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A View of Implantology from Across the Pond

One of the most exciting areas of implantology exploration to this author comes from the international flavor of this publication—seeing a global view of our profession is something that is very rare to most of the dentists in the United States. New graduates from our dental universities are generally only exposed to a single implant system during their education and leave school with either no, or little knowledge of the variety of implant types that are available, and certainly no awareness of current research and case studies. As a result, many patients who could be functionally restored with implants are presumed not to be candidates for care simply because of a lack of knowledge of options that could be successfully employed. These new professionals are taught that proper care can only be rendered by using traditional systems of two stage implants, healing caps, long waits for osteointegration, screw retained abutments, etc. They are horrified, or at least scared by the very thought of immediate loading and one-piece (integrated abutment) implants. Techniques and materials successfully perfected and in daily use that improve the lives of patients in the rest of the world are unknown to the vast majority of American practitioners. And, to make matters worse, a sense of educational superiority is instilled as a part of the implant curriculum so that anything, either information or product, that doesn't come from the old-line traditional implant companies that sponsor the implant education must be bad. Tissue punches, short large diameter implants, cortical bone supported implants, intentional sinus invasion, and even the thought of using Betadine during implant surgery represents heresy. We have developed and maintained an educational system where the proverbial fox is guarding the henhouse of knowledge.
And it gets even worse still! The lack of knowledge continues throughout the dentists' career with our professionals attending large dental meetings to meet their {continuing education' requirements for license renewals. What actually {continues' is more of the same– lectures are attended that are either sponsored hiddenly or overtly by the same implant companies that prepared the curriculum for the dental schools' original training program!

It is extremely difficult to overcome this provincial mindset. Innovative companies with successfully demonstrated products from around the world have enormous hurdles to overcome if they are to be introduced to the American public, not the least of which is a government regulatory system that is intent on {protecting' our citizens from anything and everything (except dangerous things that are well funded). If this huge roadblock can be negotiated through great amounts of time and money, the problems and expense of training, marketing, and distribution loom ahead as even greater obstacles. It is no wonder that we on this side of the pond are still in the dark ages of implantology. Yes, of course there are many highly skilled and creative practitioners in the U.S.–they are just hamstrung by the lack of availability of many new materials and education about using them. They, however, are also pursuing enlightenment with their heads stuck in the sand. Consider this: At the IDS 2007 in Cologne, out of over 100,000 visits to the show, only 654 came from all of North America (including Canada)! Of these 654 visitors, just one-third are dentists. And, according to the American Dental Association, this is out of more than 175,000 licensed dentists in the United States alone!

Directly marketing products to the public has proven highly successful to drug manufactures. Our evening television shows are more and more being sponsored by the big drug companies telling patients to request particular drug prescriptions from their physicians for sleep, better sex, feelings of well-being, protection from various diseases, allergy relief, cancer treatment, and on and on. Perhaps if implants were marketed to the general public in the same way, implantology would be moved to the top of the list of dental patient requests. Can the implant industry overcome internal jealousy and fear of competition to better spend their marketing finances on public consumer awareness so that everyone will ultimately benefit? Time will tell...

Dr. Richard Musicer

Dr. Richard Musicer is president of DentFirst, a large multi-location, multi-specialty group dental practice in Atlanta Georgia.

He may be contacted by writing to n6cr@dentfirst.com

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.

- **Case reports** give implantologists the opportunity to publish on unique patients using innovative or alternative methods for treating challenging patient conditions.

- **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

Title: Effect of periodontal disease on dental implants survival and complications

Evidence Report Purpose

Dental implant therapy has become a common treatment alternative for oral rehabilitation in patients who have lost teeth due to chronic periodontal disease. It has been implicated that implants are colonized by indigenous periodontal pathogens, which may affect dental implant success in patients with a history of periodontal disease.

Objective

To critically summarize the recently published literature examining implant survival and other outcomes in studies comparing patients with and without a prior history of periodontal disease.

Summary

There was a trend towards lower implant survival rates for subjects with a prior history of periodontal disease compared to periodontally healthy subjects. There are conflicting findings with respect to peri-implant bone resorption comparing the two groups. Further, there were no statistically significant differences for soft-tissue conditions between subjects with and without periodontal disease, though one study found a greater level of attachment loss in patients with a history of periodontal disease and guided bone regeneration prior to implant placement compared to periodontally healthy patients.

Additional methodologically rigorous comparative studies are needed to better evaluate the treatment outcomes of dental implants in relation to periodontal status.

Search strategy

A MEDLINE search was performed to identify recent studies published between January 2000 and June 2007 examining the effect of history of periodontal disease on dental implant treatment outcomes, Table 1. From a list of 26 articles, nine evaluated the treatment comparison of interest. Three articles which included implant treatment outcomes met our criteria and are included in this report.

Table 1. Medline Search Summary

Terms	Hits	Reviewed
Search „periodontitis“ [MeSH] OR “periodontal attachment loss” [MeSH]	17,771	
Search „dental implantation, endosseous „ [MeSH] OR “dental implants” [MeSH]	13,675	
Search („periodontitis“ [MeSH] OR “periodontal attachment loss” [MeSH]) AND („dental implantation, endosseous „ [MeSH] OR “dental implants” [MeSH]) NOT case report, Limits ENGLISH, Literature containing Abstracts	417	3
Search („periodontitis“ [MeSH] OR “periodontal attachment loss” [MeSH]) AND („dental implantation, endosseous „ [MeSH] OR “dental implants” [MeSH]) AND “tooth loss/rehabilitation” [MeSH] NOT case report, Limits ENGLISH, Literature containing Abstracts	6	1
Bibliographies from existing literature	3	0
Total Reviewed	3	

Outcomes

- Implant survival
- Peri-implant bone resorption
- Soft-tissue parameters

Interventions

Dental implants were placed in subjects described as follows:

Hardt (2002)

- Alveolar bone height, number of teeth, and age were used to calculate the “age-related periodontal bone loss score”. Those with the highest scores (n=25), considered susceptible to periodontitis, received 100 implants. Those with the lowest scores (n=25), representing minimal experience of periodontal breakdown, received 92 implants.

