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Disclaimer

Welcome to second issue of CMF Implant directions in 2007!

There's still a human being behind every computer

If I think about what impressed me most at IDS Cologne, as an oral implantologist, it was certainly the enormous amount of time and energy spent on hailing computerized procedures as the gateway to an apparently all-new implantological era. Technically assisted medicine is bound to win the competition, that much is certain. But behind every computer-controlled contraption there will still be a human being in the end. And that is reassuring.
As medical and dental practitioners, we are forced to deal with this development, yet there is no one asking us about the real point of the exercise.

Surgical drilling stents, for example, designed on the basis of CAT scans, appear as the dernier cri in present-day implant technology. That a whole set of short-term implants is required merely to secure these stents in the edentulous jaw is being meekly accepted – and it seems to be only a matter of time before the entire skull will be jammed into a vice to obtain a high-tech precision bore. Because that is the only thing that counts: precision drilling direction and precision drilling depth.
But that a drill may also run off in a different direction all by itself as it passes through the bone – and that not even the most sophisticated drilling sleeve can prevent this – is being ignored, because what can't be, can't be.
And any implantologist who has drilled at least 100 holes into various jawbones knows that these cases are not all that uncommon.
Well, the engineers, or more specifically the engineers of the future, are bound to solve this problem as well. Of course it would be preferable if the cloned patients of the future hat prefabricated threads for drilling stent screws embedded in their genetic code.
But until then, we won't be able to avoid collecting a little bit more in terms of empirical data, as in the present issue discussing appropriate implant diameters and lengths.

The point is that, despite all the high-tech glitter and glare at IDS Cologne, most participants at training courses ask very simple yet highly relevant questions. This is the day-to-day reality in oral implantology, which is unfortunately characterized by constantly shifting «religions», simply because we still have far too few randomized clinical studies.
For example, the statement was made on the occasion of the 10th BDIZ EDI symposium in Munich that smaller implants should be preferred to larger implants, in order not to interfere with the nutrient supply of the surrounding tissues. Certainly a reasonable approach.

However, if the field had followed the experience of implant pioneers such as Prof. Ernst Bauer, this statement could have been made as early as 20 years ago. At the time, however, that wasn't the state of the art, and implants were developed with diameters of 5.5 and even 6.5 mm – with a failure rate to match.

As we can see, there are still tremendous rifts in the communication between the different implantological religions. It would be a rewarding task for future scientists to fill these rifts with appropriate neutral studies, such as one would expect. It doesn't seem all that much too early to learn from almost 40 years of experience and to refine it based on modern technology – without resentment and without blinkers.

We do not always have to devour to the most recent technological fads. We should not forget what we know about the simple facts of oral implantology as they have emerged in many decades now. One of the favourite sayings of nuclear scientist Heisenberg was that simplicity is a sign of truth. I totally agree. But I still signed up for a course on the new surgical stent technology... You never know.

Best regards,

Dr. Werner Mander
(Editor in chief)

Typical contents in ID

- **Evidence Reports** summarize the latest «Hot Topics» from relevant journals putting similar studies «side-by-side». This unique presentation of studies allows you to compare and contrast the patient populations, the treatment interventions, and the quality of the scientific methods. The «evidence-based bottom line» is presented with an overall summary statement at the beginning. Clinical notes by implantologists with special expertise on the topic complete the Evidence Report by providing their expert clinical opinion. **ID** is an implantology publication that provides attention to detail in balancing science with clinical opinion in such a clear, concise, and visually-friendly presentation.

- **Literature Analyses** provide you with an in-depth look at the research on a given topic. A «Literature Analysis» is a critical review of the literature on the epidemiology, treatment methods, and prognosis for implant-related topics or conditions. Literature Analyses are broader than «Evidence Reports» and are written to serve as a reference tool for implantologists to help them make decisions regarding how to manage patients, to assist them in evaluating needs for future research, and to use the material for future presentations.

- **Critical Appraisals** summarize the findings from important papers used for clinical decision making or marketing by implant companies. In addition to the summary, the study's methods and clinical conclusions are critically reviewed in an effort to challenge the implantology community into not accepting everything that is published, while fostering alternative explanations and ideas.

- **Research in Context** is a helpful «what is» section to consult if you've ever read a study and asked «what is a p-value» or any other research method question. It assists clinicians with the critical evaluation of the literature by briefly describing relevant aspects of research methods and statistical analysis that may bias results and lead to erroneous conclusions.

Evidence Report

Effect of width and/or length of dental implants on implant survival and complications

Summary

Cumulative survival rates were greater for standard- compared to narrow-width dental implants. One study found better survival rates in standard- compared to wide-width implants. Cumulative survival rates were also greater for long- compared to standard- compared to short-length dental implants. There were no statistically significant differences for periotest values or marginal bone loss between standard- and narrow-width implants. Longer implant length resulted in improved stability, as determined by periotest values.

Additional methodologically rigorous comparative studies are needed to better evaluate the effects of width and/or length of dental implants.

Sampling

A MEDLINE search was performed between January 2000 and January 2007 to identify recently published studies examining the effect of width and/or length of dental implants upon treatment outcomes. From a list of 67 articles, 7 evaluated the treatment comparison of interest. Of these, 4 articles included outcomes on implant survival and are included in this report

Studies

Study 1

Romeo E, Lops D, Amorfini L, Chiapasco M, Ghisolfi M, and Vogel G (2006)

Clinical and radiographic evaluation of small-diameter (3.3-mm) implants followed for 1-7 years: a longitudinal study.

Clin Oral Impl Res 17:139-48.

Study 2

Artzi Z, Carmeli G, and Kozlovsky A (2006)

A distinguishable observation between survival and success rate outcome of hydroxyapatite-coated implants in 5-10 years in function.

Clin Oral Impl Res 17:85-93.

Study 3

Shin S-W, Bryant SR, and Zarb GA (2004)

A retrospective study on the treatment outcome of wide-bodied implants.

Int J Prosthodont 17:52-8.

Study 4

Winkler S, Morris HF, and Ochi S (2000)

Implant survival to 36 months as related to length and diameter.

Ann Periodontol 5:22-31.

Objective

To critically summarize the recently published literature examining implant survival and other outcomes in studies that compare dental implant width and/or length in the same patient populations.

Common Outcome Measures

- Implant survival
- Periotest values
- Marginal bone loss

Interventions

Dental implants were placed and were described with respect to length and/or width as follows:

- 68 patients were treated with 122 small diameter (3.3mm) titanium ITI implants, and 120 patients received 208 standard diameter (4.1mm) implants [Romeo]
- 248 HA-coated implants were placed in 62 patients and were evaluated in regards to implant length (8-, 10-, 13-, or 15-mm) and width (3.25- or 4.0-mm) [Artzi]
- 64 wide implants placed consecutively in posterior jaws and matched with 64 regular width implants placed in posterior jaws [Shin]
- 2917 implants were placed in partially or completely edentulous jaws and were compared with respect to implant length (7-, 8-, 10-, 13-, or 16-mm) and width (3- or 4-mm) [Winkler]

Table 1: Comparative studies evaluating width of dental implants

Author (year)	Study Design	Population	Diagnostic Characteristics	Treatment			Follow-up	LoE†
				Narrow	Standard	Wide		
Romeo (2006)	Prospective cohort	N =188 female: 56 % age: 55.8 (21-74) years	Partially endentulous jaws	n=122 implants, 3.3mm	n=208 implants, 4.1mm	N/A	7 years: NR*	III
Artzi (2006)	Prospective cohort	N =62 female: 67.7 % age: 56.5 (26-80) years	Partially or completely endentulous jaws	n=149 implants, 3.25mm	n=99 implants, 4.0mm	N/A	5-10 years: NR*	III
Shin (2004)	Retrospective cohort	N = 57 pts female: NR* age: wide=50.7 (23-77) years; regular=50.9 (17-77) years	Partially edentulous jaws; at least one implant in posterior jaw	N/A	n=64 implants, 3.75 or 4mm diameter Branemark	n=64 implants, 5mm diameter Branemark	5 years: NR*	III
Winkler (2000)	Prospective cohort	N = NR (2917 implants) female NR age: NR	Partially or completely endentulous jaws	N=2695 implants, 3mm diameter	N=222 implants, 4mm diameter	N/A	3 years: NR*	III

* NR (not rated) = for follow-up rate either not reported or precise follow-up rate could not be determined since the initial number of eligible patients or number lost to follow-up were not provided

† Level of Evidence (LoE) is based on study study design and methods. I = highest level; IV = lowest level.

