant osteotomy.
3. Inability to achieve primary implant stability following immediate implant placement.

*Clinical protocols: All the surgery was done by an experienced doctor.

Surgical protocol is following:

- Diameter of implants were 6mm, 6.5mm,7.0mm,8.0mm
- RBM surfaced implant and external hex type.
- Small defect or gap after implant placement was filled with autogenous bone gathered during surgery (without membrane).
- Initial stability was more than 35N/cm.
- Temporary Healing Abutment connection (One stage surgery).
- Provisionalization after 2-4 months healing.
- Final restorations were delivered 1 month after provisional restoration
- Periodical twice follow-up during a year.

RESULTS: The cumulative implant survival rate for the immediate placement and provisionalization procedure in this study was 96.6% (115/119) after at least 10 months of function with a follow-up period of up to 44 months (table 1). The reasons of failed implants are considered as soft tissue growth into gap , poor initial stability before loading and de-osseointegration after loading.

DISCUSSION: The molar roots are multiple and wide at cemento-enamel junction (7-10mm). However, existing implants are a lot different from natural molar teeth in an anatomical view. These fundamental anatomical differences make immediate implantation difficult in molar area. That is why super-wide implants such as 6.0, 6.5, 7.0, 7.5, 8.0mm in diameter have been developed for immediate implantation. Super-wide implants satisfies immediate implantation requirements in molar area.

*Immediate implantation requirements are following;

1) good initial stability.
2) minimized gap between socket and implants. (8)
3) preservation of buccal wall. (9)

The roots' shape is also important. Upper and lower 2nd molar are suit for super-wide implant system because their roots are convergent. However, a divergent first molar makes immediate implantation difficult. If one of the three requirements for immediate implantation is missing, it is better to wait for the socket healing and place super-wide implant later on. Because super-wide implants resemble the natural teeth in the emergence profile and the size of clinical crown, they still have prosthetic advantages as well. (10) They have a good stress distribution (11,12) and a platform switching causing minimal early crestal bone loss.(13) These surgical and prosthetic advantages ensure a good long-term survival rate.

CONCLUSION: For the rehabilitation of natural molar teeth, it is necessary that the diameter of implant should be similar to the width of teeth at cementoenamel junction. This thought give it a birth to super-wide implants.

This system not only satisfies surgical demand of immediate implantation;

1) good initial stability
2) minimized gap around implant placed
3) preservation of buccal socket wall

but also has prosthetic benefits;

1) minimized early crestal bone loss because of platform switching
2) good emergence profile
3) good stress distribution

As a result, patients can get comfortable implant prostheses lacking plaque retention for a long time.

Table 1. Number of implants placed in the maxilla and mandible : ( ) indicates number of failed implants

Length \ Diameter	6mm	6.5mm	7mm	8mm	Total Number (survival rate) %
10mm	6	3	32(3)	9	53 (94.34%)
8.5mm	3	7	20(1)	13	44 (97.73%)
7mm	2	2	12	2	18 (100%)
6mm	-	-	1	1	2 (100%)
5mm	-	-	1	1	2 (100%)
Total Number (survival rate) %	11 (100%)	12 (100%)	70 (94.29%)	26 (100%)	119 (96.64%)

Case 1

Fig 1.First molar with root caries
Fig 2.Approximately 8mm width bucco-lingually
Fig 3.Osteotomy for 8mm implant
Fig 4.Immediate implantation
Fig 5.Periapical X-Ray after implantation
Fig 6.Suture after implantation
Fig 7.Healing 3months after implantation
Fig 8.Provisional restoration
Fig 9.Final restoration
Fig 10.Periapical X-Ray after final restoration

Case 2

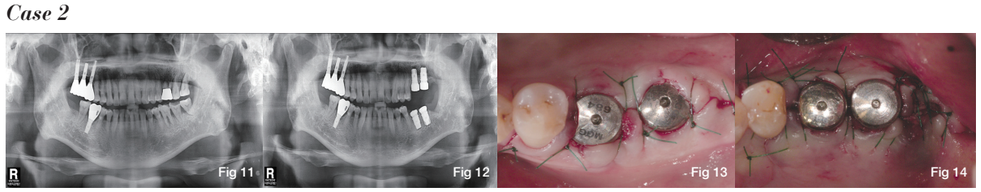

Fig 11.Panoramic view before extraction
Fig 12.Panoramic view after immediate implantation
Fig 13.Clinical view after immediate implantation on the mandible
Fig 14.Clinical view after immediate implantation on the maxilla

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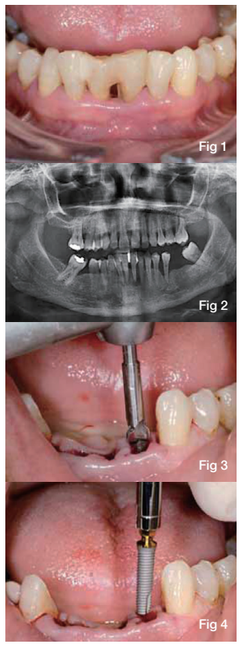
13.
Immediate loading of fixed partial bridges: clinical experience in the anterior mandible.

- Journal: YEAR24 • ISSUE 5 bis • IMPLANTOLOGY SPECIAL-QUINTESSENCE INTERNATIONAL 2008 (117-121)

Abstract:

The option of immediately loading our implant fixtures significantly simplifies the aesthetic and functional solution for patients, in particular when the anterior region is compromised. This article presents five cases of immediate loading for the replacement of four periodontally compromised mandibular incisors, carried out using Intermezzo® (Megagen Co, Ltd, South Korea) one-piece implants.



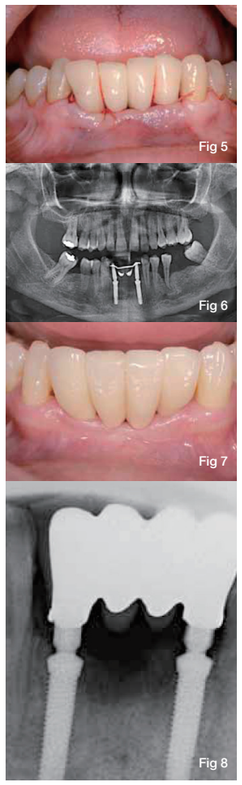


Fig 1.Patient (I01) with fractured anterior inferior splinting.
Fig 2.Initial Ortopantomography (Items I01).
Fig 3.Use of countersink to determine the correct placement of the implant neck.
Fig 4.Insertion of Intermezzo® (Megagen Co, Ltd,South Korea) one-piece implant, diameter 3.10 mm and 13 mm in length.
Fig 5.Intraoral view of bridge just cemented (Items. I01).
Fig 6.Check-up Ortopantomography(Items I01).
Fig 7.View of prosthesis already positioned (Items. I01).
Fig 8.Check-up endoral radiography: follow-up at 10 months(Items I01).

