

Int Poster J Dent Oral Med 2003, Vol 5 No 01, Poster 168

International Poster Journal

Immediate Bridge Restored Implants Under Functional Loading

IP

- A Study in Mini-Pigs -

Language: English

Authors: Jörg Neugebauer¹, U. Thams², F. San Roman², H. Steveling³, J. E. Zöller¹ ¹Medical Center University to Cologne Clinic and Teaching Hospital for Dental Surgery and for Oral-, Maxillo and Plastic Facial Surgery, Germany ²University Complutens Madrid, Spain ³University Heidelberg, Germany

Date/Event/Venue:

March 14-16, 2002 17th Annual Meeting Academy of Osseointegration Dallas/Texas

> Poster Award 1st Prize for Best Poster

Introduction

The immediate loading of dental implants in partially edentulous patients has not been widely investigated. Following the experience of the treatment of the anterior mandible (Ledermann 1979, Ledermann 1988), immediate loading requires pre-conditions such as immobilization of the implants with a superstructure and shortened surgical and prosthetic treatments (Brunski 1993). The preparation of the receptor site in the mandible is accomplished with drills. In soft bone, improvement of the bone quality can be achieved by BoneCondensing (Fürst 1999). This technique can also be used to perform minor sinus-lift procedures. Adaptation of the receptor site by "under-sizing" the osteotomy relatively to the implant is another option to help achieve primary stability (Schmidinger 1999). An animal study on mini pigs was performed to evaluate the clinical success and bone reaction during the course of osseointegration for implants in the mandible and maxilla.

Material and Methods

The premolars and the first molar were removed. After three months, implant placement and prosthetic temporization was performed for 61 XiVE® implants (FRIADENT GmbH, Mannheim, Germany). 27 implants were placed in the maxilla and 34 in the mandible. The preparation in the mandible was performed with drills. The preparation in the maxilla was performed by BoneCondensing technique to increase the local bone quantity and quality with an internal sinus-lift. The special thread design with a lower thread profile in the crestal portion allows a differentiated implant site preparation with the final crestal drill. Based on the bone quality, internal condensation by the implant is used to improve the final insertion torque. 49 implants were stabilized with prefabricated caps and glass fiber ribbons. The bridges were cemented onto the abutments at the end of surgery and controlled until the animals were sacrificed. Markers for the histological staining were given according the protocol of Becker et al. (1992).

Summary

Immediate loading of dental implants in the partially edentulous patient has not been investigated widely. Immediate loading requires immobilization of the implants by the superstructure (Ledermann, Brunski). An animal study was performed to evaluate the clinical success and the bone metabolism during the course of osseointegration on 12 implant borne bridges. Three months after tooth extraction implant insertion and prosthetic treatment was performed.

29 implants out of 62 had an insertion torque (IIT) above 35 Ncm. The average insertion torque of the implants per bridge (BIT) were determined. If the BIT was higher than 35 Ncm the bridges were successful after 4 months of loading. The histomorphometric finding of loaded and unloaded implants shows no significant difference. The procedure with prefabricated auxiliary parts allows fabricating a bridge reconstruction during one appointment as a predictable procedure if the parameters for success were considered.

Clinical Procedure Step-by-Step



Prior to the extraction of the teeth an impression was made to fabricate a surgical stent for the implant placement and for the fabrication of the provisional bridge.

The implant sites were prepared with standard drills in the mandible. The depth of the crestal preparation was reduced in soft bone to create a tighter fit of the implant (internal condensation of the bone). The implants were placed with a hand piece at 15rpm.



Situation after suturing: The implant mount called a TempBase stays in place as a temporary abutment. Complete wound closure was double checked to avoid contact of the temporary resin with the fresh wound.



The TempBases were reseated if the flats on the abutments were not placed in a straight line. The prefabricated TempBase caps were seated on the abutments for a stable reinforcement with fiber ribbon, a straight line is optimal.



Light-cured fiber material was utilized to connect the caps. Contamination for the fibers with saliva or blood during the placement of the fiber core must be prevented.



Additional resin is applied to stabilize the fibers and increase the mechanical stability. The resin should be placed in thin layers to avoid tension in the superstructure during shrinkage of the material.



The template is double checked before the auto-polymerizing resin is applied. During polymerization, irrigation fluid is utilized to protect the soft tissue from the high temperature of the resin as it sets.



After final polymerization the superstructure is removed. Voids are filled-in with resin and the bridge is finished and polished. The bridge is cemented onto the TempBase abutments.

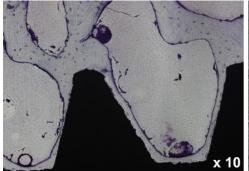
Histological Findings



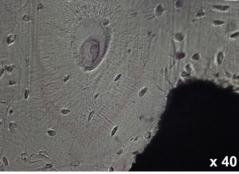
BIC, initial resorption until first rough surface.



