Cranio-maxillofacial

Implant Directions®

Vol.2 No.3 September 2007

OFFPRINT

Full Length Article »

Basal implants: A safe and effective treatment option in dental implantology

ISSN 1864-1199 / e-ISSN 1864-1237

Published by IF Publishing, Germany

Full Length Article

Basal implants: A safe and effective treatment option in dental implantology

Dr. Sigmar Kopp
Niklotstr. 39
DE-18273 Güstrow
sigmar.kopp@implantfoundation.org

Abstract

The purpose of this four years study was to report on the outcomes after using a basal implant design for treating patients especially with poor quality and quantity of bone under immediate load conditions. From May 2003 to end of April 2007, 88 consecutive patients receiving 302 BOI®-implants were enrolled in this study. No patients seeking implant treatment were turned away for any reason nor got screw type implants. The mean age at implant surgery was 50.1 years. All 88 patients and their implants were accounted for at the end of the follow-up period. All but one implant underwent immediate loading. Even in cases of severe bone atrophy, no augmentations were performed. We found a 95.7% implant survival rate among this consecutive group of patients with varying degrees of bone quality and quantity. All patients received a fixed temporary or permanent bridge within 24 hours after the implant procedure. All patients continued to possess fixed dentures, so the prosthetic outcome is 100%. Basal implants used for single tooth replacement showed the lowest survival rate (90.9%), but this was result of specific overload. No other patient or implant related characteristics were found to be associated with a failure rate over 7%. The clinical application of basal implants is safe and effective and useful in a broad range of indications with immediate loading protocols and without the need for invasive, costly, and time consuming bone augmentation procedures.

Keywords

Basal implants, implant survival, immediate loading, poor bone, BOI, basal implants

Introduction

Survival rates for conventional dental implant systems are relatively high in normal healthy bone.1 However, there are subgroups of patients that are at an increase risk of implant or treatment failure. In particular, patients with reduced quantity or quality of bone present a significant challenge to the dental implantologist and have higher rates of implant failure (2-6). Disease, congenital anodontia, trauma, or atrophy due to the aging process leads to this poor quality or quantity of bone.

A lack of physiological forces in fully- or partially edentulous patients often leads to a decrease in the residual alveolar ridge. Dental implants may help to preserve bone due to their positive load-related effects on the jawbone surrounding the implant; hence, appropriate solutions should be explored and discovered to facilitate this process in these challenging patients (7,8).

The management of poor bone with root-form dental implants typically requires additional or augmentative procedures to ensure sufficient

stability, even if there are newer developments like Osseopore®, a short conical implant design with sintered surface. Most of these short vertical integrated implants require a long functionless healing period. Bone augmentation may be necessary through procedures such as grafting, transplanting, or more novel therapies including augmentation of bone combined with substitutes and/or morphogenetic proteins (9). So all these methods typically add treatment steps to the procedure, delay loading, and increase the total risks and costs.

With basal implants (BOI®-brand of Dr. Ihde Dental AG, Switzerland) we avoid augmentation and reopening, have immediate function and generally do implantation simultaneously with the extraction, so these advantages make a study expedient.

Methods

Subjects

From May 2003 to April 2007, 88 consecutive patients (55.7% female) receiving 302 basal implants (mean = 3.4 per person; SD=2.8; median = 2.0: range, 1 – 16) and 129 prosthetic constructions thereon were enrolled in this study. All patients seeking implant treatment have been treated by BOI® only and included in the study. The surgical and prosthetic treatments were all performed by the same clinician. The mean age at implant surgery was 50.1 years (SD=14.1; range: 16 to 80 years).

Implants

Titanium basal implants consist of a cylindrical part and a larger, cortically anchored base plate. Unlike the traditional root-form implants (i.e., screw and blade implants), which are inserted vertically and primarily designed to be supported by trabecular bone, these implants are inserted from the lateral aspect of the host bone providing multicortical support. Hence, are commonly called “disk” or “lateral” or “basal” implants. BOI® implants possess one to three very pronounced „threads“ or “base-plates”, which are securely anchored in the cortical bone, a bone area which is more stable during the remodeling/resorption process and which can respond successfully to immediate loading protocols, Figures 1, 2, 3. BOI® implants allow for the favorable distribution of masticatory loads to the cortical regions. The site of force transmission is far away from the site of bacterial invasion allowing for early loading and resistance to infection. This, as well as the thin smooth shaft, may be a reason for their observed and reported equal success in smokers as in non smokers.