Key words

Immediate loading, partial bridges, one-piece implants.

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14.
Immediate implantation and immediate loading of lower incisors with INTERMEZZO® MegaGen implant system.

- Journal: 2008 AO poster

Abstract:

INTRODUCTION: Immediate implantation and immediate loading for esthetic restoration has been documented as a viable treatment option for various indications. The narrow diameter implants have specific clinical indications, e.g. where there is reduced interradicular bone or thin alveolar crest, for the replacement of teeth with a small cervical diameter. In lower incisor areas it can be mandate the narrow diameter implant for esthetic good restoration and immediate implantation and immediate loading can be shorten the treatment time due to type I or II bone quality. The purpose of this study was to document outcome of immediate occlusally loaded Intermezzo® (MegaGen Implant System, Korea) implants placed to support fixed reconstructions in the mandibular anterior regions and to present the outcomes of clinical studies on immediate and early loading protocols, identify shortcomings.

RESULT: In this study, 62 sites in 46 patient were treated by Intermezzo® MEGAGEN Implants. In immediate loading cases, the survival rate was 100%. This technique provided good clinical outcomes, and esthetic results.

CONCLUSION: The applied immediate loading protocol in combination with a screw type implant design, was shown to be a successful treatment alternative in regions exhibiting immature bone. But, there is a need to thoroughly investigate clinical outcomes to measure the economic benefit of these protocols and the impact of treatment on a patient quality of life. Furthermore, more accurate long-term studies reporting on treatment protocols for separate clinical situations are required to allow meaningful comparisons.

Table 1. Survival rates of INTERMEZZO® MegaGen Implants

	Loading		Location			Diameter			Length		
	Immediate	Delayed	Central incisor	Lateral incisor	Canine	2mm	2.5mm	3.1mm	10mm	13mm	15mm
Survival(No.)	36	24	26	33	1	11	38	13	16	36	10
Failure(No.)	0	2	1	1	0	0	0	2	0	0	2
Survival rate(%)	100	92.3	96.2	97	100	100	100	84	100	100	80

Case 1

Case 2

Fig 1,2. #32 tooth was extracted due to severe periodontal destruction.
Fig 3,4. The abutment was prepared immediately after implant placement (INTERMEZZO® MegaGen Implant System 2.5mm D/10mm L).
Fig 5,6. After 3 months, the final restoration cemented on prepared abutment.
Fig 7,8. Initial clinical and radiographic view.
Fig 9.10. After extraction of central incisors, implant was placed immediately (INTERMEZZO® MegaGen Implant System 2.5mm D/10mm L).
Fig 11,12. Clinical and radiographic view; the final restoration after 3 months

Fig 13.

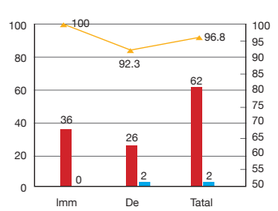

Fig 14.

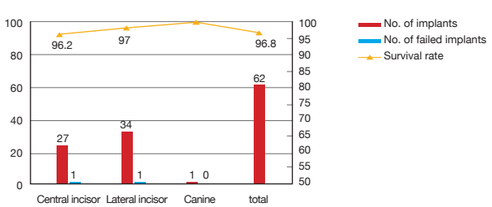

Fig 13. Survival rate according to loading type (Imm: immediate, De: delayed)
Fig 14. Survival rate according to location

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15.
Effectiveness of “Intermezzo” in small, single incisor implant replacement.

- Journal: 2008 AO poster

Abstract:

PURPOSE: the present study reports on the effectiveness of the use of “Intermezzo” implant system (narrow diameter implant of one piece fixture) in Mn. anteriors and Mx. lateral incisor (peg lateralis) of limited bone volume.
MATERIAL & METHOD: This retrospective present followed 47 “Intermezzo” is 47 patient for 3 to 44 months postloading.
RESULT: No implant failures were reported, yielding a 100% survival rate.
CONCLUSION: “Intermezzo” with a more narrow diameter allows stable, esthetic and functional replacement in mandibular anteriors and maxillary lateral incisor (peg lateralis)

Case 1

Fig 1. facial view before Ext.
Fig 2. facial view after Ext.
Fig 3. facial view after “InterMezzo” placement
Fig 4. occlusal view after “Intermezzo” placement
Fig 5. periapical X-ray after provisionalization
Fig 6. facial view after provisional restoration
Fig 7. occlusal view after provisional restoration
Fig 8. healing 3 month after implantation
Fig 9. facial view after final restoration
Fig 10. periapical X-ray after final restoration

Case 2

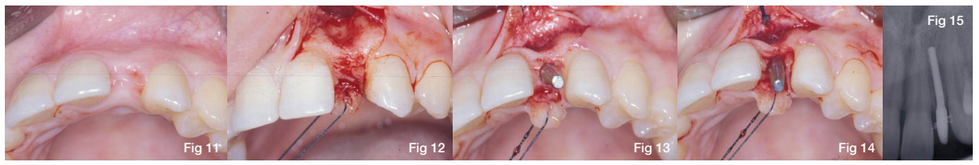

Fig 11. preoperative occlusal view
Fig 12. view of flap elevatioin
Fig 13. InterMezzo placement
Fig 14. view of bendig of neck
Fig 15. periapical X-ray after implantation
Fig 16. suture after implantation
Fig 17. healing 1 week after implantation
Fig 18. healing 3 months
Fig 19. final restoration
Fig 20. periapical X-ray after final restoration

Study & Evidence on

MegaGen Implants

Dental Implant / **Surface Treatment** / Bone Materials

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16.
Safety and effectiveness of maxillary early loaded titanium implants with a novel nanostructured calcium-incorporated surface (Xpeed): 1-year results from a pilot multicenter randomised controlled trial.

- Journal: Eur J Oral Implantol. 2012 Autumn;5(3):241-9.