Table 2: Comparative studies evaluating length of dental implants

Author (year)	Study Design	Population	Diagnostic Characteristics	Treatment			Follow-up (%)	LoE†
				Short	Standard	Long		
Artzi (2006)	Prospective cohort	N=62 female: 67.7 % age: 56.5 (26-80) years	Partially or completely endentulous jaws	n=16 implants, 8-mm	n=73 implants, 10-mm	n=159 implants, ≥13-mm	5-10 years: NR*	III
Winkler (2000)	Prospective cohort	N = NR (2917 implants) female NR age: NR	Partially or completely endentulous jaws	n=181 implants, ≤8-mm	n=770 implants, 10-mm	n=1966 implants, ≥13-mm	3 years: NR*	III

* NR (not rated) = for follow-up rate either not reported or precise follow-up rate could not be determined since the initial number of eligible patients or number lost to follow-up were not provided

† Level of Evidence (LoE) is based on study study design and methods. I = highest level; IV = lowest level.

Table 3. Evaluation of articles examining width and/or length of dental implants

Methodological Principle	Romeo (2006)	Artzi (2006)	Shin (2004)	Winkler (2000)
Study Design				
Randomized controlled trial				
Cohort study	◊	◊	◊	◊
Case-series				
Statement of concealed allocation*				
Intention to treat*				
Independent or blind assessment				
Complete follow-up of >85 %				
Adequate sample size	◊	◊	◊	◊
Controlling for possible confounding	◊		◊	◊
Level of Evidence	**III**	**III**	**III**	**III**

*** Applies to randomized controlled trials only**

Results

Implant survival by width (Figure 1)

- Cumulative survival rates were greater for standard- compared to narrow-diameter implants in all studies reviewed [Romeo, Artzi, Winkler], and this difference was statistically significant for implants evaluated at 3 years (97.7 % versus 92.7 %, respectively p<.05) [Winkler] and 10 years (96.5 % versus 90.3 %, p<.05) [Artzi].

- One study reported significantly higher survival rates in standard-compared to wide-diameter implants after 5 years (96.8 % vs 80.9 %), respectively p<.05). The risk of overall implant failure was increased approximately 4 times for every 1 mm increase in implant width (diameter) [Shin]. Note that this result is valid only for the chosen implant design. It can not be transfered i.g. to basal implants, where the diameter of the vertical part is only 1.9 - 2.3 mm.

Implant survival by length (Figure 2)

Cumulative survival rates were significantly greater for long (≥ 13 mm long) compared to standard (10 mm long) compared to short (≤ 8 mm long) implants (p<.05) [Artzi, Winkler].

Periotest values*

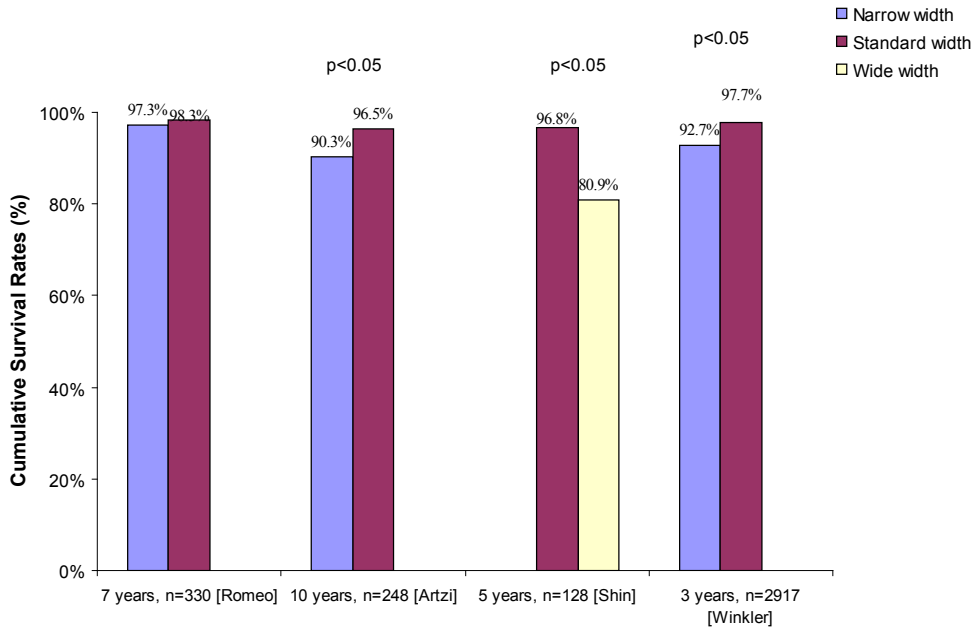
- No statistically significant differences were found for periotest values between the narrow- and standard-width implant groups at three years (mean -3.4 ± 3.0 versus -4.0 ± 2.4; respectively p>.05) [Winkler]. Further, no significant differences were found at seven years in the maxilla (median -4.6 ± 1.1 versus -4.8 ± 0.8; respectively p>.05) or the mandible (median -5.6 ± 0.8 vs. -5.9 ± 1.0, respectively p>0.05) [Romeo].
- Longer implant length resulted in improved stability, as determined by periotest values (p<.05) [Winkler].

Marginal Bone Loss

No statistically significant differences in marginal bone loss were observed between narrow- and standard-width implants at three years (mean -.69 ± 1.6mm versus -.79 ± 1.6mm, respectively p>.05) [Winkler] or seven years (mean 1.5 ± 1.5mm versus 1.4 ± 1.1mm, respectively p>.05) [Romeo].

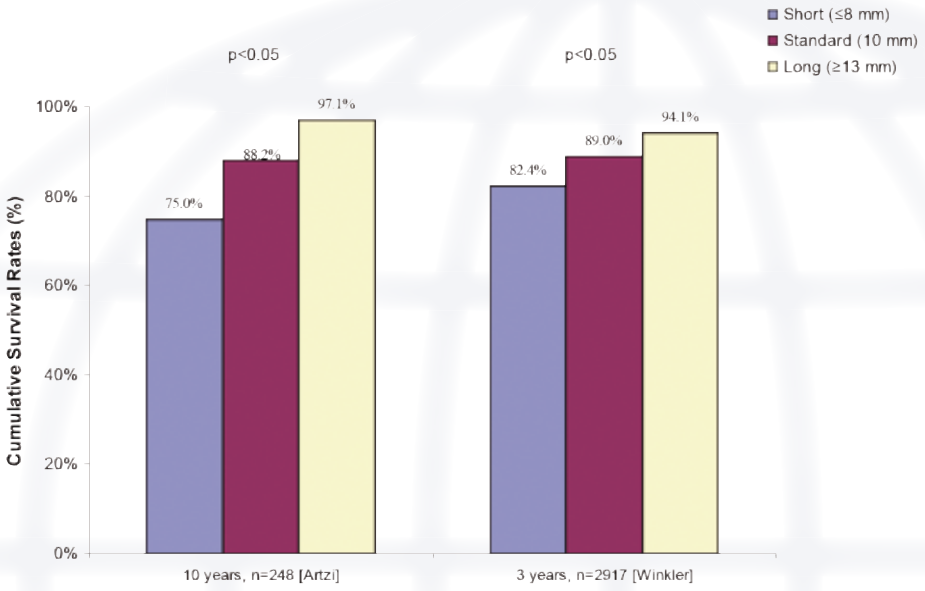
*Periotest values: A technique used to evaluate osseointegration of dental implants. Implants are considered osseointegrated when periotest values range from -7 to 0, non-integrated when periotest values are over +6, and borderline when periotest values range from 0 to +5. Some authors consider periotest values to be not relyable and the test seems to be difficult to reproduce.