While we used 11 different implant types in this series of patients with varying shaft lengths, they can be basically categorized in two major groups: BOI® with single base plates and more than one base plate (up to three). The majority of the patients who received a single disk were those with poor available vertical bone especially in the distal jaws. But the atrophic bone in this area is frequently broad, which is ideal indication for basal implants due to their lateral placement, Figures 2-5. In a few cases (N=12; 4%), the residual cavities after teeth or implant displace-

ment were so large, that it seemed appropriate to fill them with synthetic material (Nanobone® - brand of Artoss® GmbH, Germany).

Data Analysis

Descriptive statistics were calculated for baseline variables. The primary outcome of interest was implant failure defined as any reason for having to remove an implant. Survival was based on the period from implant placement to final follow-up. Because BOI® implants are immediate load implants, it was not possible to distinguish between a "healing" phase and a "loading" phase and especially in circular restorations all implants were loaded under full masticatory loads. All failures were counted immediately if they were observed. The log-rank test was used to test statistical significance comparing survival rates among risk factors.

Results

Patients were followed for a mean of 637 days (Median=540; SD=427; range: 27 - 1472 days). Because we found the highest loss rate in the first days (~4.4% when including the first month and up) and to show the tendency in survival rates, we included the youngest cases with short follow up time. The survival rate increases by time in situ up to 100% for three years and more. None of the patients disappeared or dropped out of the series reported here for any reason. Of the 302 implants, 162 (53.6%) were placed in the upper jaw and 140 (46.4%) in the lower jaw. Subantral, the distal lower jaw and often subnasal are regions with poor bone. Here were 189 (62.6%) implants inserted. 157 implants (52%) were inserted into fresh alveoli of extracted teeth or crestal and basal implants (N=20; 6.6%). Of all implants 156 (51.7%) were single disks and 146 (48.3%) were multiple disks (> 1 disk). Shaft height used was primarily 8mm (58.6%). Due to our broad inclusion criteria, we placed between 1 and 16 per patient (Mean= 3.4; Median=2), but no more than 8 each jaw. Prosthetic classes included single crowns, linear bridges on teeth and implants, or on implants only, as well as circular bridges on mostly four implants. With the exception of one implant which underwent closed healing, remaining implants (99.7%) were loaded immediately or within the first 24 hours after the implantation. Fixation of the permanent prosthetic construction followed after surgery (Mean=47; SD=30.6; Median=44; range 0-156 days). Thirteen implants failed (Mean=391; Median=432; SD=273; range 41- 841 days) during the follow-up period giving an overall survival rate of nearly 96%.

The survival curve for the entire series of implants is shown in Figure 6. Survival rates stratified by different factors are shown in Table 1. The number of base plates induced a significant ($p<0.05$) difference in survival rates of 1.7%. Only in the single crown group a higher but non-significant failure rate was observed (9.1%). There were no implant failures in the implant groups longer than three years in situ set subnasal used in combination with Nanobone®, or when fixed horizontally by bone screws, Table 1.

All patients in this series continue to maintain healthy fixed crowns or bridges giving a prosthetic success rate of 100%.

Discussion

We found a nearly 96% implant survival rate among a consecutive series of 88 patients receiving 302 BOI® implants and fixed dentures with varying degrees of bone quality and quantity. The only statistically significant factor on success we found, is implant design ($p<0.05$). The survival rate in multiple disk implants (96.6%) is 1.7% higher than in those with single disk (94.9%). This confirms clinical observations, because multiple disks will be used in higher but narrow bone ridges, single disk implants when vertical bone loss is extreme, so leverage differences are obvious. Patients who received a single crown had the lowest survival rate (90.9%; $p>0.05$). Here were two failures among 22 implants, but these suffered from non-physiological, uncompensated forces. No other patient or implant related characteristics were found to be associated with a failure rate over 7%. The non-significant difference in bone status results brings a strong evidence for immediate placing of basal implants. So even post extraction healing periods can be avoided.