Mengel (2005a)

- Seventy-seven implants were placed in 15 patients at least two years after having undergone treatment for generalized aggressive periodontitis and 43 implants were placed in 12 patients at least two years after having undergone treatment for generalized chronic periodontitis to replace teeth lost due to periodontal disease. Thirty implants replaced teeth lost due to trauma or aplasia in 12 periodontally healthy patients.

Mengel (2005b)

- Fifteen implants were placed in 10 patients at least two years after having undergone treatment for generalized aggressive periodontitis to replace teeth lost due to periodontal disease. Bone in the region of the extraction was augmented by guided bone regeneration using titanium-reinforced expanded polytetrafluoroethylene (e-PTFE)

membranes in preparation for implant placement. Eleven implants were placed without prior bone regeneration in 10 periodontally healthy patients in whom replaced teeth were lost due to trauma, aplasia, or endodontic lesions.

Table 2. Comparative studies evaluating dental implant outcomes in patients with and without a history of periodontal disease.

				Treatment			
Author (year)	**Study Design**	**Population**	**Diagnostic Characteristics**	**History of Periodontal Disease (Group A)**	**No Periodontal Disease (Group B)**	**Follow-up (%)**	**LoE†**
Hardt (2002)	Retrospective cohort	N = 50 female: 57% age: 57.6 (20-83) years	Partially dentate posterior maxilla, treated with implant-supported fixed bridges	n=25	n=25	5 years: NR*	Moderate
Mengel (2005a)	Prospective cohort	N = 39 female: 54% age: NR	Indication for dental implant placement	n=15 generalized periodontitis; n=12 generalized chronic periodontitis	n=12	3 years: NR*	Moderate
Mengel (2005b)	Prospective cohort	N = 20 female: 90% age: 24-45 years	Indication for dental implant placement	n=10	n=10	3 years: NR*	Moderate

*NR (not reported) = 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 design and methods (Very high, High, Moderate, and Poor)

Table 3. Evaluation of articles examining implant placement in patients with and without a history of periodontal disease

Study design and methods	Hardt (2002)	Mengel (2005a)	Mengel (2005b)
1. What type of study design?	Retrospective Cohort	ProspectiveCohort	ProspectiveCohort
2. Statement of concealed allocation?*	N/A	N/A	N/A
3. Intention to treat?*	N/A	N/A	N/A
4. Independent or blind assessment?	NO	NO	NO
5. Complete follow-up of >85%?	NO	NO	NO
6. Adequate sample size?	YES	NO	NO
7. Controlling for possible confounding?	YES	YES	YES
LEVEL OF EVIDENCE	Moderate	Moderate	Moderate

* Applies to randomized controlled trials only

Results

Implant survival (Figure 1)

There was a trend for lower survival rates in those subjects susceptible to periodontal disease; however, differences were not statistically significant:

- At 5 years, subjects susceptible to periodontal disease demonstrated a survival rate of 92.0% and those with minimal experience of periodontal breakdown a survival rate of 96.7%; p>.05. [Hardt].

Peri-implant bone resorption (Figure 2)

There is a trend towards increased peri-implant bone resorption in subjects with a history of periodontal disease compared to those who are periodontally healthy.

- One study reported a significantly greater mean bone loss in subjects susceptible to periodontal disease compared to those with minimal periodontal destruction (-2.2mm ± 0.8 vs. -1.8mm ± 0.8, respectively; p<.05) [Hardt].
- Another study found greater peri-implant bone resorption in patients with a history of periodontal disease and GBR prior to implant placement compared to periodontally healthy patients without GBR at 3 years (-1.78mm vs. -1.40mm, respectively; p=.08). Although these differences are not statistically significant, these findings may be due to the small number of subjects in this study. [Mengel 2005b]

Soft tissue parameters

- No statistically significant differences were found for peri-implant soft-tissue parameters (probing depths, bleeding on probing, gingival recession, gingival index, and plaque index) between patients with and without a history of periodontal disease at 3 years (p>0.05) [Mengel 2005a].
- No statistically significant differences were found in clinical attachment levels between patients with and without a history of periodontal disease at 3 years (p>0.05) [Mengel 2005a]. However, a significantly greater level of attachment loss was reported in patients with a history of periodontal disease and GBR prior to implant placement compared to periodontally healthy patients without GBR at 3 years (0.65mm vs. 0.12mm, respectively; p<.05). [Mengel 2005b]

Methodological considerations

- All studies reviewed were cohort studies with a rating of moderate (low quality cohort) level of evidence. No very high quality randomized controlled trials or high quality cohort studies were identified in the literature.
- All of the studies had small sample sizes, and two of the studies [Mendel 2005a, 2005b] had sample sizes that were likely inadequate to show a difference between the study groups.
- Since multiple implants in the same subject are not statistically independent, either one implant should be chosen per patient or sta-

tistical 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.

References

Studies

Study 1

Hardt CRE, Gröndahl K, Lekholm U, Wennström IL

Outcome of implant therapy in relation to experienced loss of periodontal bone support. A retrospective 5-year study.

Clin Oral Impl Res 13:488-94.