Figure 1. Cumulative survival rates for dental implants by width*



Statistical significance noted on graphs if provided by author
* n=number of implants

Figure 2. Cumulative survival rates for dental implants by length*



* Statistical significance noted on graphs if provided by author
n=number of implants

Methodological considerations

- All studies reviewed were level of evidence (LoE III) studies. No high quality randomized trials (LoE I) or good quality cohort studies (LoE II) were identified in the literature.

- Since multiple implants in the same subject are not statistically independent, either one implant should be chosen per patient or statistical analysis should account for multiple implants per patient. None of the studies reviewed accounted for multiple implants in the same subject.

- None of the studies reported a follow-up rate or provided data adequate enough to calculate the follow-up rate. A follow-up rate of ≥85 % is necessary to ensure valid study results.

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Implant Directions

Editor: Dr. Werner Mander
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Literature Analysis «Poor Bone» Part I

A «Literature Analysis» is a critical review of the literature on the epidemiology, treatment methods, and prognosis for implant-related topics or conditions. Literature Analyses are broader than «Evidence Reports» (also published in each issue of Implant Directions) which focus on one specific treatment intervention by comparing and contrasting only 3 to 5 high quality articles in greater depth.

Literature Analyses are written to serve as a reference tool for implantologists:

- *To help them make decisions regarding how to manage patients;*
- *To assist them in evaluating needs for future research;*
- *To use the material for future presentations.*

Introduction

Overall success rates of dental implants, generally defined as lack of mobility, pain, pathologic problems or crestal bone loss[1], appears to be high, with implant failure rates reported as low as 7.7 % over one 20-year review period.[2] However, there are subgroups of patients that are at an increase risk of implant failure. In particular, patients with poor quantity or quality of bone present a significant challenge to the dental implantologist. Patients who present for dental implant procedures with «poor» or «compromised» bone present a significant challenge to the dental implantologist. Disease, trauma, or atrophy due to the aging process or radiation therapy leads to low quality or quantity of bone. Such changes in bone require careful attention and appropriate implants to achieve acceptable success rates.

Aging and decreased estrogen levels have a negative influence on both tooth retention and residual alveolar crest preservation.[3] Osteoporotic effects are more pronounced in the maxilla than the mandible, with implant failure rates reported at three times higher in the maxilla than the mandible.[4 - 6] Even in the healthy jaw, maxillary bone consists of more trabecular bone than the mandible, with a thinner or absent cortical plate that may be less able to support an implant.[6] However, cortical bone is more susceptible to the effects of osteoporosis, compounding problems of bone quality in the mandible under osteoporotic-like conditions.[5]

The presence of poor bone requires alternative approaches to conventional implant placement. Bone augmentation may be necessary through procedures such as grafting or more novel therapies including bone morphogenetic proteins.[7] We discussed the limitations of bone augmentation in the last two issues of «CMF Implant Directions» [Vol 1, No.1, 12/2006 and Vol 2, No.1, 3/2007]. Zygomatic implants are in some cases an alternative to bone augmentation [8], however their oral penetration region usually lies in the palatal side of the alveolar crest. This makes this therapy difficult to accept for many patients.Conclusions regarding the best choice of implant are difficult to make as relatively few studies have been carried out comparing different types of implants within the same study. In studies of low-density bone, Branemark

implants in the mandible and maxilla have shown failure rates of 2 - 15 %.[5] An implant of >10mm length appears to be the most successful when using root-form implants requiring sufficient bone to support the length of the implant. Therefore, most conventional methods for treating patients with - poor - bone require additional procedures, delayed loading and increased patient costs.

Several questions exist when considering implant therapy in patients with «poor» or «compromised» bone including the following:

- *Are patients with poor bone at greater risk of implant failure than patients with «normal» bone?*
- *Are some anatomical areas at greater risk of failure if they possess poor bone?*
- *What are the current methods for providing dental implants in patients with poor bone?*
- *What are limitations of these methods?*
- *Are some implants more effective than others in treating patients with poor bone?*
- *Are there other methods that have not been fully reported or investigated that may be more advantageous in providing implants for patients with poor bone?*

The purpose of this Literature Analysis was to critically search the literature to try and answer these questions using clinical studies that included patients with and without - poor - bone. Part I will be presented in this issue of Implant Directions and will address the following objectives:

Define the following bone related conditions as they relate to dental implantology:

1. **Define** poor bone quantity
2. **Report** poor bone quality
3. **Describe** osteoporosis
4. **Evaluate** bone density

Report the types of implant «failure» associated with patients with poor bone.

- Describe the current methods available for treating patients with poor bone.
- Evaluate the association between poor bone and dental implant failure.

Part II will be presented in the next issue of CMF Implant Directions and will address the following objectives:

- Evaluate the efficacy of various dental implant methods for treating patients with poor bone
- Review studies evaluating basal implants, e.g. BOI®
- Provide justification for BOI® implants as a solution for treating patients with poor bone while allowing immediate loading
- Summarize the findings on «poor bone» from both Part I and Part II of this Literature Analysis

Search Strategy

MEDLINE was searched to identify studies reporting data on patients with and without poor bone who received dental implants (Table 1). There was no restriction on year published. An attempt was made to identify studies of high

methodological quality (systematic reviews, RCTs and cohort studies) comparing poor bone to good bone in patients receiving dental implants. The following strategies were employed to identify literature that would address the mentioned objectives:

First strategy: Identify review articles discussing challenges treating patients with poor bone using dental implants.

Second strategy: Identify review articles describing the current methods of management and their outcomes in treating patients with poor bone using dental implants.

Third strategy. Identify studies or meta-analyses specifically designed to evaluate the association between poor bone and dental implant failure.

Fourth strategy: Identify studies or meta-analyses specifically designed to evaluate the efficacy of specific dental implantology methods used to treat patients with poor bone.

Table 1. Medline Search Summary

Terms	Hits	Reviewed
Dental Implants [MESH] OR Dental Implantation [MESH] OR Dental Restoration, Temporary [MESH] OR Dental Restoration, Permanent [MESH] OR Dental Restoration Failure [MESH] OR Dental Prosthesis, Implant-Supported [MESH]	41,765	0
AND bone AND (quality OR quantity)	558	9
AND osteoporosis	8	3
Studies summarized	12	

Definitions of poor bone in dental implantology

The term «poor» bone is generally applied to describe bone of compromised quantity and/or quality as a result of trauma, disease state, or the natural aging process. Determination of bone quantity and quality is accomplished by various densitometry methods including radiographs, computerized tomography (CAT scans), single photon absorptiometry (SPA), dual-photon absorptiometry (DPA), dual-energy x-ray technology (DPA) and peripheral dual-energy x-ray (pDEXA).[3]

Bone quantity indicates a quantitative bone measurement and may be described in terms of alveolar ridge height, width and density (also an indicator of quality). A decrease in bone quantity is marked by resorption at the alveolar ridge, often leading to tooth loss. The severely atrophic maxilla or mandible may be unable to support an endosseous dental implant[7]. (Note that these challenges may be overcome with alternative treatment methods).