There are limitations to the present study. While we were all inclusive and did not turn any patients away who desired implants, we did not quantify bone quantity and quality. Had we done this, we feel we would make an even stronger case for the use of BOI® implants in patients with poor bone, Figures 3-5. However, we did report a similar rate of survival among patients who received single-disk implants (94.9%) versus multi-disk implants (96.6%). Patients who received single-disks generally had very little vertical bone available and therefore this group may serve as a surrogate for patients with poor vertical bone, as well as the difficult regions (95.2%), Table 1. We have only placed basal implants in our practice during the observation period and therefore a direct comparison to traditional root-form implant is not possible. This is a case series and can only be compared to historical publications; however, our survival rates are very similar to those found in the literature.

The strengths of this study are many. Since we did not exclude any patients who presented to our clinic, even those send away by colleagues, we feel that our findings are generalizeable. Even patients who typically may be turned down due to poor bone quality or recommended to receive bone augmentation procedures, are smoking or show periodontal involvement are, according to our findings, good candidates for basal implants. This is a consecutive series of patients and hence does not represent a convenience sample or select group.

Diskimplants® are similar in form and function to BOI® implants and have reported rates of successful osseointegration of ≥ 97% with relatively long follow-up periods. Scortecci performed a prospective case series of 783 implants (627 Diskimplants®), placed in 72 patients with completely edentulous maxillae using an immediate load protocol. Follow-up ranged from 6 – 48 months. At 6 months, 98% of implants were osseointegrated, with all fixed prostheses remaining functional during the study period.10 Scortecci combined crestal and basal implants, which makes it difficult to distinguish between the merits of basal and crestal implant

designs. Our study shows that basal implants by themselves are safe and effective.

Ihde and Mutter performed a retrospective case series of 275 BOI® implants in 228 patients over a period of five years. Molars were replaced with BOI® implants in combination with natural abutments. Osseointegration was achieved in 254 implants at final follow-up. Fifteen implants were lost (11). This study shows that basal implants work well in combination with natural abutments.

Donsimoni et al performed a retrospective case series evaluating 1352 consecutive basal implants placed over a 10 year period in 234 circular bridges (12). Osseointegration was achieved in 97%. Of the 41 implants that failed, 25 had to be replaced. Only one full upper bridge had to be permanently removed rendering a clinical success of 99.9%. Interestingly, smokers and non-smokers experienced similar rates of implant losses. This may indicate that smokers, reported as having a higher risk of implant loss in conventional implants (14), may benefit from BOI® implant treatment. Donsimoni et al used only basal implants in their study, however they inserted a greater number of basal implants per jaw (up to 12) compared to us (<= 8). Nevertheless the results presented in this article match well with our findings.

The found missed influence of patient's age, sex, and the time of placement of the implant after tooth extraction correlated with Haas et al (18).

The better survival rate in implants longer in situ comes from their survival of initial threats as possible infections, malocclusions and surgical and prosthodontic mistakes. A similar result is found in literature, where the secondary bone loss like crater in crestal implants begins about eight years after implantation (19). Checkup of this cohort about ten years after implantation may bring significant findings regarding the implant loss after functional use.

Conclusion

The standard procedure for placing basal implants includes one surgery followed by immediate loading, thus reducing time, cost, and stress to the patient (10,14-17). With the emphasis on lateral rather than vertical placement, preimplantological bone augmentation was never necessary. Estimated decrease in cost treatment time is ~ 50%16. There is no hospital residence needed, no time period without proper masticatory function, no second surgery. Complications associated with basal implants are rare and have proven to be easy to handle. The clinical application of BOI® implants is safe and effective and useful in a broad range of indications.