Study 2

Mengel R and Flores-de-Jacoby L (2005)

Implants in patients treated for generalized aggressive and chronic periodontitis: a 3-year prospective longitudinal study.

J Periodontol 76:534-43.

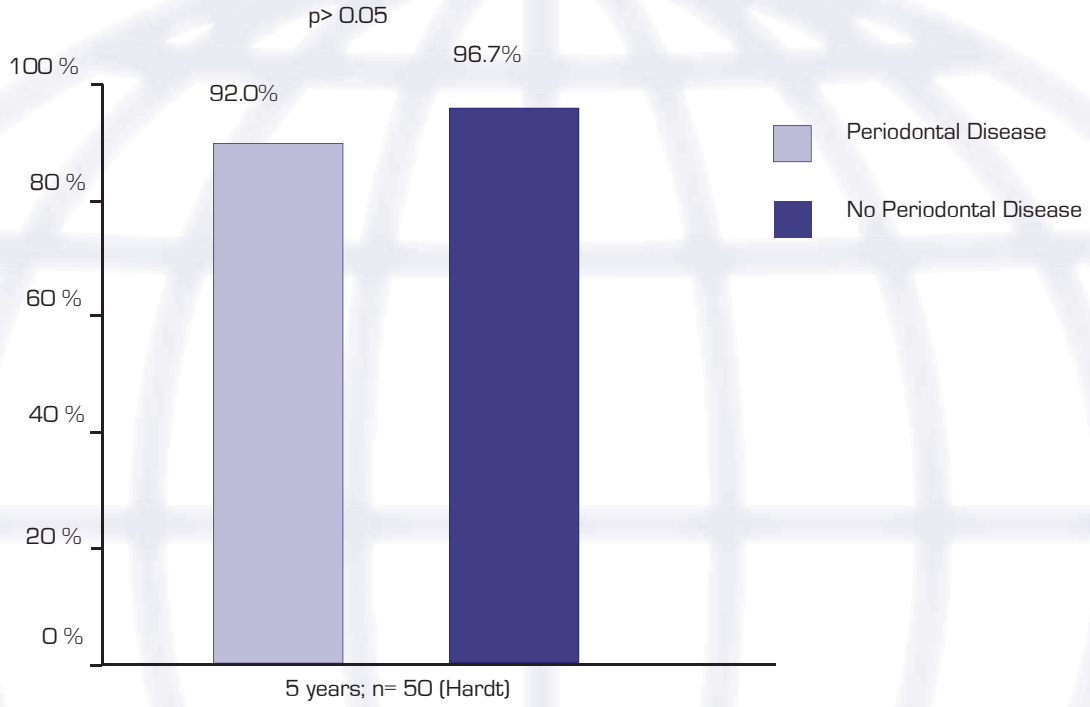
Study 3

Mengel R and Flores-de-Jacoby L (2005)

Implants in regenerated bone in patients treated for generalized aggressive periodontitis: a prospective longitudinal study.

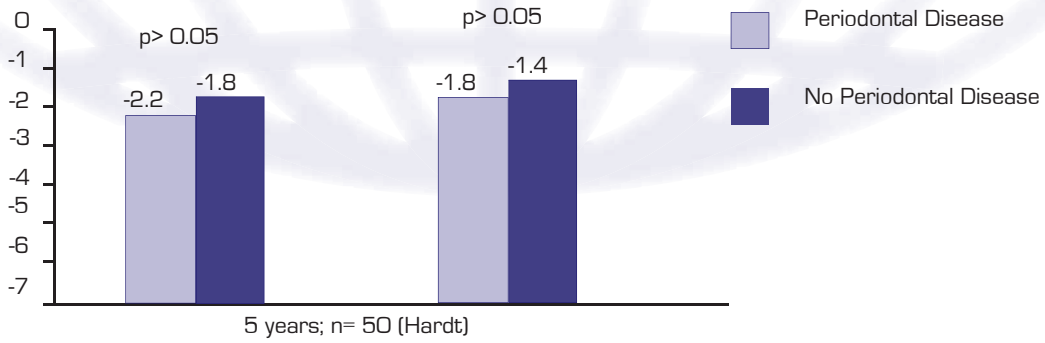
Int J Periodontics Restorative Dent 25:331-41.

Figure 1. Cumulative survival rates for dental implants by periodontal condition*



Statistical significance noted on graphs if provided by author

Figure 2. Mean peri-implant bone resorption for dental implants by periodontal condition*



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

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Literature Analysis

Osteomyelitis
In Craniomaxillofacial Conditions

How common is it?

Background

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.

Purpose

The purpose of this Literature Analysis was to systematically search the literature to identify key articles in an effort to better understand osteomyelitis in general and in oral conditions specifically. We were interested in the rate of oral osteomyelitis with particular interest in dental implants.

Moreover, to identify acceptable techniques for accurately diagnosing oral osteomyelitis and to discuss other pathologies which may be misinterpreted as osteomyelitis. Understanding osteomyelitis in long bones was also reviewed to help better understand its etiology. This literature analysis will address the following objectives:

1. **Provide** a general background of long bone osteomyelitis by providing a definition and reporting on its incidence, etiology, diagnosis, and current treatment methods.
2. **Provide** a general background of oral osteomyelitis by providing a definition and reporting on its incidence, etiology, diagnosis, and current treatment methods.
3. **Report** acceptable and unacceptable diagnostic techniques for osteomyelitis in the following
    - a. Long bones
    - b. Oral conditions by:
- Summarizing current diagnostic techniques
- Comparing methods
- Describing conditions which may be misdiagnosed as osteomyelitis

4. **Report** the following current methods for managing patients with oral osteomyelitis:
- Surgical management
- Medical management

5. Provide a summary and recommendations for the diagnosis and management of osteomyelitis in oral conditions

Search Strategy

We performed a MEDLINE search to identify studies reporting HUMAN data on OSTEOMYELITIS with a focus on craniomaxillofacial and

dental implants (Table 1). We also included some literature on long bones in an effort to gain more knowledge that may assist us in our overall understanding of oral osteomyelitis. An attempt was made to identify studies of high methodological quality (systematic reviews, RCT and cohort studies). Case studies were included due to the minimal literature identified on this topic. Literature reviews were included for background information. Key articles that were identified from this strategy were explored further by using MEDLINE`S "Related Articles" feature. In addition, bibliographies of retrieved articles were reviewed. There was no restriction on year published.