Lekholm and Zarb have defined a qualitative rating scale of bone quantity as follows:[3]

A= no ridge resorption
B= moderate resorption
C= advanced resorption
D= some resorption of basal bone has begun
E= extreme resorption of basal bone

Bone quality is generally described in terms of composition. A decrease in bone quality is marked by a change in bone density, including a loss of cortical bone, a decreased density of trabecular bone and a weakened collagenous framework.[2] Bone quality, as opposed to quantity, may have a greater effect on implant osseointegration, with quality at the implant site being the best indicator of success.[3]

Lekholm and Zarb have defined a rating scale of bone quality as follows:[3]

1= entire jaw comprised of homogeneous compact bone
2= thick cortical layer surrounds a core of dense trabecular bone
3= thin cortical layer surrounds a layer of low-density trabecular bone
4= thin layer of cortical bone surrounds a core of low-density trabecular bone

As defined by the World Health Organization, osteoporosis is a disease characterized by «low bone mass and microarchitectural deterioration of bone tissue leading to higher bone fragility and an increase in fracture risk» (i.e., bone compromised in both quantity and quality, or poor bone). [5] The term osteoporosis often implies postmenopausal osteoporosis, a condition in which estrogen depletion leads to an overall bone loss. Estrogen depletion appears to cause a significant bone loss in the edentulous mandible but not in the dentate mandible; a phenomena which may contribute to the challenges of implant osseointegration in the edentulous patient.[2] The relationship between skeletal bone mass and mandibular bone density has been

evaluated. It appears as musclar function decreases, osteoporosis develops in edentulous jaws.[9, 10]

Bone quantity is considered to be synonymous with bone volume and bone quality with relative bone density which can be determined and quantified with computerized tomography scanning and other sophisticated radiological techniques.[11]

Types of «failure» associated with patients with poor bone

Implant failure is generally defined as mobility of the implant, peri-implant radiolucency, and/or pain, discomfort or persistent infection at the implant site.[12]

The following factors have been suggested as contributing to implant failure in patients with poor bone:

Early failure: Failure of osseointegration is often correlated with poor bone quality, or with surgeon experience.[4, 5, 7] In a review of 2.131 implants placed at 30 medical centers, over half of failures occurred at just 20 % of the centers. Furthermore, failure rates for implants placed by surgeons who had performed <50 procedures were more than twice as great as those for surgeons who had place ≥50 implants prior to the study period.[12] Other studies also note surgeon experience as an important factor in implant success rates.[4]

Late failure: Late failure, or failure post-loading, may occur due to peri-implantitis and implant overload.[5]

Current methods for managing patients with poor bone

The current methods for managing patients with poor bone have a number of limitations including very high costs, surgical risk, and delayed time to loading, all of which add to the physical and emotional challenges of the patient, Table 2.

The following are examples of these methods:

Bone graft: Several bone grafting materials are currently in use, including the following:

- Autogenous bone from the iliac crest, tibia, mandible or maxillary tuberosities
- Allogeneic bone
- Bone graft substitutes (e.g., xenografts)
- A combination of the above[7]

Success rates of dental implants when combined with bone grafting have been reported at 75 - 90 %.[5]

Zygomatic implants:

Zygomatic implants are a partial or complete alternative to bone augmentation in the severely atrophic maxilla or following maxillectomy in cancer patients.[5, 8]

One to three zygomatic implants can be placed in the body of the zygomatic bone, with a couple of conventional dental implants in the frontal region of the maxilla to stabilize the prosthesis.

Eliminating the need for bone grafting allows for earlier denture loading.

- Success rates for this procedure are reported at approximately 97 %.[5]

Additional treatments

Enamel matrix derivative (EMD) may be used to help regenerate lost tissue following severe periodontitis. A review of 10 trials showed that one year after its application, EMD significantly improved probing attachment levels (PAL) (mean difference 1.2 mm, 95 % CI 0.7 to 1.7) and pocket depth (PPD) reduction (0.8 mm, 95 % CI 0.5 to 1.0) when compared to a placebo or control. The authors note that a high degree of heterogeneity was observed among trials and suggest that overall treatment effect may be overestimated.[13] EMD has not routinely been used in combination with dental implants.

Systemic treatments such as long-term high-dose glucocorticosteroids, estrogen replacement therapy and calcium plus vitamin D3, as well as bisphosphonate therapy, are used to treat the effects of osteoporosis.[5]

- Bone morphogenetic proteins (BMPs), a family of osteoinductive proteins, have been used in Phase II clinical trials to induce de novo bone growth.[7]

Table 2. Limitations of the current treatments for poor bone

Method	Description	Limitations
Bone Grafting[7]	• Augmentation by means of autogenous, allogeneic or bone substitute grafting	• Delayed loading due to bone healing time • Additional surgery (e.g. bone harvesting) • Complications (e.g., pain, infection) • Cost • Potential lack of harvestable bone
Zygomatic implants[5, 8]	• A partial or complete alternative to bone augmentation in the severely atrophic maxilla, or following maxillectomy in cancer patients[5, 8]	• A few conventional implants in the frontal maxilla are still required to stabilize the prosthesis
Enamel Matrix Derivative (EMD)[13]	• An extract derived from developing pig teeth used to help regenerate lost hard tissue, following severe periodontitis	• Delayed loading • Authors suggest that overall treatment effect may be overestimated • Cost
Long-term high-dose glucocorticosteroids, estrogen replacement therapy, calcium plus vitamin D3, bisphosphonate therapy[5]	• Systemic treatments used to treat osteoporosis symptoms	• Study results are conflicting regarding effects of these therapies • Loss of osseointegrated implants after bisphosphonate therapy has been reported • Cost
Bone Morphogenetic Proteins (BMPs)[7]	• A family of osteoinductive proteins used to induce de novo bone growth	• Long treatment course (4-month bone induction before implant placement in Phase II clinical trial) • Delayed loading during augmentation response • In clinical trial stage • Cost

Relationship between poor bone and dental implant failure rates

Eight clinical studies evaluating dental implant failure rates in poor bone met our search criteria and our objectives. These studies were summarized by pooling data on similar indications and outcomes.

- Comparison of implant failure rates in poor bone versus acceptable bone (Table 3):
  - Four studies were identified that compared patients defined as having «poor» bone to patients defined as having «acceptable» bone.
  - The risk of implant failure in poor bone was two to seven times greater than that for acceptable bone in most of these studies. This effect was observed in the maxilla but not the mandible.
  - A minimal increase in success was observed in older patients compared to younger patients in one study. Age as a surrogate for poor bone may not be appropriate.

- Comparison of implant failure rates between LZ bone qualities (Table 4):
  - Five studies were identified which made implant failure comparisons between different bone quality levels using the system by Lekhom and Zarb.
  - There were only small differences in implant failure rates between levels for most studies (0 % - 8.4 %); however, we pooled levels 1, 2, and 3 and compared it to level 4 (poorest quality) in the study by Rocci[14] and found a 60 % increase risk of failure in the poor quality group compared to the others.

- Comparison of implant failure rates between LZ bone quantities (Table5):
  - Only one study was identified which made implant failure comparisons between different bone quantity levels using the system by Lekhom and Zarb.
  - Implant failure rates differed little between groups (3.7 % - 7.5 %); however, all failures occurred in the maxilla.