References

1. Gapski R, Wang HL, Mascarenhas P and Lang NP: Critical review of immediate implant loading. Clin Oral Implants Res. 14: 515-27, 2003.
2. Becker W, Hujoel PP, Becker BE and Willingham H: Osteoporosis and implant failure: an exploratory case-control study. J Periodontol. 71: 625-31, 2000.
3. Blomqvist JE, Alberius P, Isaksson S, Linde A and Hansson BG: Factors in implant integration failure after bone grafting: an osteometric and endocrinologic matched analysis. Int J Oral Maxillofac Surg. 25: 63-8, 1996.
4. Bryant SR and Zarb GA: Outcomes of implant prosthodontic treatment in older adults. J Can Dent Assoc. 68: 97-102, 2002.
5. Rocci A, Martignoni M and Gottlow J: Immediate loading of Branemark System TiUnite and machined-surface implants in the posterior mandible: a randomized open-ended clinical trial. Clin Implant Dent Relat Res. 1: 57-63, 2003.
6. Truhlar RS, Morris HF and Ochi S: Implant surface coating and bone quality-related survival outcomes through 36 months post-placement of root-form endosseous dental implants. Ann Periodontol. 5: 109-8, 2000.
7. Sanfilippo F and Bianchi AE: Osteoporosis: the effect on maxillary bone resorption and therapeutic possibilities by means of implant prostheses–a literature review and clinical considerations. Int J Periodontics Restorative Dent. 23: 447-57, 2003.
8. von Wowern N: General and oral aspects of osteoporosis: a review. Clin Oral Investig. 5: 71-82, 2001.
9. Boyne PJ, Lilly LC, Marx RE, Moy PK, Nevins M, Spagnoli DB and Triplett RG: De Novo Bone induction by recombinant human bone morphogenetic protein-2 (rhBMP-2) in maxillary sinus floor augmentation. J Oral Maxillofac Surg. 63: 1693-707, 2005.
10. Scortecci G: Immediate function of cortically anchored disk-design implants without bone augmentation in moderately to severely resorbed completely edentulous maxillae. J Oral Implantol. 25: 70-9, 1999.
11. Ihde S and Mutter L: Versorgung von Freiend-Situationen mit basal osseointegrierten Implantaten (BOI) bei reduziertem ver tikalen Knochenangebot. Dtsch Zahnärztl. Zeitschr. 58: 94-102, 2003.
12. Donsimoni JM, Dohan A, Gabrieff D and Dohan D: Les implants maxillofaciaux a plateaux dassise. Implantodontie. 13: 217-228, 2004.
13. Liran L and Schwartz-Arad D: The effects of cigarette smoking on dental implants and related surgery. Implant Dentistry. 14: 357-361, 2005.
14. Ihde SK: Fixed prosthodontics in skeletal Class III patients with partially edentulous jaws and age-related prognathism: the basal osseointegration procedure. Implant Dent. 8: 241-6, 1999.
15. Ihde S: Restoration of the atrophied mandible using basal osseointegrated implants and fixed prosthetic superstructures. Implant Dent. 10: 41-5, 2001.
16. Ihde S and Eber M: Case report: Restoration of edentulous mandible with 4 boi implants in an immediate load procedure. Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub. 148: 195-8, 2004.
17. Ihde S: Principles of BOI. Springer Berlin Heidelberg New York ISBN 3-540-21665-0, 2005
18. Haas R, Mendorff-Pouilly N,Mailath G, Bernhard T: Five-year results of maxillary intramobile Zylinder implants. Br J Oral Maxilofac Surg, 36,2,123-8, 1998
19. Ihde S, Konstantinovic V: Comparison and definition of the pathological phenomena occurring after a tooth replacement and the possible therapeutic stages implying basal and crestal implants, Implantodontie, 14, 176-185, 2005