The following strategies were employed to identify literature to meet the objectives:

First strategy: Identify review articles describing oral osteomyelitis. Topics such as definition, incidence, etiology, diagnosis and common treatment methods were included.

Second strategy: Identify HUMAN studies reporting the incidence of osteomyelitis in patients with dental implants.

Third strategy: Identify HUMAN studies reporting diagnostic techniques for oral osteomyelitis in patients with or without dental implants.

Table 1. Medline Search Summary

Terms	Hits	Reviewed
Search „osteomyelitis" [MeSH]	4226	2
Search „osteomyelitis" [MeSH] AND dental	79	5
Search „osteomyelitis" [MeSH] AND dental AND implant	9	
Search "osteomyelitis" [MeSH] AND dental AND diagnosis	179	6
Search „osteomyelitis" AND dental	109	
Search „osteomyelitis" AND (craniomaxillofacial OR dental)	15	2
Search „osteomyelitis" AND dental AND (device OR prosthesis OR implant)	30	2
Total Reviewed	**17**	

The following are results of the various search strategies:

First strategy: We identified five review articles that provided background with respect to definition, etiology, diagnosis, and current treatment methods. No review articles summarizing the incidence of oral osteomyelitis (in general or in dental implants, specifically) were identified.

Second strategy: We were unable to identify any human studies that reported the incidence of oral osteomyelitis in general or in dental implants specifically. There were only nine "hits" when osteomyelitis was combined with dental implants. From these, we identified nine case reports of osteomyelitis in dental implants. Since each involved just one patient, we did not summarize in detail or table format.

Third strategy: We identified five articles specific to the diagnosis of oral osteomyelitis, including two comparison studies which reported successful differentiation between tumors and osteomyelitis through various radiographic techniques. Further, we identified six articles discussing non-related pathologies which may be misdiagnosed as osteomyelitis. All were case series or reports.

Osteomyelitis in long bones

a. Definition: Osteomyelitis is an infection involving the bone marrow. The bones most commonly affected are the weight-bearing bones. Osteomyelitis may be classified by duration, pathogenesis, location, extent, and host status. Several classification schemes have been followed to describe the etiology and progression of the infection, (e.g.. the Waldvogel system and the Cierny-Mader system).[1,2] Although these systems are useful for describing general osteomyelitis, they do not apply to special circumstances such as infections involving implanted materials, or to smaller bones (e.g., the craniofacial area).

b. Incidence: less than 1% in total joint replacements.[3] No additional data summarizing the incidence in long bones was identified.

c. Etiology: generally defined as:

- exogenous = pathogen introduced during surgical procedure.
- hematogenous = pathogen introduced through the blood supply.

d. Diagnosis: Radiographic changes may lag several weeks behind both infection and improvement, making results difficult to interpret.[2 3] The following imaging techniques are commonly used to identify long bone osteomyelitis:

- plain radiography
- radionuclide imaging
- computed tomography
- magnetic resonance imaging
- Identification of the pathogen through blood sample or bone culture

e. Treatment: The following techniques are utilized:

- Surgery involves debridement of necrotic bone and tissue, obtaining appropriate cultures, managing dead space, and, when necessary, obtaining bone stability.
- Medical therapy includes improving any host deficiencies, initial antibiotic selection, and antibiotic modification based on culture results.[2]

Oral osteomyelitis

a. Definition: Oral osteomyelitis is a microbial infection of the bone marrow, most often in the mandible, accompanied by pain, fever, potential drainage of suppuration into the mouth, and poorly defined radiolucencies and/or radiopacities.

- Very serious condition that can cause destruction of large sections of the jaw and become very difficult to cure.
- More common in the mandible than the

maxilla, possibly due to the superior blood supply in the maxilla.[4]

b. Incidence: No review or human studies were identified allowing for the calculation of prevalence or incidence of oral osteomyelitis in general or in dental implants, specifically.

- A case series by Esposito who performed histopathologic assessments to identify cause of dental implant failure noted one patient out of twenty with osteomyelitis; however, statements regarding incidence cannot be made from a single series of patients.[5]
- Given this finding, it is assumed that such events are extremely rare and hence "expected" rates cannot be summarized.

c. Etiology:

- Osteomyelitis may result from untreated pulpal and/or periapical infections, or from exogenous sources such as direct inoculation following surgical procedures (e.g., placement of dental implants).[6] Almost always, a bacterial infection is involved.
- Gram-positive bacteria are the most common cause, although gram-negative bacteria are more frequently seen in post-surgical infections.
- Virtually any microorganism has the potential to cause osteomyelitis.[3]

d. Diagnosis: Clinical findings include pain, redness and swelling, with possible parasthesia or anesthesia of the mental nerve. Chronic osteomyelitis may form fistulas or sinus tracts through the cutaneous or mucosal surface.[4] Microscopic analysis shows simultaneous bone destruction (osteoclasts) and bone deposition (osteoblasts).