Future Directions

In part I of this Literature Analysis on «poor bone» the following important observations were made:

- Failures can occur early or late. Causes of early failure are often related to poor bone conditions or surgeon experience. Late failures often occur due to peri-implantitis or overloading.
- Current methods for managing patients with poor bone have a number of limitations including high cost, surgical risk, and delayed time to loading.
- There is an increase risk of implant failure in poor bone compared to healthy bone. This risk is up to seven times greater. Most studies making this comparison are of moderate quality only; hence, these findings should be taken with caution.

- This effect is observed only in the maxilla. Rates are similar in the mandible.

Part II, which will be published in the october edition of Implant Directions, will adress the following objectives:

- Evaluate the efficacy of various dental implant methods for treating patients with poor bone.

- Review studies evaluating basal implants.

- Discuss BOI® implants as an alternative for treating patients with poor bone while allowing immediate loading.

- Summarize the Literature Analysis findings on poor bone from both Part I and Part II.

APPENDIX I
SUMMARY TABLES

Table 3. Comparison of Implant Failure Rates between Poor and Acceptable Bone.

Outcome by Bone Characteristic:										
LoE		**Author**	**Outcome (Failed Implants)**	**n/N (implants)**	**%**	**n/N (implants)**	**%**	**RR (95 % CI)**	**p-value**	**Statistical Significance**
				Poor bone		Acceptable bone				
	Maxilla	Blomqvist (1996)		32/74	43.2	4/71	5.6	7.7 (2.9, 20.6)	<0.001	YES
	Maxilla	Smedberg (1993)		12/33	36	0/53	0	Not calculable	NA	NA
III	**Maxilla**	Engquist (1988)		48/137	35	10/54	19	1.9 (1.0, 3.5)	0.03	YES
III	**Mandible**	Engquist (1988)		4/61	7	5/87	6	1.1 (0.32, 4.1)	0.84	NO
	Combined			273/1038	26.3	37/502	7.4	3.6 (2.6, 4.9)	<0.001	YES
				Younger patients (26-49 years)		Older patients (60-74 years)				
III	**Combined**	Bryant (2002)	Successful Implants	2366/2730	86.7	175/190	92.1	0.94 (0.90, 0.98)	0.03	YES

Table 4. Comparison of Implant Failure Rates between Maxillary and Mandibular Implants in Poor Quality Bone.

Outcome by Bone Quality (L-Z):													
LoE	Author	Outcome (Failed Implant)	n/N (implants)	%	n/N (implants)	%	n/N (implants)	%	n/N (implants)	%	RR (95 % CI)	p-value	Statistical Significance
Bone Quality:			LZ-1		LZ-2		LZ-3		LZ-4				
III	Friberg (2002)	Maxilla:	0/0	0	14/76	18.4	1/113	0.9	3/109	2.7	Did not calculate	NA	NA
		Mandible:	0/17	0	0/25	0	0/17	0	0/22	0	Did not calculate	NA	NA
III	Truhlar (1994)	Maxilla/ Mandible	8/187	4.3	29/1007	2.9	20/783	2.6	6/154	3.9	Did not calculate	NA	NA
II	Truhlar (2000)	Maxilla/ Mandible	16/258	6.2	93/1387	6.7	93/1100	8.4	22/253	8.7	Did not calculate	NA	NA
II	Rocci (2003)	Maxilla/ Mandible	NA	NA	0/10	0	5 of 88	5.7	17/23	7.4	Did not calculate	NA	NA
		Pooled	24/462	5.2	136/2505	5.4	119/2101	5.7	48/561	8.5	LZ4 = 8.5 % LZ1-3 = 5.5 % 1.6 (1.2, 2.1)	0.003	YES
III	Becker (2000)	Combined	NR	NR	NR	NR	NR	NR	NR	NR	aOR= 2.6 (1.1-6.2)*	Not provided	YES

Adjusted Odds Ratio provided by author, no raw data available
NR = Not reported

Table 5. Comparison of Implant Failure rates between Maxillary and Mandibular Implants in Poor Quantity Bone.

LoE	Author	Outcome		n/N (implants)	%	n/N implants)	%	n/N implants)	%	n/N implants)	%
Bone Quantity:			LZ-A	LZ-B		LZ-C		LZ-D		LZ-E	
II	Friberg (2002)										
		Maxilla:	NA	12/160	7.5	4/109	3.7	2/29	6.9	NA	NA
		Mandible:	NA	0/64	0	0/2	0	NA	NA	0/15	0
		Maxilla/ Mandible	NA	12/224	5.4	4/111	3.6	NA	NA	NA	NA

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Critical Appraisal

Reference: Cornelini R, Cangini F, Covani U, Barone A, Buser D.
Immediate restoration of single-tooth implants in mandibular molar sites: a 12-month preliminary report. Int J Oral Maxillofac Implants. 2004 Nov-Dec;19(6):855-60.

Performing Clinic: University of Genoa, Italy

Abstract

Purpose:
The aim of this prospective clinical study was to evaluate the survival rates at 12 months of transmucosal implants placed in the posterior mandible and immediately restored with single crowns.

Materials and Methods
Thirty ITI dental implants with sandblasted, acid-etched surfaces were placed in 30 patients missing at least 1 mandibular molar and immediately restored if acceptable primary stability was attained. Primary stability was measured with resonance frequency analysis (RFA) using the Osstell device, and only implants with a stability quotient greater than 62 were included in the study. RFA measurement and radiographic assessment were made at baseline and 6 months after implant placement. Plaque Index, Bleeding Index, probing depth, attachment level, and width of keratinized tissue were measured at the 12 month follow-up examination.

Results
At 12 months, only one implant had been lost; it was removed because of acute infection. Radiographic as well as clinical examination confirmed osseointegration of all implants, with a survival rate of 96.7 %.

Discussion:
Interestingly, implant stability as measured using RFA did not increase significantly from baseline to 12 months ($P > .05$).

Conclusion:
The present study showed that immediate restoration of transmucosal implants placed in the mandibular area with good primary stability can be a safe and successful procedure. However, larger, long-term clinical trials are needed to confirm the present results.

Article Summary

Author's Summary
The present study showed that immediate restoration of transmucosal implants placed in the mandibular area with good primary stability can be a safe and successful procedure. However, larger, long-term clinical trials are needed to confirm the present results.

Objectives/Aims
- To evaluate the survival rates at 12 months of transmucosal implants placed in the posterior mandible and immediately restored with single crowns.

Methods

Study Design
- Prospective case series.