Implants	Implanted	%	Survival N	%	Sig.* p-value
Over all	**302**	**100**	**289**	**95.7**	
Time in situ					
30 days and more	297	98.3	284	95.6	
60 days and more	266	88.1	255	95.9	
90 days and more	253	83.8	143	96	
180 days and more	252	83.4	242	96	
1 year and more	197	65.2	190	96.4	
2 year and more	103	34.1	101	98.1	
3 year and more	49	16.2	49	100	
Bonestatus (placed into)					**.671**
Healed bone	145	48	138	95.2	
Fresh alveoli: of teeth/implants	157	52	151	96.2	
of implants only	20	6.6	20	100	
Gender					**.139**
Female patients	156	51.7	151	96.8	
Male patients	146	48.3	138	94.5	
Jaw					**.519**
Upper jaw	162	53.6	154	95.1	
Lower jaw	140	46.4	135	96.4	
Localization					**.576**
Sub nasal	29	9.6	29	100	
Sub antral	76	25.2	71	93.4	
Distal lower jaw	84	27.8	80	95.2	
Summation difficult bone areas	**189**	**62.6**	**180**	**95.2**	
Upper canine & 1st premolar	57	18.9	54	94.7	
Between foramina in lower jaw	56	18.5	55	98.2	
Summation difficult bone areas	**113**	**37.4**	**109**	**96.5**	
Implant design					**.043**
Single disks	156	51.7	148	94.9	
Multiple disks	146	48.3	141	96.6	
Shaft height in mm (range 3-11)					**.567**
< 8	82	27.2	78	95.1	
= 8	177	58.6	169	95.5	
> 8	43	14.2	42	97.7	
Prosthetic class					**.350**
Crown on implant	22	7.3	20	90.9	
Segmental bridge on implants only	58	19.2	54	93.1	
Bridge on implants with teeth	56	18.5	54	96.8	
Circular bridge on implants only	166	55	161	97	
Added by Nanobone®	**12**	**4**	**12**	**100**	
Initially fixed by osseous fixation screw	**6**	**2**	**6**	**100**	
Loaded immediately (within 24h)	**301**	**99.7**	**289**	**95.7**	

*Log-rank test (Mantel-Cox)

Figure 1. Typical BOI® shapes representing single, double and triple base-plate designs as well as three different supra structure connectors as external thread connection, integrated abutment and external octagon connector with internal screw (ITI-compatible).

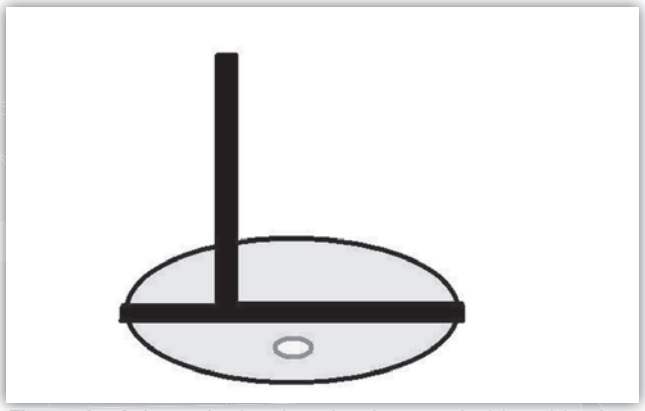

Figure 2. Schematic drawing showing a typical basal implant after trans-osseous insertion in the distal mandible. This implant was inserted from the right side, achieving a bi-cortical support.

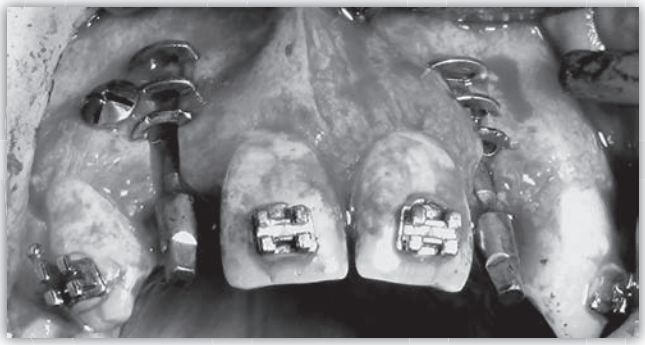

Figure 3. A typical patient with congenital anodontia and therefore a thin bone ridge is treated with BOI® in an immediate loading protocol. The right 2nd incisor implant was primarily fixed by a osseous fixation screw. (Published with the patient`s