Abstract:

PURPOSE: To evaluate clinical safety and effectiveness of a novel calcium-incorporated titanium implant (Xpeed, MegaGen Implant Co. Limited, Gyeongbuk, South Korea).
MATERIALS AND METHODS: Sixty patients were randomised to receive either 1 to 6 calcium-incorporated or control titanium implants in the maxilla according to a parallel group design at 2 different centres. Implants were submerged and exposed at 3 different endpoints in equal groups of 20 patients each at 12, 10 and 8 weeks, respectively. Within 2 weeks, implants were functionally loaded with provisional or definitive prostheses. Outcome measures were prosthesis failures, implant failures, any complications and peri-implant marginal bone level changes.
RESULTS: Thirty patients received 45 calcium-incorporated implants and 30 patients received 42 control titanium implants. One year after loading, no drop-outs and no prosthesis or implant failures occurred. There were no statistically significant differences between groups for complications (P = 0.61; difference in proportions = -0.27; 95% CI -0.71 to 0.18) and mean marginal bone level changes (P = 0.64; mean difference -0.04 mm; 95% CI -0.22 to 0.13).
CONCLUSIONS: Nanostructured calcium-incorporated titanium implants seem to be at least as effective and safe as conventional titanium implants.

Key words

calcium-incorporated titanium, early loading, randomised controlled trial, surface Modification

Fig 1.The types of implants evaluated in the study were 10 and 11.5 mm long with a 4mm diameter and internal connection: a) EZ Plus MegaGen titanium implant with a surface blasted with particles of resorbable calcium phosphates; b) Xpeed MegaGen implant with thermally modified nanostructured calciumincorporated titanium surface.

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17.
The cytocompatibility and osseointegration of the Ti implants with XPEED® surfaces.

- Journal: Clinical Oral Implants Research. 2012 Nov;23(11):1283-9

Abstract:

OBJECTIVES: This study evaluated cytocompatibility and osseointegration of the titanium (Ti) implants with resorbable blast media (RBM) surfaces produced by grit-blasting or XPEED® surfaces by coating of the nanostructured calcium.

MATERIAL AND METHODS: Ti implants with XPEED® surfaces were hydrothermally prepared from Ti implants with RBM surfaces in a solution containing alkaline calcium. The surface characteristics were evaluated by using a scanning electron microscope (SEM) and surface roughness measuring system. Apatite formation was measured with SEM after immersion in modified simulated body fluid and the amount of calcium released was measured by inductively coupled plasma optical emission. The cell proliferation was investigated by MTT assay and the cell attachment was evaluated by SEM in MC3T3-E1 pre-osteoblast cells. Thirty implants with RBM surfaces and 30 implants with XPEED® surfaces were placed in the proximal tibiae and in the femoral condyles of 10 New Zealand White rabbits. The osseointegration was evaluated by a removal torque test in the proximal tibiae and by histomorphometric analysis in the femoral condyles 4 weeks after implantation.

RESULTS: The Ti implants with XPEED® surfaces showed a similar surface morphology and surface roughness to those of the Ti implants with RBM surfaces. The amount of calcium ions released from the surface of the Ti implants with XPEED® surfaces was much more than the Ti implants with RBM surfaces ($P < 0.05$). The cell proliferation and cell attachment of the Ti implants showed a similar pattern to those of the Ti implants with RBM surfaces ($P > 0.1$). Apatite deposition significantly increased in all surfaces of the Ti implants with XPEED® surfaces. The removable torque value ($P = 0.038$) and percentage of bone-to-implant contact (BIC %) ($P = 0.03$) was enhanced in the Ti implants with XPEED® surfaces.

CONCLUSION: The Ti implants with XPEED® surfaces significantly enhanced apatite formation, removal torque value, and the BIC %. The Ti implants with XPEED® surfaces may induce strong bone integration by improving osseointegration of grit-blasted Ti implants in areas of poor quality bone.

Key words

Biomaterials, Bone implant interactions, Animal Experiments

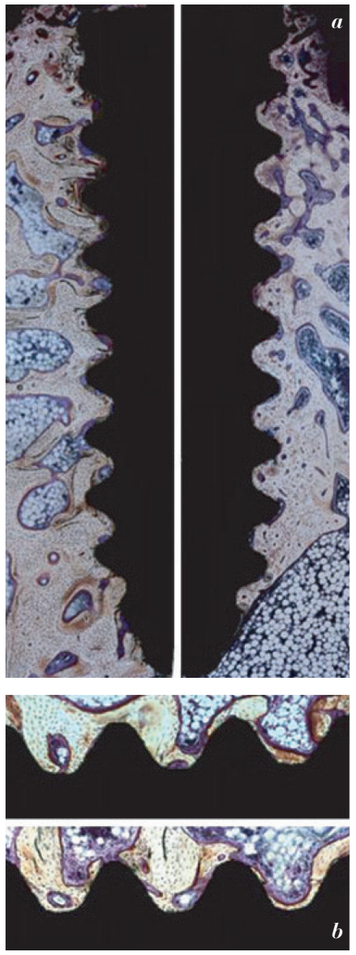

Fig 1.Histological sections of the Ti implants with RBM surfaces (left) and the Ti implants with XPEED® surfaces (right) in all threads (a) and the Ti implants with RBM surfaces (upper) and the Ti implants with XPEED® surfaces (lower) in three threads of implants (b)4 weeks after implantation in rabbit femurs. Magnification of 940 (a) and 9100 (b) (stained with Villaneueva stain). Direct bone contact can be observed along the surface of both Ti implants.

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18.
Biological cell activity and gene expression on implants with different macro/microstructured surfaces and chemical composition.

- Journal: POSTER SIO CONGRESS MILAN 2013

Abstract:

OBJECTIVE: The interaction between cells and implant is determined by surface macro/microstructure and by its chemical composition. It is not yet clear which biological cell activity is influenced by these parameters. For this reason the surface characteristics and shape of dental implants are a topic of growing interest in dental literature. The aim of this study was an in vitro comparison of Osteoblast cells adhesion, proliferation, differentiation and gene expression related to two different surface treatments applied to two implant designs to determine whether and how the interaction between cells and implant is influenced by macro / micro structure (micro design and roughness) and the surface chemical composition of the implant.

MATERIAL AND METHODS: The originality of this investigation was that all the implants were tested by a clinical use protocol (no disks but fixtures „ready to use“ were analyzed). Fifty-two implants were used: n°=26 EZ-Plus Internal (Megagen Implant Co, Ltd, Korea) 5mm x 13mm (n°=13 with HA grit sandblasted RBM surface and n°=13 with a Ca2 + incorporated in titanium XPEED surface) and n°=26 Anyridge (Megagen Implant Co, Ltd, Korea) with same dimensions and surface treatments of the previous implants but with different macro/microstructure. First the implant macro and micro structures were analyzed by SEM (SEM LEO 420, LEO Electron Microscopy, ltd) at 18kV and at 2kV of voltage (to highlight possible carbon contamination) and STEREO SEM (EVO MA 10, Carl Zeiss SMT), then the surface chemical composition by X-Ray Photoelectron Spectroscopic (XPS) analysis (Perkin Elmer PHI 5400 ESCA with 20kV voltage at 200 Watt). The analyzed surface depth was of 5nm. For the biological qualitative tests (adhesion and proliferation at 6-24-72h) SaOS-2 Osteoblasts, coming from human osteosarchoma, cultured in 2.5 ml of McCoy's 5a medium supplemented with 15% fetal bovine serum, L-glutamine, penicillin, streptomycin and amphotericin-B were used. For the biological quantitative tests the Immunofluorescence analysis was performed (cell bodies staining with Alexafluor 488 and cell nuclei staining with DAPI) using a number of 12 disks for each type of surface. The Real Time Reverse Transcription (qRT-PCR) was used to investigate the expression degree of some genes involved into: Bone Formation (Coll1, OC, BSP, BMP-2, OPG, OP), Cell Differentiation (ALP, RunX2), Healing (IL6) and Bone Resorption (RANKL).