Sampling
- 30 patients with single missing molars were treated with a single implant
- Only patients with an implant stability quotient (ISQ) that exceeded 62 using the Osstell device were included
- 12 females and 18 males were included
- Mean age was 47.5 years (range 27-59)

Inclusion Criteria reported by author
- Need for the restoration of a single mandi-bular molar
- Natural teeth next to the edentulous space with an intact occlusal surface and free of infection
- Sufficient bone quantity for implant placement (absence of any atrophy)
- An occlusal pattern that allowed for bilateral stability
- Willingness to follow the study protocol
- Provision of informed consent

Exclusion Criteria reported by author
- Compromised general health conditions that would jeopardize the bone healing process
- Severe maxillomandibular space discrepancies
- Severe parafunctional habits
- Drug or alcohol abuse
- Poor oral hygiene
- The need for tissue augmentation procedures

Surgical Protocol
- ITI solid implants with a sandblasted, acid-etched surface were inserted to replace a missing mandibular molar.
- Sterile surgical procedures were followed as described previously by the authors.
- All implants were clinically stable at the time of placement confirmed by resonance frequency analysis
- Sutures were removed 7-10 days after surgery

Prosthetic Protocol
- Restorative treatment was started immedi-ately after implant placement
- Within 24 hours after implant placement, a temporary screw-retained resin restoration was fabricated and connected to the implant
- The occlusal contacts were restored with the provisional crowns

Outcomes measurements
- Resonance frequency measurements for implant stability quotient (ISQ) using the Osstell machine
- Radiographic assessment
- Modified plaque index (mPLI)
- Modified sulcus bleeding index (mSBI)
- Presence or absence of suppuration
- Probing depth (PD, in mm)
- Distance between the implant shoulder and the mucosal margin (DIM, in mm)
- Clinical attachment level (AL, in mm)
- Width of keratinized mucosa
- Distance between the implant shoulder and the first visible bone-implant contact (radiologic assessment; «DIB», in mm)

Follow-up

- Patients were examined at baseline and 6 months. The authors report a final follow-up at 12 months but there are conflicting statements in the paper regarding 6 months or 12 months as the final follow-up. Mean follow-up times and ranges are not reported.
- Follow-up rate was implied to be 100 %

Results

- At 12 months, one implant was lost (n=1/30) due to acute infection
- Twenty nine of 30 implants survived (survival rate = 96.7 %)
- The mean ISQ value was 70.6 ± 5.8 at baseline and 76.6 ± 7.0 at 12 months
- No mechanical complications were reported in the 12-month period
- All patients considered their restorations to be esthetically acceptable
- Clinical measurements at the 12 month visit are reported in the following table:

Clinical Parameters	Mean	SD	Range
DIM (mm)	0.8	0.4	0.6-1.4
Probing depth (mm)	1.6	0.8	0.2-2.7
Attachment level(mm)	0.8	0.3	0.2-1.1
mPI	0.5	0.4	0-2
mBI	0.4	0.5	0-2

REVIEWER'S EVALUATION

Evaluation of methodological principles.

Methodological Principle	
Statement of concealed allocation*	NA*
Intent to treat principle*	NA*
Independent blind assessment	NO
Patient reported outcomes	NO
Complete follow-up of > 80 %	YES
Consistent follow-up times	NO**
Adequate sample size	NA†
Appropriate analysis and use of effect measures	NA†
Controlling for possible confounding	NA
Inclusion and exclusion criteria clearly defined	YES

* Apply to randomized trials only.
** This cannot be assessed without summary data on follow-up times (i.e., means and ranges)
† Not applicable. These apply to cohort studies where two groups are being compared.

1. What were the study's methodological strengths?

- High clinical 12-month follow-up rate
- Several clinical outcomes were measured at least at one point during the study

2. What were the study's methodological limitations?

- The authors reported that only patients that achieved an ISQ 62 qualified for the study. It is unclear why the authors excluded these patients and how many patients during this period of time did not qualify. This creates at least two potential problems:
    - The study conclusion as it is currently written is not valid. We can only apply these findings clinically to patients with this baseline score. It's unclear what percentage of the total population this may represent.
    - We have no way of knowing how patients who had a baseline score lower than this performed. It would be more useful to see a survival rate using this treatment method reported on a «consecutive» series of patients with a score above and below this threshold.
- It is unclear who performed the outcomes evaluations. In a prospective study, it is advisable to identify an independent observer to make these assessments to avoid unintended bias.

3. How might the findings from this Critical Appraisal be applied to patient care?

Clinical Reviewer 1:

I think that the authors should have listed the values of the single placements and of course they should have justified the ISQ value of 62. Further, I wonder why the mean value in the included implants is so high, while the inclusion critieria threshold is low. How can one give a patient an adequate prognosis in an immediate load setting when the values or percentages are not available before the operation. If one can place a 4.8 mm implant with 10 or 12 mm of available bone, then any implant will perform successfully. This population did not possess any horizonzal or vertical atrophy which makes them an unrealistic patient population. The results can not be transferred to edentulous patients with mild or severe atrophy.

Clinical Reviewer 2:

It is important to mention the implant sizes to make a clinical application (i.e., diameter and length). I strongly doubt that a 3.2 x 10 mm is adequate to receive the same immediate load as a 4.1 or 4.8 x 12 mm. Frank Renouard once said regarding the root replacement concept, «when you are replacing a lower molar, it is always safer to place two 3.6 x 11 than a single implant, to avoid the cantilever forces on a single implant in that area, or you might loose your implant in subsequent years, because of continuing crestal resorption».

From a biomechanical point of view, most problems with a single lateral implant appear later

than 6 or 12 months, when the implant receives a porcelain crown harder than composite. It is not a problem to achieve nice initial results with a «soft» temporary composite. Moreover, we all know, that we can exclude it from occlusion during the first weeks. In my opinion it would act as a «shock absorber», reducing the load on the implant. The problem is, can they achieve the same results with a definitive restoration in an unprotected load environment?

In summary , this study reports on an extremely rare clinical population and the short term results are clinically irrelevant, as single implants in wide gaps may impose a clinical problem in the long term. Further, the conclusion does not clearly inform the reader that the strict exclusion criteria severely limits the generalizeability of these findings.

4. Were all clinically important outcomes for this treatment intervention considered? If not, what additional outcomes should be considered?

Clinical Reviewer 1:

The authors did not note the time after extraction for each case or summary data for all cases. Survival rates are higher if implants are placed immediately after extraction, but Ostell-values may initially be lower. The samples size and the number of failures appear too small to show that above a certain value immediate load is predictable.

Furthermore, it is unclear why the authors didn't use the modified SLActive® surface for this study. There have been reports by Buser et al, demonstrating the advantages of the new surface. Assuming this surface is significantly more beneficial clinically, then it would not appear appropriate to use the old surface especially in immediate load cases, as patients may be at greater risk of failure.

It would have been advisable for the authors to have taken x-rays and compared the horizontal bone levels to other studies. At a minimum they should have reported these findings after 12 months in their own data. It is unclear what the authors mean by «the DIB difference was statitically not significant.» Osteonal remodelling ceases no earlier than 12 months after the surgical intervention. At this time, relative stability within the osteonal bone is to be expected, but not earlier. Finally it is unclear as to why the authors showed DIB after 6 months and DIM after 12 months.

5. Are the likely treatment benefits worth the potential harm and costs?

Clinical Reviewer 2

Because large triangular crestal resorption or some bone detachment from the vertical implant axis may occur after 1 or 1.5 years in immediate load cases, this should have been described. There was no description of crestal bone loss- was it present? If so, how much loss? How harmful might this be? Interestingly the radiographic assessment of bone level (DIB) ends after 6 months, although the clinical assessment of mucosal level (DIM) shows a wide range between 0.6 and 1.4 mm, indicating that

up to 14 % of the vertical bone may have been lost. It is not acceptable to simply state that a number of implants were placed and that there were no failures. Instead, one must also define the crestal bone loss (if present) to determine if the benefits of such treatment outweigh the potential harm and costs. There was no description of bone quantity or quality e.g. using the classifications described by Leckholm & Zarb. For this reason, the study does not meet adequate scientific standards for clinical application. Were all patients bone type I, or was there a greater variation in bone quality and quantity?

In addition, it is unclear from the abstract or the text body when the provisional was replaced by a definite restoration. Was it replaced at all? Finally, it is unclear if all implant crowns had antagonists. The authors also do not discuss, that all occlusal contacts may have been protected by the surrounding teeth. For this reason the results of this study cannot be transferred to cases where no such protection exists (i.e., where the implants not only restored but also really loaded immediately). The authors report on «immediate restoration». In the text the authors indicate however, that the implants have been «immediately loaded», but there is no explanation about how the loading was acchieved and controlled. The authors should have made clear that «restoring» the implants does not necessarily mean that the implants are also loaded.