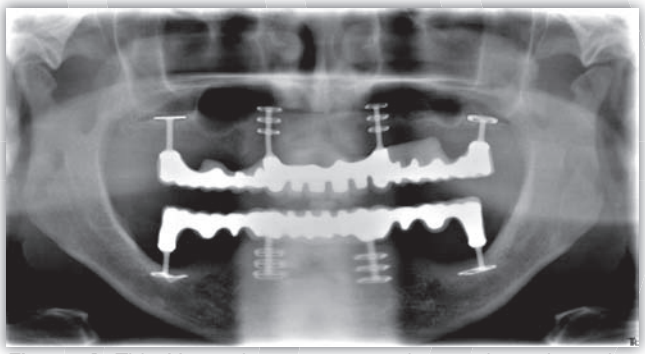

Figure 4. This X-ray shows an exemplary male patient nine months post surgery, where five residual teeth and removable dentures were replaced with two bridges on eight BOI® in strategic position. The atrophic distal jaws are excellent regions for BOI®. (Published with the patient`s consent)

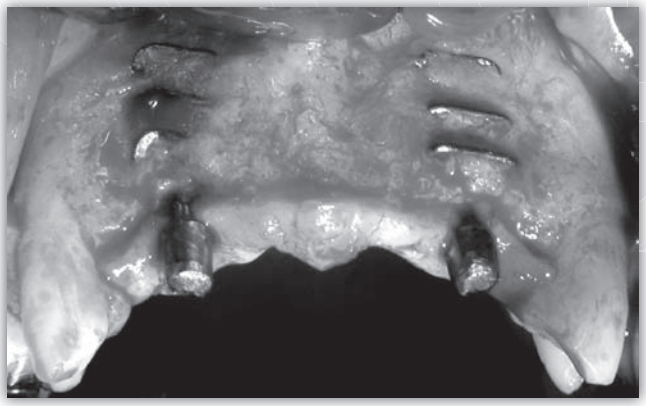

Figure 5. Open implant region nearly one year after Implantation. The reopening was necessary, because the implants were bent forward by artificial forces by this male patient, the osseointegration did not suffer any harm. Two BOI®s were added between the existent ones and a new bridge was fixed. (Published with the patient`s consent)

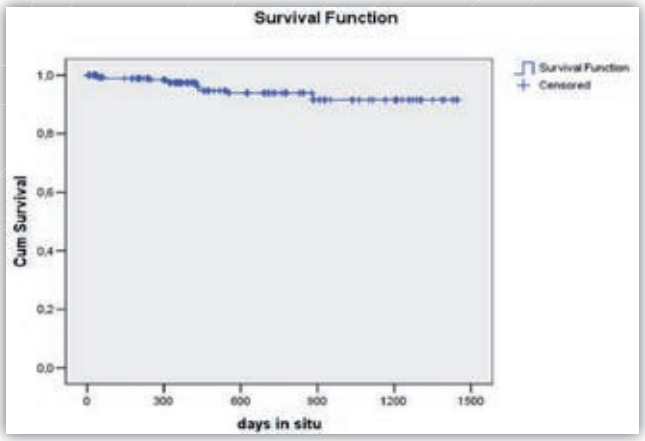

Figure 6. Kaplan-Meier survival curve for all implants in this consecutive case series.

Educational Video Series

Maxillary Implant Placement

1 Crestal & Basal Implants
Order Nr. 6667

2 Replacing Replace®
Order Nr. 6669

Each DVD contains approx. 20 minutes of oral surgery.With explanations in english and german language.

j 35,00

Please send your order via e-mail to:
publishing@implantfoundation.org
www.implantfoundation.org

or via regular postage mail to:

Guide for Authors

ID publishes articles, which contain information, that will improve the quality of life, the treatment outcome, and the affordability of treatments.
The following types of papers are published in the journal:
Full length articles (maximum length abstract 250 words, total 2000 words, references 25, no limit on tables and figures). Short communications including all case reports (maximum length abstract 150 words, total 600 words, references 10, figures or tables 3) Technical notes (no abstract, no introduction or discussion, 500 words, references 5, figures or tables 3). Interesting cases/lessons learned (2 figures or tables, legend 100 words, maximum 2 references).

Literature Research and Review articles are usually commissioned.
Critical appraisals on existing literature are welcome.

Direct submissions to:
publishing@implantfoundation.org.
The text body (headline, abstract, keywords, article, conclusion), tables and figures should be submitted as separate documents. Each submission has to be accompanied by a cover letter. The cover letter must mention the names, addresses, e-mails of all authors and explain, why and how the content of the article will contribute to the improvement of the quality of life of patients.