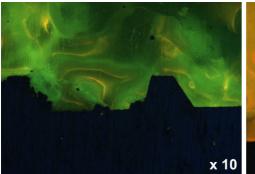
Toluidin blue staining of loaded implant. Good Toluidin blue staining of un-loaded implant. Complete BIC even at smooth collar of the implant.



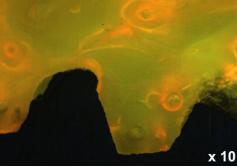
Toluidin blue staining of unloaded implant illustrates close bone-to-implant contact at the apical threads. The bone between the threads shows large marrow spaces.



Toludin blue staining of loaded implant with newly formed osteozyt between the apical threads. Alizarin staining shows time of reossification.



shows active remodeling around the crestal threads after internal condensation.



Unloaded implant in flourochrome microscopy Fluorochrome microscopy of the apical region of a loaded implant. Strongest cell activity is shown after eight weeks with Allzarinmarker.

Histomorphometric Analysis									
	Ν	Mean value (%)	SD (%)	Minimum (%)	Maximum (%)				
Bone-to-implant contact (immediately loaded)	28	77.8 _{p=0.917}	5.9	66.8	83.5				
Bone-to-implant contact (unloaded)	7	78.0	5.8	70.0	86.0				
Interthread bone area (immediately loaded)	28	57.9 - p=0.735	20.2	37.0	76.8				
Interthread bone area (unloaded)	7	55.3	8.6	42.0	66.0				
Peri-implant bone area (immediately loaded)	28	64.6 - p=0.735	9.9	49.0	80.5				
Peri-implant bone area (unloaded)	7	64.1	5.8	56.0	72.0				

Histomorphic Analysis

The histomorphometric analysis was performed for the mandibular implants for statistical reasons. The following definitions were used:

bone-to-implant contact = length of the bone surface border in direct contact with the implant/complete implant surface.

interthread bone density = area of bone inside the threads/complete area inside the threads.

Surrounding the implant, up to a lateral extent of two mm **peri-implant bone density** = bone volume/tissue volume (McMillan et al. 2000).

A 2-way analysis of variance was used, with implant placement technique as first factor and animal identity as the second factor to compensate any influence by the study design (Kolmogorov-Smirnov-Test and Levene's Test). There was no significant difference (P-value $\leq .05$) for the bone to implant contact, the interthread and the peri-implant bone density for the loaded and unloaded implants detected.

Results

Due to the adaptation of the receptor site preparation based on the bone quality, utilizing cortical drills in the mandible and bone condensing instruments in the maxilla, 92% of all implants were placed with an insertion torque (**IIT**) above 25 Ncm. The mean value of the insertion torque per bridge (**BIT**) was evaluated. If the BIT was less than 35 Ncm the bridges were not stable and the implants were lost after a few weeks prior to the first recall. In the mandible, of the directly loaded implants (N=27) two failures occurred (92.6% success). The control implants in the mandible had a 100% success rate (N=7).

Three out of 22 directly loaded implants in the maxilla were stable after three months (13.6% rate). Two out of 5 control implants in the maxilla were stable (40% success rate).

	IIT / BIT	Maxilla			Mandible			
	15 - 20 Ncm	4 (4) implants			-			
	25 - 30 Ncm	15 (12) implants	5 (5)	bridges	4 (0) implants			
	35 - 45 Ncm	3 (3) implants	1 (0)	bridges	-	2 (0) bridges		
50 and over Ncm 3 (2) implants					23 (2) implants 4 (0) bridges			
	Torque analysis loaded implants (failures)							

RFA-Value	Minimum	Median	Maximum	Mean	Ν
Maxilla	67	76	80	75.2	5
Mandible	42	77	88	75.4	34

RFA-Analysis

There was no difference between loaded and unloaded implants regarding the RFA Resonance Frequency Analysis - values visible after three months of implant placement (Rasmusson 1998).

Discussion

Primary stability is a pre-condition for immediate implant placement. Internal condensation has been used to improve primary stability. In the maxilla additional bone condensing was used to gain additional length into the sinus. With these techniques, BIT values between 25 and 45 Ncm were reached in the maxilla.

In the mandible the BIT values were between 35 Ncm and more than 50 Ncm.

Bridges with a BIT below 35 Ncm failed. Bridges with BIT above 35 Ncm were successful in the animal model. The control implants were placed next to the immediate loaded implants, losing the immediate loaded implants also damaged these implant sockets. The control implants in the mandible showed complete osseointegration. Histological observation and histomorphometric analysis showed no difference in bone contact for loaded and unloaded implants in successfully osseointegrated implants.