Research in Context

Outcomes in Dental Implantology
What is success and what is failure?

Since the beginning of dental implantology, there have been published reports on treatment outcomes. With implant survival acknowledged as the gold standard for dental implant outcomes, authors have published survival rates for decades. What are we to make of these published numbers? What do we consider success and what do we consider failure of a specific implant therapy when we critically evaluate the literature?

No published clinical study is perfect. Every study has its share of strengths and weaknesses. It is not uncommon for two clinical studies to collect data on the same implant system and come to widely different conclusions. Why does this happen? There are a myriad of reasons often attributed to factors such as patient population, surgeon skill level, study design and analysis, and specific outcomes measures.

This *Research In Context* article will focus on outcomes. The other factors will be covered in subsequent editions of the ID journal. Why is selection of appropriate outcomes measures important? Consider the following reasons:

- They allow you to evaluate the effectiveness of multiple implant options
- Health care authorities and patients can consider competing interventions
- Success or failure of implants are based on treatment outcomes
- Readers are becoming more critical of the literature; therefore, outcome selection should be undertaken with best evidence in mind.
- Selecting appropriate outcomes may have far reaching implications

Implant survival and failure are the gold standard, yet these definitions vary widely from study to study. Several different definitions have been proposed [1-3], but no clear consensus has been reached. In some studies, success is defined as survival of the prosthesis. In others, it is survival of the implant. When the prosthesis is considered, implants not subjected to loading due to improper angulation may be scored as successful provided the prosthesis doesn't fail because it is supported by other implants.[4] Some studies account for all implants placed and report all removals as failures, while others report failures that occur following loading.

ten Bruggenkate et al.[5] observed that some studies mention the number of implants placed in the abstracts and introductions, but in the subsequent text, statistics are performed on much smaller numbers. Early trials of Brånemark implants reported by Adell et al.[6, 7]excluded all implants loaded less than 1 year. Walton[8] has demonstrated a wide variation in success rates when replacement, repair, and modification of prostheses are taken into account. These studies make it clear there is not clear definition of failure, or when to start counting failures. With the emergence and popularity of immediate load protocols, it is imperative that failures are counted as soon as implants are placed. How can studies performed under immediate, early

or late loading conditions be compared at all? It is reasonable to differentiate between early and late failure in delayed loading protocols; however, to be able to compare delayed loading implant systems to immediate load systems, failures must be counted immediately.

How early is too early? What about those who are turned away in the dentist office because they are not good candidates for implants. This is not discussed or quantified in the literature. It is not uncommon for patients with poor bone conditions (qualitatively/quantitatively) to be told that implants are not an option. Or if they are, the options are expensive, timely, and invasive bone augmentation procedures. These patients are often left without an option for implants. Is that a failure? In an era where nearly all edentulous patients would prefer fixed teeth rather than removable dentures, perhaps we need to start counting failures as soon as the patient is turned away.

In addition to survival rates, clinical studies in dental implantology should also measure patient-centered outcomes. How does the patient feel with respect to their oral health? Oral health related quality of life (OHQoL) has been summarized by the following:

- chew and eat full range of foods native to diet
- speak clearly
- socially acceptable smile
- socially acceptable dentofacial profile
- comfortable and free from pain
- have fresh breath

Several OHQoL instruments have been summarized in the literature.[9] The following are existing measures that may serve as a tool for measuring OHQoL after implant therapy.

- Geriatric Oral Health Assessment Index: 12 items
- Oral Health Impact Profile: 49 items and 14 items
- Oral Impacts on Daily Performances: 8 item
- Oral Health-related Quality of Life: 3 items
- UK Oral Health-Related Quality of Life Measure: 16 items

It is noteworthy that none of these instruments were developed specifically for or validated in dental implant patients. So while some form of OHQoL measure is recommended for measuring patient's perception of their success, these aforementioned tools may not be ideal.

The Implant Foundation has been working on an OHQoL instrument designed specifically for dental implant patients that focuses questions on the patient teeth with respect to the following domains:

- Appearance
- Swelling and inflammation
- Pain
- Chewing
- Speaking
- Work disability
- Household chores
- Family relationships
- Social relationships
- Stress
- Sleeping
- Financial loss

In immediate loading protocols, failure rates and OHQoL should be measured early. When considering failures, consideration for those patients that are turned away as «poor candidates» should be reported - if not as a failed outcome, as a baseline factor in published case series.

An OHQoL instrument designed specifically for and validated in dental implant patients should be developed as a tool for comparing different dental implant therapies.

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BOI® a case of an immediate loading alternative after failed dental implants

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Though failure rates of endosseous dental implants are relatively low, the increasing number of implant surgeries being performed worldwide is leading to a greater number of implant failures.

This is creating a challenge for both the implantologist and the patient. Patients, who have been treated successfully with implants in the past, will likely select implants again in lieu of prostheses in the event of an implant failure. However, most patients do not understand, nor do they want to experience, the long waiting period necessary for returning to normal masticatory function after initiating the re-implantation process. This waiting period can be eliminated with the application of basal osseointegrated (BOI®) implants. The case presented here demonstrates the possibility of returning the patient to normal masticatory activity in a short period of time after failed screw implants.

Key words
- dental implantology
- immediate loading
- dental implant failure
- basal implants
- screw implants

Introduction

Survival rates for conventional dental implant systems are relatively high in normal healthy bone[1]. However, since osseointegration represents a dynamic process both during its establishment and its maintenance[2], even implants which initially integrate well, may occasionally show unexpected mobility when the bone/implant/restoration system is in actual function.

A huge number of dental implants have been performed worldwide. In the USA alone, it has been estimated that more than 300,000 dental implants are performed annually[3,4]. According to a recent report, those actually implanted in the USA in 2000 numbered 910,000 (Annual Industry Report, 2000).

Therefore, despite a relatively low failure rate in today's dental implant environment, the absolute number of failures is high and presents a clinical challenge to the dental implantologist. Because of the growing demand for dental implants, their failure is becoming one of the most challenging dental complications of our times[5-8]. The major problem in implant dentistry in the future will become late-stage failure and loosening.[6.]

The likelihood for re-integration of a mobile screw implant is small if the interface between the implant and the bone is bacterially contaminated (due to vertical or horizontal mobility) and the perfusion in the interface area is increased. In some patients, general and local contraindications may restrict the possibilities for re-implantation[9]. Methods to overcome this challenge

therefore need to be proposed and evaluated. We report on an alternative implant method that is ideal for the treatment of patients who present with a failed screw implant(s) and the desire to continue relatively normal uninterrupted mastication.

Case Report

This is a report of a 61 year-old male who was treated four years ago after the loss of several teeth (region 34-37). The patient received a crown block with four chewing units through a two-stage procedure. A three month healing period preceded the placement of three screw implants each with a diameter of 3.75 mm and an enossal length of 13 mm, 11mm, and 9mm, respectively. The patient underwent an additional three month healing period after implant placement, before prosthetic use of the implants was initiated. The same treatment was performed in the opposite right lower jaw.