RESULTS: The Xpeed and RBM surfaces have different chemical composition. The Xpeed surfaces of EZ Plus and Anyridge show different chemical composition (their macrostructure may have affected the surface treatment). The Xpeed surfaces show the < Ti (from 6.2% to 12.9%) and > Ca (from 8.5% to 12.7%) A great C peak (58.9%) on the Xpeed surface of EZ Plus. The Xpeed and RBM surfaces have similar values of Ra and Rq (2D linear roughness), Rz and RSm (3D quality of roughness). Both surfaces are SB and the nanometric Ca++ layer of the Xpeed surface does not modify the roughness. (Tab. 2) Cells on the Xpeed surface have a greater increase in proliferation and spread more rapidly. Data from Anyridge PCR analysis show that SaOS2 cells grown in 24h on the Xpeed [Blue] surface have an overexpression of some genes that regulate the processes of bone regeneration compared to those grown on the RBM [Brown] surface. After 72h gene expression is similar between the two surfaces. After 8 days gene expression is much more evident on the RBM surface indicating that the osteogenetic processes start earlier on the Xpeed surface. Data from EZ Plus PCR analysis show that SaOS2 cells grown in 24h, 72h and 8 days on the Xpeed [Orange] and RBM [Green] surfaces have similar gene expression.

CONCLUSIONS: The XPEED surface showed less contaminant. A low percentage of Carbonium (less than 40%) did not decrease the surface wettability and well promoted a cell to implant contact. The macro-micro pore structured design and the chemical composition of the XPEED surface allowed a better and faster cell adhesion and proliferation but did not play an obvious role in in vitro cellular differentiation. It can assumed that differences in gene expression, even within the same surface treatment, may be due to macrostructure characteristics (fixture design and geometry), as follows: affecting the surface treatment and consequently the surface chemical composition or by self induction of bone formation (biomimetic geometry).

Table 1. Stereo SEM Analysis results

Specimen	EZRBM (μ)	EZX (μ)	ARRBM (μ)	ARX (μ)	Machined (μ)
RL	1.29 ± 0.09	1.30 ± 0.10	1.27 ± 0.21	1.26 ± 0.30	1.03 ± 0.02
Ra	1.17 ± 0.19	0.98 ± 0.07	1.07 ± 0.11	0.96 ± 0.21	0.31 ± 0.03
Rq	1.29 ± 0.32	1.20 ± 0.12	1.12 ± 0.35	1.20 ± 0.12	0.40 ± 0.02
Rz	7.57 ± 0.75	7.09 ± 0.61	7.07 ± 0.75	6.79 ± 0.61	2.89 ± 0.12
Rp	4.28 ± 0.31	3.81 ± 0.42	4.07 ± 0.31	3.81 ± 0.42	1.11 ± 0.09
Rv	3.28 ± 0.21	3.28 ± 0.22	3.00 ± 0.21	2.98 ± 0.22	1.78 ± 0.22
Rc	4.00 ± 0.32	3.58 ± 0.32	4.00 ± 0.32	3.58 ± 0.32	1.28 ± 0.12
RSm	32.70 ± 4.02	29.29 ± 2.02	32.70 ± 4.02	29.29 ± 2.02	21.98 ± 1.42

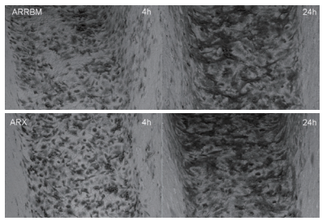

Fig 1.Time Course Proliferation

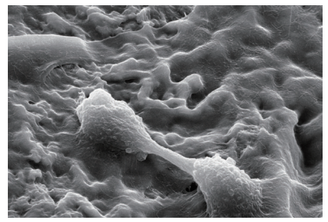

Fig 2. 24h on RBM surface

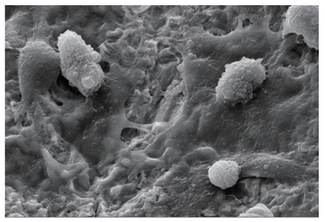

Fig 3. 24h on Xpeed surface

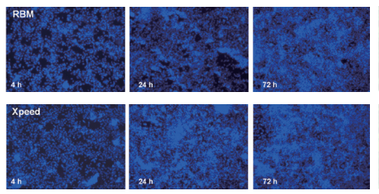

Fig 4. IF CELL BODIES STAINING

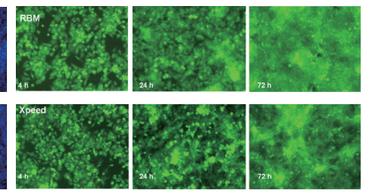

Fig 5. IF CELL NUCLEI STAINING

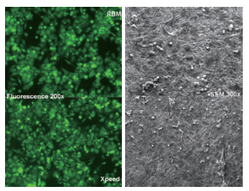

Fig 6. IF vs. SEM

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Key words

dental/craniofacial material; dental/ endosteal implant; nanomaterials/ nanophase

19.
Fabrication and characterization of functionally graded nano-micro porous titanium surface by anodizing.

- Journal: J Biomed Mater Res Part B: ApplBiomater 88B: 427–435, 2009

Abstract:

The purpose of this study was to fabricate and characterize nanotubular structure on machined titanium (MA) and resorbable blast media (RBM) treated titanium by anodizing. The anodized MA and RBM were characterized with scanning electron microscopy, transmission electron microscopy, X-ray diffraction, energy disperse spectra, X-ray photoelectron spectra, and nano-indentation and scratch test. Highly ordered nanotubular layers of individually 100 nm in diameter and 500 nm in length approximately were formed regardless of the substrates. The nanotubular layers consisted mainly of amorphous TiO2 with trace fluorine. The nanotubular surfaces on both the substrates significantly reduced water contact angles and elastic modulus compared with those prior to anodizing.