Significant radiographic changes may be seen, including:

- involvement of bone away from the periapical region;
- indistinct outline (diffuse growth pattern);
- A combination of radiolucencies and radiopacities (mottled radiographic appearance). [7]
- Sequestra in the cancellous bone.[4]

e. Treatment: Osteomyelitis is very difficult to cure, and may persist or recur over long periods of time. An intensive antibiotic regimen and possible surgical debridement and repair may be necessary. [2,3,7]

Diagnostic techniques for oral osteomyelitis

1. Methods

a. Non-acceptable: Clinical observation is not sufficient for diagnosis of osteomyelitis. Indications such as pain or implant loosening may not be present. Radiographic evidence, preferably accompanied by histopathological evaluation, is necessary.[4,5,8]

b. Acceptable: Radiography and histopathological analysis are generally necessary for the diagnosis. The most common diagnostic techniques for identifying osteomyelitis are summarized in Table 2.

Table 2. Current techniques for the diagnosis of osteomyelitis.

Technique	Diagnostic Uses	Capabilities and Considerations
Computed tomography (CT)[9,10]	• Differentiate between oral malignant tumors and osteomyelitis • Relate radiographic findings to likelihood of "curing" osteomyelitis. Extent of diseased area and change in bone width are significant indicators in "curability" of disease.	• Detects increase in medullary density. • Sequential tomographic cuts may be helpful in identifying opacities. • Major role in finding sequestra in chronic osteomyelitis.[3] • Excellent definition of cortical bone. • No information on activity of infection. • Prosthetic material may interfere. • High radiation dose.
Through-transmission alveolar ultrasonography (TAU)[11]	• Assessment of alveolar cancellous bone pathologies.	• Velocity of sound in cancellous bone has a linear correlation with density.
Magnetic Resonance Imaging (MRI)[8,12]	• Detects bone marrow edema in early infection.	• Penumbra sign useful in differentiating between osteomyelitis and tumors. • Increased signal in medullary bone with well-defined, lucent margin. • Takes several weeks to develop visible margin. • Well-defined rim around active disease. • Imprecise images of cortical bone. • No radiation.

2. Comparison of methods

Two papers were identified which discussed the use of imaging methods to discriminate between oral osteomyelitis and a tumor.[9,12]

a. Scintigraphy and MRI were compared for their ability to detect osteomyelitis.[12]

- In early phases of osteomyelitis, scintigraphy is the most sensitive method of detection and has been described as the "gold standard", with diagnosis possible 2-3 days after infection begins. However, this method cannot discriminate between osteomyelitis and a tumor.
- Within 2-3 weeks, a reformative process begins which can be detected with standard radiographs. [12]
- Scintigraphy and MRI were shown to be equally sensitive in detecting osteomyeli-

tis (100% of cases). MRI was significantly more sensitive (P<0.05) at detecting soft tissue inflammation.

b. CT was found to be effective in differentiating between tumors and osteomyelitis.[9]

- Common tumor patterns show permeative bone destruction, cortical bone expansion and the enlargement of the masseter and medial pterygoid muscles. Primary intraosseous malignant tumors of the mandible resemble inflammation associated with mandibular bone destruction.
- Osteomyelitis results in a diffuse sclerotic change and a periosteal reaction. A review of 21 patients (12 with tumors, 9 with osteomyelitis) revealed that 83.3% (n=10) of tumor patients showed a permeative destruction pattern, while only 11.1% (n=1; P<0.01) of osteomyelitis patient showed this same pattern.
- Cortical bone expansion was seen in 58.3% (n=7) of tumor patients and none of the osteomyelitis patients (P<0.01).
- Diffuse sclerotic changes of the mandible were found in all osteomyelitis patients (100%, n=9) but only 8.3% (n=1; P<0.01) of tumor patients.

3. Conditions which may be misdiagnosed as osteomyelitis

Osteomyelitis progresses through different stages, with some stages mimicking other diseases. It is necessary to understand the disease course in order to avoid misdiagnosis. The following are some of the dental pathologies that may be confused with osteomyelitis:

a. Peri-implantitis: Whereas peri-implantitis is an infectious process of the soft tissue, an intraosseous infection originates in the alveolar bone at the bone-implant interface, either as granuloma or osteomyelitis.[6] Finding of a sequestrum may be the first sign that an infection has progressed from a soft-tissue situation to a bone infection.[4]

b. Periapical infection: A granuloma-type infection may develop at the periapex of an implant, i.e. a defined lesion surrounded by a layer of macrophages and multi-nucleated giant cells, followed by lymphocytes and finally fibroblasts that wall of the lesion, as opposed to the diffuse nature of an osteomyelitis.[6]

c. Neuralgia-Inducing Cavitational Osteonecrosis (NICO): An intraosseous septic cavity which may or may not be clinically distinct from osteomyelitis.[6]

d. Paget`s disease[13,14]: Radiographically, both conditions have a “cotton-wool” appearance.[14]

e. Crohn`s disease[15]

f. Tuberculosis-derived osteomyelitis incorrectly attributed to a dental procedure.[16]

Current methods for managing patients with oral osteomyelitis

1. Surgical management

Surgical debridement of the affected tissue is often needed to arrest the disease progression. (Bone specimens may be obtained at this time for the identification of primary pathogens and corresponding antibiotics.) Fracture mobility, foreign bodies (implants) and tooth infection should be considered, as they may be the source of bacterial entry. Current management suggests maintaining healthy teeth as long as possible.[4] Extraction is indicated with grossly mobile or infected teeth, or when more than 50% of the root is exposed at the fracture line.[4]