RFA-analysis showed no difference between mandible and maxilla. Also, there was no visible difference between loaded and unloaded implants.

The reduction of the occlusal contacts in the maxilla, to avoid maximal load was much more difficult than in the mandible due to the anatomy of the animal model.

In general this procedure, utilizing pre-fabricated components, allows the fabrication of a provisional bridge in one appointment for immediate loading. The histomorphometric evaluation demonstrates that immediate loaded implants shows no difference to unloaded implants four month after implant placement if the primary stability of the bridge was suitable for initial loading.

Positive parameters

- BIT greater than 35 Ncm
- Implant stabilization by resin superstructure

Negative parameters

- BIT less than 30 Ncm
- Internal sinus lift for gaining vertical bone height
- · Limited reduction of horizontal load during the first weeks of initial loading

Literature

- Becker, J. Meissner, T. Neukam, F.W. Knöfler, W. Graf, H.-L. / Reichart, P.: Tierexperimentelle Untersuchungen zur Einheilung von ANOF-beschichteten Titanimplantaten, 1991
- Brunski JB. Avoid pitfalls overloading and micromotions of intraosseous implants (interview). Dent Implantol Update, 1993; 4(10):77-81
- Fürst, U., Klug, D., Neugebauer, J.: Sinusbodenelevation mit dem FRIALIT-2 BoneCondenser, ZWR, 1999; 108: 506-510
- Ledermann P.D.: Die neue Ledermann-Schraube Quintessenz 1988, 5, 1-17
- Ledermann PD. Stegprothetische Versorgung des zahnlosen Unterkiefers mit Hilfe von plasma-beschichteten Titanschraubenimplantaten. Dtsch. Zahnärztl. Z. 1979; 34:907-911.
- Rasmusson, L., Meredith, N., Kahnberg, K.-E., Sennerby, L.: Stability assessments and histology of titanium implants placed simultaneously with autogenous onlay in the rabbit tibia, Int. J. Oral Maxillofac. Surg. 1998;27: 229-235
- Schmidinger, S., Uhl, F.: Sinus Elevation, is there a need for spezial implants? Posterpresentation EAO- Annual Meeting Cophenhagen April 16-17,1999
- McMillan PJ, Riggs ML, Bogle GC, Crigger M. Variables that influence the relationship between osseointegration and bone adjacent to an implant. Int J Oral Maxillofac Implants 2000;15:654-661

This Poster was submitted by Dr. Jörg Neugebauer.

Correspondence address: *Dr. Jörg Neugebauer* Medical Center University to Cologne Clinic and Teaching Hospital for Dental Surgery and for Oral-, Maxillo and Plastic Facial Surgery Kerpener Strasse 32 D-50937 Cologne Germany

Poster Faksimile:

Immediate Bridg	ge Reste - A	ored Implant Study in Mi	ts Under Fur ni-Pigs -	nctional Load	ding Neuget Steveli	auer J.', Ti ng H. ³ , Zöll	nams U.², Sa er J. E.¹	in Roma	n E²,	0
Introduction		Clinical Procedu	re Step-by-Step	Histologic	al Findings		Re	ults	1.	
widely investigated. Following the experience particity ministry of the treatment of the experience mandfalls Ladermann 1978, Ladermann 1988), sking The electric immediate locating requires pre-conditions such as immobilization of the implants with a scenttracture and stortment burgical and a scenttracture and stortment burgical and on mini sizes was a	que can also be used to sinue-lift procedures, receptur site by "under- ny relatively to the implant, to help achieve primary primer solo and the implant primer solo evaluate the not bone macilian during contequation for implants.					preparation based officing certical del bore condensing in 92% of all insplant insertion torque (if mean adue of the in (BiT) was evaluated than 35 Nom the 5 and the implants we Torque analysis in	on of the seceptor site on the borne quality, is in the manifolds and draments in the macilia, is were placed with an F) above 25 Norn. The sector torque per tridge d. If the 917 was less ridges were not stable in solar after a few weeks aded impliants (tofume	control implants success rate (7 Three out of 22 the maxile we (13.0% rate). T in the maxile rate).	aded implants ed (952.97% s- in the mandbi (e-7). 2 directly loads e-stable after wo out of 5 ce were stable ()	 (N+27) fac access). The is had a 100% od implants in three months setsol implants
		Prior to the automation of the least-air impression was made to thoroads a surgical stancing the impaint processing and for the fabrication of the provisional bridge.	The implicit size when personal with element of the rearranged has adjust whith a result personalise was excluded in and the presence of the fill of the implicit presence or demonstration. If the excess is the regularity wave passed with a lower passed of them.	Teach Sun daring of oachd rights, South C, Marrisochor- anti Enersiagh surface.	Touth-row stating of an executivity and Gorgans Brilleran at smooth online of the implicit	4718/7 15-20 Nov	4 (r) explants		As molificate	
Material and Method	9	Statement of the second second	State of the second state	MY Y IN	STREET, STREET	25-30 Nom 35-45 Nom	15 (10) implants, 5 5 (1) implants, 5		(1) implants	2 CD bridgen
	ed implant sits preparation			114	2 0 2.5	50 and over Nem RFA-Amphysia	3 (1) implants		(3) implants, 4	
enformed for 61 XIVE* implants (FRIADENT guality, internal co	e drill. Based on the bone indensation by the implant	A CARLEND AND A CARL				RFA-Analysis RFA-Value	Maranan Media	n Maximum	Minari	N
ore placed in the maxilla and 34 in the 49 implants were s	the fisal insertion torque, abliced with prefabricated ser ribbons. The bridges	H Harr Carlos	and the second se			Maaitta	67 36	80	75.2 75.4	5
the maxilia was performed by end of surgery i pneCondensing technique to increase the animals were as	to the abutments at the and controlled until the criticed. Markers for the rg were given according Besker et al. (1992).	Plates and solars. The report root and a brother design and a solars, the report root and a brother design and the report root and the solar and the report of the solar and solars and the solar and the solar root.		The second secon	a 43 Dates the descent of basics relates of streng brown binst pringer free strengt brown. Altern strengt brown binst	and unipaded impl	rence between loaded into regarding the RFA incy Analytic - values	vialble after placement (Ra		
artisity adentations patient has not been isopae of the imple- vestigated auto-(i). Intra-Salar leading determined. If the regures immobilization of the implement isopaet the bindper re-source study was performed to realisate in animal study was performed to realisate finding of leaders. In the study of the study of animal study was performed to realisate independence of the study of the study of animal study was performed to realisate independence of the study of the study of animal study was performed to realisate independence of the study of the study of animal study was performed to realisate independence of the study of the study of animal study and the study of animal study and the study of animal study and animal study of animal study and animal study of animal study o	The average interflor ris per bridge (BIT) were BIT was higher than 35 were accessed arbor 45 The historication of the reast of florence. The flablocated auxiliary parts a bridge inconstruction intend as a predictable parameters for success	When the second		e 19 minuted in these terms approved to provide the	A the response of the sector o	innectare implie condensation has primary stability. In some condensing w length run the share that waters betwee reached in the mass to the reardable that 35 Mon and more bridges with a 811 Bridges with 0.11	Discret Princy stability is a pre-verifient to immediate inplacement. Internation condensation has been used to increase princy stability in the maximal addision increases and the stability of the stability of stability between 23 and 25 hors were realized in the maximal stability of the stability of the stability mediated in the maximal stability of the stability of the stability mediated in the stability of t		I the occlusal is in the maximal is an in the maxi- animal model is propedure, orients, allows taridge in one ading. The hist nonatrates th the shows ha shows have primary stability orients baseling	and was much sible due to the utilizing pre- the tabrication e appointment anophameth at insmediation difference to a sher implan is of the tridg
Elementaria dei referenzia dei refer	entralise charte nacionale entrali negra nentralisen		Connel	Historscriptometric Analysis 1 Normality	reacting the intervent for statistical research. The Ministry deficience users and have a singlence statistics in apply of the source and the statistical bears and a singlence statistics in apply of the source and the intervention of the source of the source of the manufacture statistics and index the threads. Source outputs the source descent of the source of the property of the source descent of the source of the property of the source outputs of the source of the property of the source outputs of the source of the property of the source outputs of the source output of the property of the source outputs of the source output of the source output of the source output of the source output of the property of the source output of the sou	Implants were place tousted implants, teo implants also damage The control implants completies canse-in observation and has showed no differen toused and unicade observation of different backed and unicade observation and unicade	d meet to the immediate baded ing the immediate baded of trass impland sockuts. In the manoble showed togration. Histological tomorphometric analysis ros in bore contact for d implants in successfully plants. d no difference between	Positive para BiT groute Implant sta supershird Negative para BiT less fi Information	maters. r than 35 Nom offication by a low amaters an 30 Nom real I/T for pail	esin
11th Annual Assessment of Descent Descentinguillon Conferences March 14 - 15, 2002 Design, Texast		The investige is simple-checked inter- the public subjections, with a public check public subjection of a simple subjection of the statistic check public subjection of the subjection of the subject check public subjection of the	Mile free propression for appointention is sourced, from per basis with water and the initial is freedow and performance free strategy or a comparison for initial is freedow and performance.	Anonperson on all all all all all all all all all al	Become fast and Lanavet 1 fast, There will in staffice difference (Friedman 2 20) for the local to install called, th constrained and the part-installed land density for the basis and unitability parts interaction.	mandible and map	ils. Also, there was no between loaded and		t duction of ho first weeks of	