The anodizing treatment significantly increased the surface roughness of the smooth MA, but significantly decreased the surface roughness of the roughened RBM. The critical delamination forces of the nanotubular layer were not obtained due to the limitation of surface roughness. The anodized RBM consisted of a nano-micro porous graded structure, or a nanotubular amorphous fluoride containing TiO2 layer on top of micro-roughened titanium surface, which is expected to significantly improve the surface area that can be used to deliver drugs and growth factors and alleviate the interfacial elastic modulus mismatch as to enhance osseointegration when compared with conventional dental and orthopedic implant devices with smooth or acid etched surface.

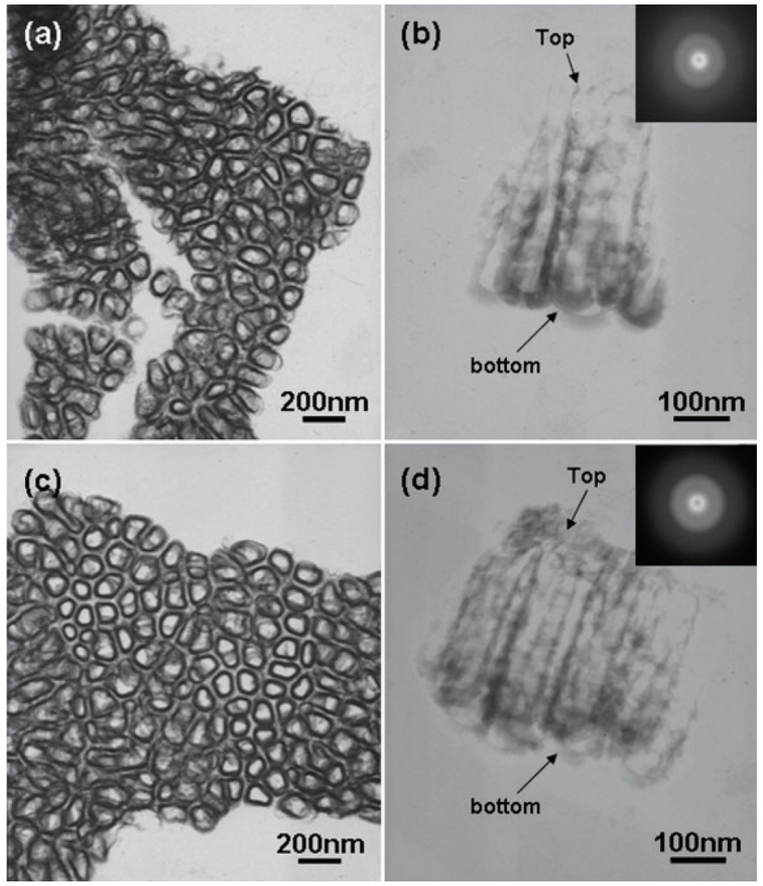

Fig 1.TEM photographs and selective area electron diffraction patterns (SADP) of TiO2 nanotubes formed on machined surface (a,b) and RBM surface (c,d). The SADP clearly exhibits that the nanotubular layer has an amorphous structure. The individual one-end closed nanotubes were 500 nm in length and 100 nm in diameter.

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20.
Cellular activities of osteoblast-like cells on alkali-treated titanium surface.

- Journal: The Journal of the Korean Academy of Periodontology (JPIS) 37(Suppl) 0250-3352 KCI No. 2(Suppl.), 2007

Abstract:

To improve osseointegration at the boneto-implant interface, several studies have been carried out to modify titanium surface. Variations in surface texture or microtopography may affect the cellular response to an implant. Osteoblast-like cells attach more readily to a rougher titanium surface, and synthesis of extracellular matrix and subsequent mineralization were found to be enhanced on rough or porous coated titanium. However, regarding the effect of roughened surface by physical and mechanical methods, most studies carried out on the reactions of cells to micrometric topography, little work has been performed on the reaction of cells to nanotopography. The purpose of this study was to examme the response of osteoblast-like cell cultured on blasted surfaces and alkali treated surfaces, and to evaluate the influence of surface texture or submicro-scaled surface topography on the cell attachment, cell proliferation and the gene expression of osteoblastic phenotype using ROS 17/2.8 cell lines. In scanning electron micrographs, the blasted, alkali treated and machined surfaces demonstrated microscopic differences in the surface topography. The specimens of alkali treatment had a submicro-scaled porous sur-face with pore size about 200 nm. The blasted surfaces showed irregularities in morphology with small(<10㎛) depression and indentation among flatter-appearing areas of various sizes. Based on profilometry, the blasted surfaces was significantly rougher than the machined and the alkali treated surfaces (p<O.01).

On the x-ray diffraction analysis, anatase and rutile(TiO2) were observed on alkali treated surfaces, whereas not observed on machined and blasted surfaces. The attachment morphology of cells according to time was observed by the scanning electron microscope. After 1 hour incubation, the cells were in the process of adhesion and spreading on the prepared surfaces. After 3 hours, the cells on all prepared surfaces were further spreaded and flattened, however on the blasted and alkali treated surfaces, the cells exhibited slightly irregular shapes and some gaps or spaces were seen. After 24 hours incubation, most cells of the all groups had a flattened and polygonal shape, but the cells were more spreaded on the machined surfaces than the blasted and alkali treated surfaces. The MTT assay indicated the increase on machined, alkali treated and blasted surfaces according to time, and the alkali treated and blasted surfaces showed significantly increased in optical density comparing with machined surfaces at 1 day (p<0.01).

Gene expression study showed that mRNA expression level of αI(I) collagen, alkaline phosphatase and osteopontin of the osteoblast-like cells showed a tendency to be higher on blasted and alkali treated surfaces than on the machined surfaces, although no siginificant difference in the mRNA expression level of αI(I) collagen, alkaline phosphatase and osteopontin was observed among all groups. In conclusion, we suggest that submicroscaled surfaces on osteoblast-like cell response do not over-ride the one of the surface with micro-scaled topography produced by blasting method, although the microscaled and submicro-scaled surfaces can accelerate osteogenic cell attachment and function compared with the machined surfaces.

Key words

Titanium, Blasting, Alkali treatment, Microtopography

Table 1. Surface roughness in each group

Group	Ra (㎛)	Rz (㎛)	Rt (㎛)	Rq (㎛)
Control	0.31 ± 0.07	2.03 ± 0.50	2.32 ± 0.71	0.40 ± 0.09
Group1	0.33 ± 0.05	2.56 ± 0.57	2.96 ± 0.70	0.43 ± 0.06
Group2	1.93 ± 0.19	13.35 ± 1.77	14.85 ± 2.08	2.46 ± 0.23

The calues are the mean ± standard deviations. (: p<0.01)
Ra : Arithmetic acerage deviation of the absolute values of all points.
Rx : Average peak-to-valley height of the profile
Rt : Maximum peak to valley height of the entire magnitude trace of the profile
Rq : Root mean square of the values of all points of the profile

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21.
Surface characteristics of titanium implant anodized after blasting treatment.