2. Medical management

a. Antibiotics: Long-term antibiotic treatment is generally prescribed except in advanced cases where poor vasculature prevents the medication from reaching the source of infection.[14]

b. Calcitonin: Calcitonin has been reported to improve systems in patients who failed to improve following NSAIDs, long-term antibiotics and surgical debridement.[17]

c. Disodium clodronate is a bisphosphonate used to treat bone and calcium metabolism disease. Patients in a randomized study tolerated the drug well, but administration did not immediately relieve pain better than a placebo. However, after 6 months there was a significant improvement in the study group over the placebo group. [18]

[Caution with bisphosphonate use. Recent published research is demonstrating the deleterious effects of bisphosphonates on oral health. This is the focus of a future literature analysis]]

d. Gentamicin-polymethylmethacrylate bead implantation.[4,8]

3. Pre-existing osteomyelitis is not an immediate contraindication for dental implants. Implants may be a means of managing the effects of osteomyelitis when used in non-infected bone in patients with diffuse sclerosing osteomyelitis (DSO).[14]

Summary and Recommendations

1. **The** paucity of literature on this topic suggests that oral osteomyelitis is quite rare.
2. **Further,** osteomyelitis in dental implants is even rarer. Only a small selection of case reports have been reported in the literature.
3. **The** lack of reports in human studies and review articles suggest that osteomyelitis is not a typical complication following dental implants.
4. **There** are only two explanations for these findings:
   - Underreporting of osteomyelitis
   - Extremely rare condition
5. Implantologists should be careful with the diagnosis of osteomyelitis.
   - Before making this diagnosis, it should be confirmed by acceptable diagnostic

techniques described in this review.

- In the event a case is identified using such methods, these should be published to include information on diagnosis and clinical management.

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Critical Appraisal

Reference:
Nkenke, E., Schultze-Mosgau, S., Radespiel-Tröger, M., Kloss, F., Neukam, F.W. Morbidity of harvesting of chin grafts: a prospective study. Clin. Oral Impl. Res. 12, 2001; 495–502.

Performing Clinic:
Department of Oral and Maxillofacial Surgery, University of Erlangen-Nuremberg,
Glückstr. 11, 91054 Erlangen, Germany

ARTICLE SUMMARIES

Authors' Summary:
The large number of complications and the high postoperative strain of the patients reveal that chin grafts should not be used as the first choice in augmentation procedures. However, complications are reported with all other donor sites for autogenous bone, especially the iliac crest. Therefore, for all widely used donor sites, prospective trials should be performed to find out which one puts the minimum strain on patients.

Study Objectives:
To prospectively determine the morbidity of harvesting chin grafts in conjunction with dental implant placement.

Design:
Prospective case-series with before-after within subject comparisons.

Inclusion/Exclusion Criteria:
- Patients with normal inferior alveolar nerve function bilaterally and with a complete dentition from teeth 35-45 were included. None of the patients had previous surgery in the anterior mandibular region.
- 23 patients were included (14 women and 9 men); average age 44.6 years ± 16.5 years.

Interventions:
- After paramarginal incision from region 35 to 45, a muco-periosteal flap was prepared and the mental nerve was identified bilaterally.
- Three experienced surgeons performed 23 chin grafts harvested at least 5 mm away from the mental foramina in an anterior direction and 5 mm caudally from the apices taking the root contour on the vestibular plain of the symphyseal region as landmarks.
- Monocorticospongious bone grafts were harvested with a trephine drill (10 mm in diameter).
- Placement of grafts or implants was not described.

Outcome Measures:
Patients were evaluated pre-operatively and then post-operatively at 7 days and 1, 3, 6 and 12 months for the following:

- Superficial sensory function of the inferior alveolar nerve as assessed by the Pointed-Blunt Test and the Two-Point-Discrimination Test;
- Sensory disturbance, measured by the Pain

and Thermal Sensitivity Test (PATH Test);
- Pulp sensitivity of teeth 35-45 by cold vitality using carbon dioxide snow.

At the last follow-up, patients were asked to rate the postoperative strain of harvesting the chin grafts in comparison to implant insertion, using a visual analogue scale (100 equaled maximum post-operative strain).

Follow-up:

Three patients did not attend all follow-up sessions and were excluded from the study leaving 20 patients for the final analysis.

Results:

- One week post-op, 8 patients suffered from impaired sensory function, with 8 nerve territories showing hypoaesthetic reaction and 5 showing hyperaesthetic reaction. At 12 months post-op, 2 patients continued to show hypoaesthesia on one side of the chin.
- Comparing the pre-op and 7-day post-op data for the Two-Point Discrimination Test, all patients suffered statistically significant sensitivity impairment of the chin (pre-op left/right median: 8.17/8.17 mm, interquartile range (IQR) 1.00/ 2.00 mm, versus 7-day left/right median: 9.00/8.33 mm, interquartile range (IQR) 1.67/ 2.66 mm).
- There was a significant tendency for nerve regeneration between the 7-day post-op and 12-month post-op data (left/right median: 8.00/7.84 mm, interquartile range (IQR) 0.66/ 2.00 mm.)
- 7-days post-op, 21.6% of teeth (n= 38/176) had lost their pulp sensitivity.
- 12-months post-op, 11.4% (n= 20/176) of teeth did not have pulp sensitivity. (Canines were preferentially affected (n= 8/20)).

Conclusions provided by authors:

Comparing pre-op to post-op data, there was a significant reduction in pulp sensitivity, with no statistically significant recovery at the 12-month post-op examination. Patients undergoing chin graft procedures should be extensively informed about impairment of the inferior alveolar nerve beyond the 12-month post-op period. Loss of pulp sensitivity is also a frequent event. Studies investigating alternative grafting sites should be pursued due to the high rate of complications resulting from harvesting of chin grafts.