The patient presented to our dental clinic, four years after the initial surgery, with increased loosening of the implants in the left lower jaw in the vestibular-lateral direction. The patient did not report any pain but was bothered by restricted chewing ability on the right side. The following treatment alternatives were discussed with the patient: a) removal of the bridge in quadrant III and removal of the implants with a subsequent two-stage approach with new screw implants. After a regeneration period of 4-5 months, the patient could undergo re-insertion of crestal implant bodies, a three month healing period and the subsequent incorporation of a prosthesis; or b) removal of the bridge in quadrant III and removal of the implants followed by immediate insertion of 2-3 basal implants (aka BOI®) 10-13 taking advantage of the intact cortical bone available. The patient chose the second option as it would allow him immediate return to normal masticatory activity. Inserting larger screw implants into the existing implant cavities did not seem possible clinically taking into account the total bone width.

After extraction of the implants and the bridge under local anesthesia, two basal implants were inserted laterally using multi-cortical support by taking advantage of the existing cortical bone available. In region 34, a three-segment, one-piece, basal implant was inserted directly into the extraction alveole. In region 37, distal to the extraction alveole, an asymmetrical basal implant was used. Tooth 33 was included in the restoration. The impression was taken directly after the implant installation. The sutures were removed at the next appointment, during which the metal casting was examined, and the final metal/ceramic bridge was incorporated on the 4th post operative day. Figures 1 and 2 show enlarged sections of the treatment process from the panoramic overview shots.

Clinically, the patient showed visible swelling of the left cheek for 3 days and he denied taking any pain medications. The patient was asked to refrain from the consumption of hard food for 2 months; however, he began using the new bridge immediately for all other masticatory function and reported similar use and oral function compared to his bridge in the contralateral jaw.

Discussion

Failed implants pose a significant challenge to both the implantologist and the patient, especially when using conventional dental implant systems (e.g., screw implants). From the patient's perspective, who has grown accustom to normal mastication with the existing implant system before experiencing symptoms, the thought of «starting over» and having to wait a significant amount of time before returning to normal function is daunting.

However, the implantologist must be prudent in his surgical treatment and rehabilitation so as to avoid another failed implant. It could be argued that one should be particularly careful during the initial operation so as to avoid this scenario all together. However, failed implants are inevitable despite a quality implant and a skilled implantologist. Though failure rates have declined over the past several decades, more implant operations are being performed. The absolute number of failures, therefore, is on the rise.

In the patient case that we have presented, the patient decided to have basal implants inserted because he could avoid the 6 months of treatment and rehabilitation necessary for return to normal mastication if screw implants were re-inserted. With the option of basal implants that are inserted from the lateral aspect of the jaw bone, using the resorption-resistant cortical bone, we were able to provide the patient a viable alternative which allowed for a single surgical procedure followed by immediate masticatory function. Prosthetical constructions which combine teeth and basal implants also have proven to be good option for future success. [14]

The replacement of failed screw implants with basal implants, regardless of the etiology (e.g., infection, functional loosening, etc.), constitutes an important indication for BOI®-implantology 10-13.

The remaining bone quality and quantity available is also not an issue – in fact, that is a strength of the BOI® procedure. When conventional dental implant systems fail, there is typically little bone for immediate re-implantation. For BOI® implants, almost any amount of bone remaining is sufficient for corrective procedures in most cases. This, coupled with the patient benefit of immediate functional use, makes BOI® an excellent alternative for treating patient with failed dental implants.

Conclusion

Basal implants are an excellent alternative for the implantologist faced with a patient who has experienced an implant failure(s), to provide a new implant(s), in lieu of prostheses, and allow the patient to return to normal masticatory function with little to no delay.

Figures

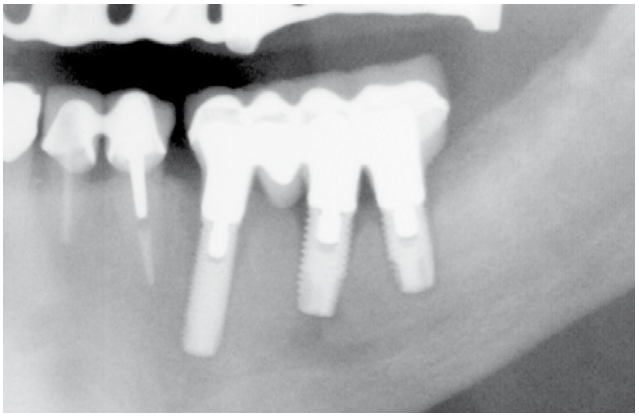

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Figure 1.
The radiolucent areas around the enossal implant area are shown in the preoperative overview photo.

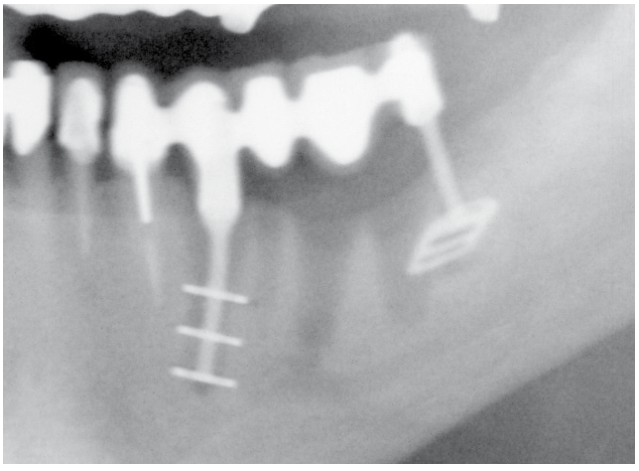

Figure 2.
The newly placed and previously incorporated implants are shown four days post-operative. The extraction alveoles in the area of the lost implants and the relation to the placed implants are clearly visible.

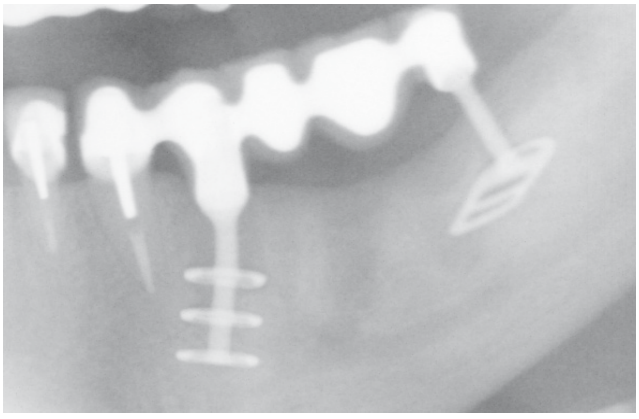

Figure 3
14 month postoperatively panoramic view on the inserted implants. The bony healing has progressed and the implants are well integrated.

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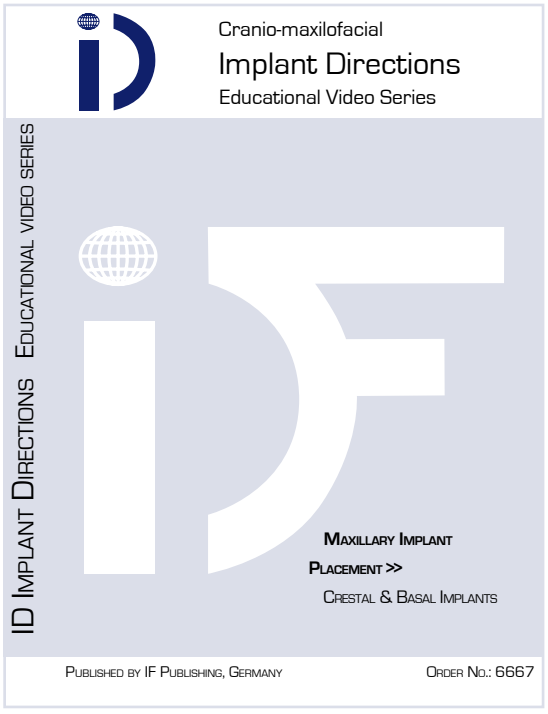

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