- Journal: The Journal of the Korean Society for Dental Materials 34(1):15-21, 2007

Abstract:

This study was performed to evaluate the surface characteristic of anodized titanium implant after blasting treatment by HA powder. Forty fixtures (Megagen Co, Korea) with external hex type were divided randomly into four groups of machine-turned, blasted with HA powder, anodized after machine-turning, and anodized after blasting with HA powder. Blasting was executed at 5 atm by using a HA powder with 50/50 wt% mixture of mean size 100~150 □ and 90 □. Anodizing was performed at current density of 30 mA/□ up to 290 V in 0.015 M DL-α-glycerophosphate disosium salt hydrate (GP) and 0.2 M calcium acetate hydrate (CA) using a regulated DC power supply (Kwangduck FA, Korea).

The results obtained in this study were summarized as follow;

1. The micropores less than 4 □ in diameter were observed on the anodized oxide layer, and the size of micropores was larger at the bulgy parts than that in the hollow parts.
2. The porous oxide layer formed by anodic spark oxidation was distributed homogeneously. However, in blasted and anodized group, the titanium oxide film was created on the irregular surface blasted,
3. The surface roughness of anodized and blasted implant was higher than that of anodized surface, and the significant difference was observed among groups ($p<0.05$).
4. The release amount of Ca and P ion in group treated anodic spark oxidation was measured in significantly higher value rather than group treated HA blasting ($p<0.05$).

Key words

Implant, Anodic Oxidation, Arc Discharge, Surface Roughness, Ion release

Table 1. Surface roughness values of machine-turned, blasted, anodized after machine-turning, and anodized after blasting

Roughness	Machine-Turned	Blasted	Anodized after machine-turning	Anodized after Blasting
Ra	0.128±0.0149	1.191±0.0824	0.493±0.0277	1.125±0.0607
Ry	0.822±0.0541	7.549±0.8425	3.172±0.3363	6.387±0.2725

Table 2. Solubility of Ca and P in 0.9 % saline for 10 days at 37 °C (ppm)

Group	Ca	P
Machined	-	-
Blasted	0.256±0.087	0.051±0.025
Anodized after machining	1.632±0.111	0.903±0.059
Anodized after blasting	2.634±0.351	1.431±0.032

Study & Evidence on

MegaGen Implants

Dental Implant / Surface Treatment / **Bone Materials**

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22.
In vitro and in vivo osteoinductive and osteoconductive properties of a synthetic bone substitute.

- Journal: Oral & Craniofacial Tissue Engineering;2011, Vol. 1 Issue 3, p244-251, September 2011

Abstract:

PURPOSE: The present study tested a recently introduced bone substitute material (BSM) with a novel structure to determine its osteoinductive and osteoconductive properties in vitro and in vivo. The specific aims were to determine the microstructure of the as-manufactured BSM, as analyzed with scanning electron microscopy, and to characterize different cellular interactions.

MATERIALS AND METHODS: Human bone marrow stromal cells were cultured in the presence of the BSM. In vitro, attachment of osteoblastlike cells (SAOS-2) to the BSM was observed with the scanning electron microscope. The expression of genes related to osteogenic differentiation (alkaline phosphatase, bone sialoprotein, type I collagen, and osteocalcin) was determined by reverse-transcriptase polymerase chain reaction. In vivo, bone formation was examined with a murine model of ectopic bone formation through histology and computed tomographic scanning by using tissue-engineered constructs with the BSM and ovine bone marrow stromal cells.

RESULTS: Early cellular attachment could be detected as early as 6 hours. Cellular morphology developed in the following 66 hours toward a starlike appearance. Human bone marrow stromal cells cultured in the presence of the BSM showed no reduction in their viability. Osteocalcin was up-regulated during cell culturing, demonstrating an osteoinductive effect of BSM. Histologic and computed tomographic analyses showed the formation of new bone surrounding BSM particles, and a vascular meshwork was observed in the porosity of the particles.

CONCLUSION: The analyzed bone substitute of synthetic origin presented osteoinductive properties that may exert a differentiative stimulus upon osteoprogenitor cells. The tested material allowed cellular adhesion of osteoblastlike cells and, following tissue construct implantation in vivo, supported the formation of new bone.

Key words

beta-tricalcium phospate, bone augmentation, bone marrow stromal cells, ectopic bone formation, gene expression, hydroxyapatite, reverse-transcriptase polymerase chain reaction

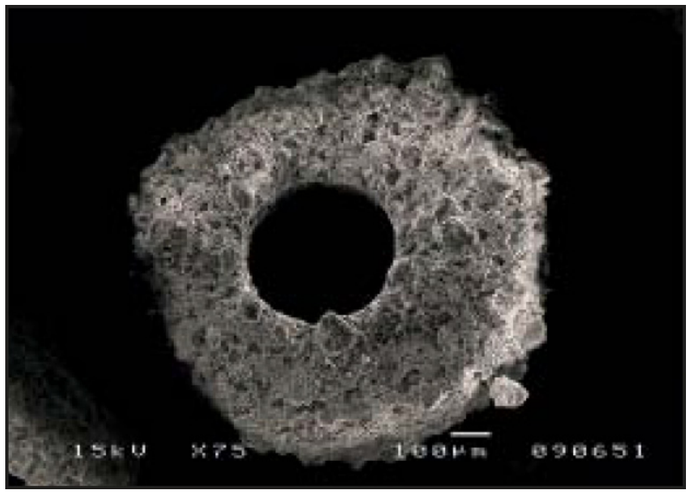

Fig 1.Microphotograph at low magnification showing the general macrostructure of BonePlus Eagle Eye substitute material. Each particle of this synthetic β-TCP/HA composite has ringlike structure with surface microporosities offering channels into the core of the material.

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23.
Healing of rabbit calvarial bone defects using biphasic calcium phosphate ceramics made of submicron-sized grains with a hierarchical pore structure.

- Journal: Clin Oral Implants Res. 2010 Mar;21(3):268-76.

Abstract:

OBJECTIVES: This study investigated the efficacy of new bone graft substitutes - biphasic calcium phosphates (BCP) made of submicron-sized grains with fully interconnected wide-range micron-scale pores in two different macrodesigns: donut shaped with a 300-400 microm central macropore (n-BCP-1) or rod-shaped (n-BCP-2)--in the healing of rabbit calvarial defects, and compared their bone-healing properties with those of various commercial bone substitutes, which included substitutes with similar BCP composition (MBCP and Osteon), anorganic bovine bone (Bio-Oss), and beta-TCP (Cerasorb).