REVIEWER'S EVALUATION

1. What were the study's methodological strengths?

- Prospective design ensured that patients were followed up at similar time points.
- Follow-up rate was greater than 85%.
- Several subjective and objective sensory measures were clearly described and assessed.
- Appropriate statistical methodology.
- Authors` conclusions match their results.

2. What were the study's methodological limitations?

- Lack of a control or comparison group. This area of research is lacking a quality study

comparing groups who undergo extra-oral and intra-oral grafting and groups comparing harvesting to groups receiving implants that do not necessitate harvesting in the same populations (e.g., basal implants) with respect to morbidity, function, quality of life, and costs.

- Despite a simple VAS, there were no patient reported measures assessing function and overall quality of life. Sensory tests alone do not give us the overall magnitude of morbidity from intra-oral harvest sites.
- The follow-up was restricted to only morbidity and complication measures. Since the authors undertook a prospective effort such as this, it would have been useful to assess functional measures such as time to loading and time to mastication to determine the impact on function and cost as well.

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

The article underlines the importance of telling the patient about the transient impairment of chin sensitivity and long lasting impairment of pulp sensitivity. If this method of grafting is used, it is prudent to inform the patient of these potential complications to limit legal liability.

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

The main limitation in this study is the lack of comparison of outcomes between bone from other commonly used donor sites is used (e.g., parietal, iliac crest). One should keep in mind that when using the parietal bone as a donor site, several deaths of patients due to haematoma below the dura have been reported. After liac crest transplants, fractures of the pelvis have been reported in addition to other common complications. Compared to these events, sensitivity impairments are minor problems. For a more clinically useful study, one or more comparison groups with other donor sites would have been necessary.

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

The article describes only the complications found on the donor sites after chin graft harvesting. In order to evaluate whether it could be cost effective to accept these transient complications, it would have been necessary to evaluate the outcomes of the augmentation procedures. It is known that complications in the recipient sites are major challenge and the leading discussion are primarily focused on which bone-material (e.g., lateral mandible block, iliac crest, parietal block, etc.) promote the best results in the recipient areas. Transient impairment of chin sensitivity would likely be accepted by patients if the augmentation is successful. As we have seen in the former issues of the ID, this is often not the case.

We know from implant procedures and other surgeries (e.g., wisdom tooth extractions, resections in the area of the molars and premolars), that the impairment of chin sensitivity is not

rare and often leads to legal implications. Had the authors also assessed the augmentation success and changes in patient quality of life, more light would have been shed on the question - the cost of transient sensitivity loss versus the potential change in quality of life. Based on the authors report, we cannot make this determination.

Immediate Loading of Dental Implants: Where is the dip?

Comments beyond present limits of scientific thinking

Authors:
Ihde Stefan K.A, Dr.med.dent
Lindenstr. 68
CH-8738 Uetliburg
e-mail: dr.ihde@bluewin.ch

Vitomir S. Konstantinovic MD.DDS.PhD, Clinic of Maxillofacial Surgery, Faculty of Dentistry, University of Belgrade,
Dr.Subotica 4,
RS-110 00 Belgrade

Address correspondence to:

Ihde Stefan K.A, Dr.med.dent
Lindenstr. 68
CH-8738 Uetliburg
e-mail: dr.ihde@bluewin.ch

Abstract

Immediate or early loading of dental implants has been a hot topic in implantology. It shortens the treatment time and makes it possible to provide the patient with a functional and aesthetic reconstruction during the entire treatment period. Given the desire to produce implants that can be safely administered in immediate loading protocols, some manufacturers are eager to produce implants or implant surfaces that promote faster healing. This article reviews previously published reports discussing primary stability which occurs with immediate implant placement and secondary stability which occurs after several months of osseointegration. The theoretical loss in stability that occurs between these two periods has been the focus of implant design and surface modifications in an attempt to facilitate increased stability during this period. The timing of these events is theoretical and hence we cannot be sure where the "critical period" occurs. Moreover, it is unclear whether this loss of stability can be influenced in any appreciable way. Stability is highest immediately and after months of healing. Hence, this article promotes the importance of immediate loading as opposed to early loading which may put the implant at risk. Further, implant stability may actually be enhanced if loaded immediately analogous to immediate weight bearing protocols in orthopedic applications.

Key words

Dental implants, immediate loading, osseointegration, timing, implant surface

Introduction

Immediate or early loading of dental implants has been a hot topic in implantology. It shortens the treatment time and makes it possible to provide the patient with a functional and aesthetic reconstruction during the entire treatment period. Historically, dental implantologists have followed the well-established Branemark protocol.[1] his protocol requires two surgical procedures separated by a 3- to 6-month healing period.[2] Success rates with conventional implant methods are relatively high;[3] however, clinically, many

patients are opposed to the waiting period associated with their reconstructive work.

Furthermore, they do not appreciate the inconvenience of transitional removable prostheses. From the field of orthopedic surgery we have learned that immediate load is an acceptable treatment method which promotes bone growth and earlier functional performance. [4-6]

The immediate loading movement

In 1990, the first longitudinal clinical trial was published suggesting that implants could be loaded immediately or early in mandibles of select patients.[4] Several authors have reported positive results in both animal and clinical studies. [8-26]

The majority of these studies reported similar success rates when compared to the traditional 2-stage approach. A recent Cochrane review reported some evidence from trials in people with healthy lower jaws that immediate or early loading with dentures (in 6 weeks) had similar outcomes to waiting several months.[27]

However, the authors suggested that more research is needed to be sure that immediate or early loading is safe and effective, in upper and lower jaws, and in which populations it is best indicated.