MATERIAL AND METHODS: The surface morphology of the bone substitutes was investigated using scanning electron microscopy (SEM). Defects 8 mm in diameter were created in the calvaria of 30 adult male New Zealand White rabbits and were filled with six types of bone substitutes. The percentage of newly formed bone (NB%) was evaluated histomorphometrically 4 and 8 weeks after implantation.

RESULTS: SEM observation showed submicron-sized grains with fully interconnected micropore structures in the n-BCP-1 and n-BCP-2 groups; these groups also showed considerable new bone formation in inner micropores as well as on the outer surfaces. The n-BCP-1 group exhibited enhanced new bone formation and direct ingrowth of bone tissue with blood vessels into central pores. Histomorphometric analysis showed significantly greater NB% in the n-BCP-1 group when compared with the other groups at 4 and 8 weeks ($P<0.05$).

CONCLUSION: A new BCP ceramics made of submicron-sized grains with a hierarchical pore structure was an effective osteoconductive material for the treatment of osseous defects of rabbit calvaria.

Key words

biphasic calcium phosphate, bone substitute, histomorphometry, pore structure, submicron grain

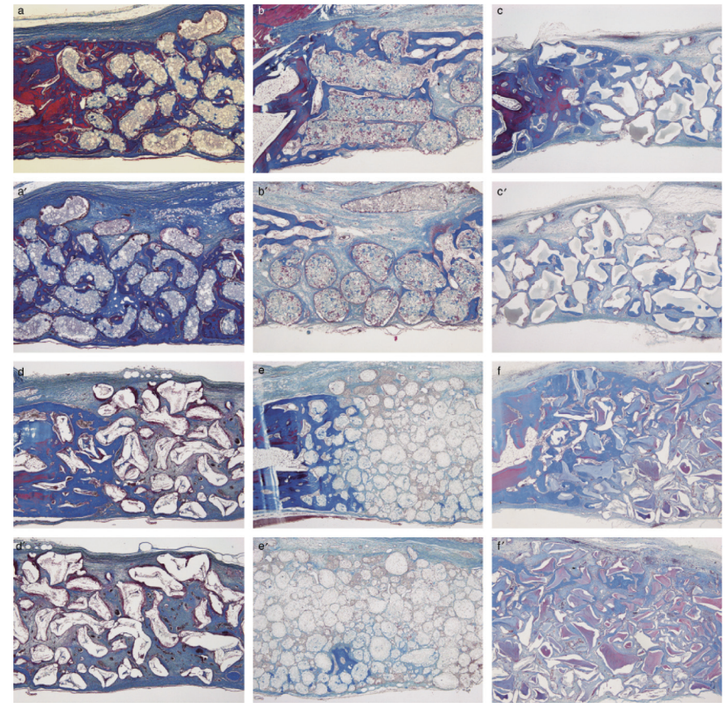

Fig 1.Histological sections of n-BCP-1 (a, a'), n-BCP-2 (b, b'), MBCP (c, c'), Osteon (d, d'), Cerasorb (e, e'), and Bio-Oss (f, f')-grafted defects of the areas close to the defect margins (a–f) and the middle areas of the defects (a'–f') at 4 weeks of healing. Stained with Masson's trichrome. Original magnification of x 40.

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24.
Histomorphometric evaluation of bone healing with fully interconnected microporous biphasic calcium phosphate ceramics in rabbit calvarial defects.

- Journal: J Korean Acad Periodontol 2008;38:117-124

Abstract:

PURPOSE: The purpose of this study was to histomorphometrically evaluate the osteoconductivity of a new biphasic calcium phosphate ceramics with fully interconnected microporous structure.

MATERIAL AND METHODS: Osseous defects created in the rabbit calvaria were filled with four different bone graft substitutes. Experimental sites were filled with a new fully interconnected microporous biphasic calcium phosphate with(BCP-2) or without(BCP-1) internal macropore of 400㎛ in diameter. MBCP(Biomatlante, France) and Bio-Oss(Geistlich Pharma, Switzerland) were used as controls in this study. Histomorphometric evaluation was performed at 4 and 8 weeks after surgery.

RESULT: In histologic evaluation, new bone formation and direct bony contact with the graft particles were observed in all four groups. At 4 weeks, BCP-1(15.5%) and BCP-2(15.5%) groups showed greater amount of newly formed mineralized bone area(NB%) compared to BO(11.4%) and MBCP(10.3%) groups. The amounts of NB% at 8 weeks were greater than those of 4 weeks in all four groups, but there was no statistically significant differences in NB% between the groups.

CONCLUSION: These results indicate that new bone substitutes, BCP with interconnected microporous structure and with or without internal macroporous structures, have the osteoconductivity comparable to those of commercially available bone substitutes, MBCP and Bio-Oss.

Key words

biphasic calcium phosphate; microporous structure; histomorphometry; osteoconductivity.

Table 1. Histomorphometric Analysis of Newly Formed Mineralized Bone Area (means±SD, %)

Group	4 weeks	8 weeks
BCP-1	15.53±2.78	21.11±2.24*
BCP-2	15.52±3.28	18.74±6.93
MBCP	10.30±4.56	17.98±5.62*
Bio-oss	11.46±4.58	16.52±8.63

* Statistically significant difference between two healing periods ($p<0.05$ by t-test).

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25.
Comparative study on the physicochemical properties and cytocompatibility of microporous biphasic calcium phosphate ceramics as a bone graft substitute.

- Journal: J Korean Acad Periodontol. 2006 Dec;36(4):797-808. Korean.

Abstract:

OBJECTIVE: The purpose of this study was to evaluate the physicochemical properties and cytocompatibility of microporous, spherical biphasic calcium phosphate(BCP) ceramics with a 60/40 hydroxyapatite/beta-tricalcium phosphate weight ratio for application as a bone graft substitute.

MATERIALS AND METHODS: Microporous, spherical BCP granules(MGSB) were prepared and their basic characteristics were compared with commercially available BCP(MBCP; Biomatlante, France) and deproteinized bovine bone mineral(Bio-Oss; Geistlich-Pharma, Switzerland, BBP; Oscotec, Korea). Their physicochemical properties were evaluated by scanning electron microscopy, X-ray diffractometry, Fourier-transform infrared spectroscopy, inductively coupled plasma atomic emission spectrometer, and Brunauer-Emmett-Teller method. Cell viability and proliferation of MC3T3-E1 cells on different graft materials were evaluated.

RESULTS: MGSB granules showed a chemical composition and crystallinity similar with those in MBCP, they showed surface structure characteristic of three dimensionally, well-interconnected micropores. The results of MTT assay showed increases in cell viablity with increasing incubation times. At 4d of incubation, MGSB, MBCP and BBP showed similar values in optical density, but Bio-Oss exhibited significantly lower optical density compared to other bone substitutes($p < 0.05$). MGSB showed significantly greater cell number compared to other bone substitutes at 3, 5, and 7d of incubation($p < 0.05$), which were similar with those in polystyrene culture plates.

CONCLUSION: These results indicated the suitable physicochemical properties of MGSB granules for application as an effective bone graft substitute, which provided compatible environment for osteoblast cell growth. However, further detailed studies are needed to confirm its biological effects on bone formation in vivo.

Key words

biphasic calcium phosphate, micropore, bone substitute, surface characteristics

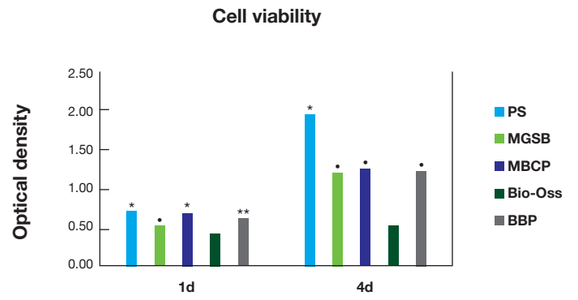

Fig 1.The optical density measured after 1 and 4d of culture at a wavelength of 570nm by ELISA reader (n = 5 per group).
* statistically significant difference compared to othergroups ($p < 0.05$),
** statistically significant difference compared to MGSB and Bio-Oss groups ($p < 0.05$), statistically significant difference compared to Bio-Oss group at 1d of culture ($p < 0.05$),
• statistically significant difference compared to Bio-Oss group at 4d of culture ($p < 0.05$)

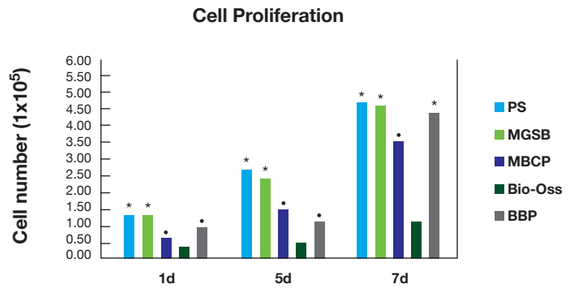

Fig 2.Cell proliferation measured at 3, 5 and 7d of culture (n = 3 per group).
* statistically significant difference compared to other bone substitutes at 3, 5 and 7d of culture ($p < 0.05$)
• statistically significant difference compared to Bio-Oss group at 3, 5, and 7d of culture ($p < 0.05$)

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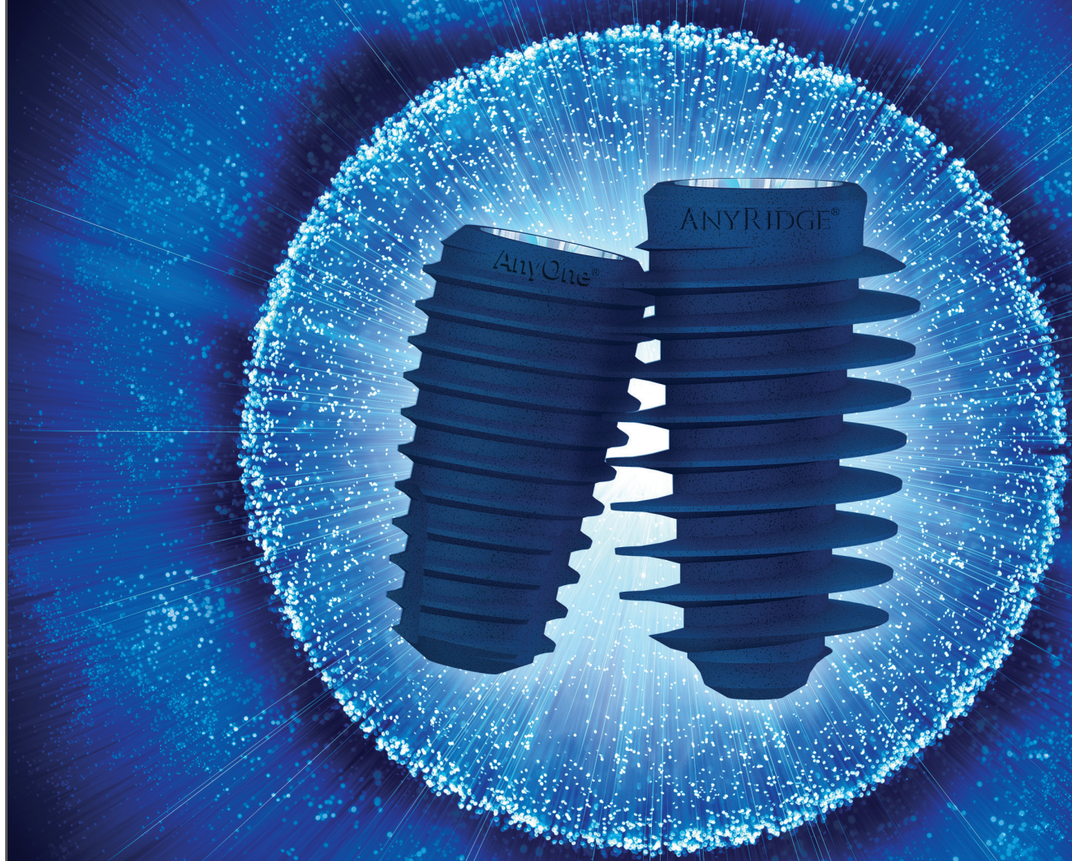

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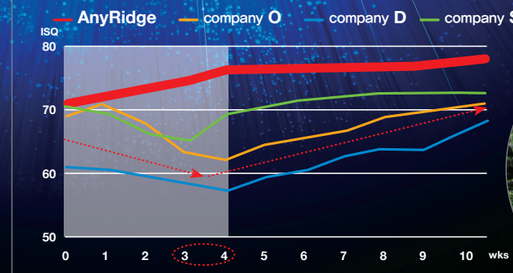

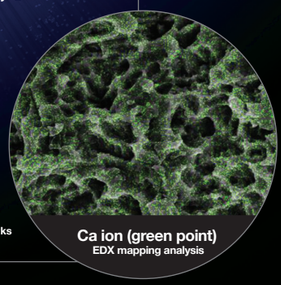

Ca ion (green point)
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