Claims to improve immediate loading

Given the desire to produce implants that can be safely administered in immediate loading protocols, some manufacturers are eager to produce implants or implant surfaces that promote faster healing. Other approaches focus on an improved macro design to allow immediate loading.[28-30] Considering the tremendous importance of this endeavor, and the potential for overly optimistic claims, we thought it would be important to look at this topic more critically.

Since several studies have been published, including a systematic review,[27] on the clinical outcome of immediate loading, our aim was to evaluate some of the evidence currently being used to justify and evaluate immediate loading implants. We selected two pivotal papers (i.e., frequently cited) to use as our background to further investigate the current evidence that many are relying on to make claims or clinical decisions. Hence, this review is not a systematic review of the literature. Instead it is more appropriately a critical investigative report with clinical recommendations to consider. We have selected a review article that has been cited frequently both in primary research papers and manufacturer`s claims with respect to the timing of loading dental implants.[31] We selected a pre-clinical animal study that evaluated surface modifications for facilitating the placement of implants in the critical early treatment period.[32]

Our hope is that the findings from our critical report will cause all manufacturers and implantologists to pause for a moment to consider just where we are with immediate loading and what we base our claims and decision making on. Furthermore, we hope that this report will further the discussion on immediate loading and promote future research protocols that assess that which is clinically important.

Timeline of osseointegration and stability

Raghavendra et al recently published a litera-

ture review in an attempt to present the current knowledge of early wound healing adjacent to endosseous implants.[31] This paper provided a nice review of wound healing and osseointegration. Furthermore, they discussed osteoinduction and osteoconduction. This background led to a discussion about the relationship between surface technology and the timeline of osseointegration.

The "timeline of osseointegration" and associated claims regarding when to safely load an implant were supported by Figure 2 from the Raghavendra paper, Figure 1 (reproduction).

This figure depicts the changeover from primary stability created at the time of implant placement to secondary stability created by deposition of new bone (modeling or remodeling?) in humans. This figure does not have a reference, yet the y-axis (percent stability) and the x-axis (time in weeks) have values and may be taken as fact. Specifically, the period between 2 to 4 weeks is reported by the authors as a "critical" time period for implant healing. This period has been coined "the dip" by others representing the reduction in stability during the transition between primary and secondary stability. The period where "the dip" is most likely to occur is the area where manufacturers and investigators seem most interested in influencing with surface characteristic changes. A personal communication with the corresponding author of this article revealed that this Figure represents a theoretical construct and that that there is no scientific evidence or previous literature to support it. [33]

The figure of interest, (Figure 1 in this paper) differentiates between primary mechanical stability, provided by the implant design, to biological stability provided by newly formed bone as osseointegration occurs during early wound healing.

Further, this group reports there is a "critical" period of time where osteoclastic activity has decreased the initial mechanical stability of the implant but the formation of new bone has not yet occurred to the level required to maintain implant stability. They theorize that a loaded implant would be at greatest risk of relative motion and would be most susceptible to failure of osseointegration during this period. Raghavendra cites a couple of studies that may have contributed to this "theoretical" figure.

An important paper by Schwartz and Boyan is cited which discusses the wound healing paradigm around implants as a series of discrete but overlapping stages from early mesenchymal cell attachment and proliferation to remodeling at three weeks.[34] This paper also displays a very different figure, with pictures, that nicely depicts this 3 week process.

It is possible that the theoretical Figure 2 from the Raghavendra article was created from this figure; however, it is presumed that the figure from Schwartz is also hypothetical as no primary research is cited to support their specific timeline. It should be noted that this group states that "rapid bone growth is not synonymous with good bone formation" so even if the timeline were valid, it would not necessarily translate to clinical stability.

The other important article cited to "theoreti-

cally" support this figure we presume is the paper by Berglundh.[35] The authors summarized this study and concluded from their review that replacement of original bone that was responsible for initial stability of the implant at placement was "well underway at the 2-week mark". It is implied again that this 2-week point in the dog was a "critical period"; however, Berglundh states that "despite this temporary loss of hard tissue contact, the implants remained clinically stable at all times."

Yet, in the Raghavendra article, the authors appear to take this 2-week time point for the dog and multiply it by 1.5 (to adjust for the dog healing faster than the human based on personal communication with Cochran) to further justify the timing of "the dip" in figure 2.

Given the uncertainty between the relationship between stability and time it might be appropriate to ask, "Where`s the dip?" Based on the data presented, it is not clear. Whether the theoretical figure presented by Raghavendra is valid, we must caution its use for clinical or research purposes, and in particular, it application in dental implant claims.

A practical application of "the dip"

A study by Buser et al published several years before the Raghavendra review article concluded that the modified SLA surface promoted enhanced bone apposition during early stages of bone regeneration.[32] This period was between 2 to 4 weeks – the time period proposed by Raghavendra as the "critical period" for implant loading. This paper had several methodological limitations that may call in to question the application of the findings to clinical practice.[38] Despite their conclusions, the authors acknowledged that the findings did not suggest superior bone anchoring at earlier time points. Yet, clinicians and manufacturers have either cited this article or use this article to support implant claims.

We may need to ask ourselves again, "Where`s the dip?" Is there a "dip" that can be influenced by implant design or surface preparation? Perhaps, more importantly, if there is a "dip"; what are its clinical consequences? Should we focus so strictly on influencing this "critical" period of time, which is unclear? Despite what we measure in vivo, these findings may not translate to clinical reality with respect to immediate loading.

- Is it possible that implants are better able to tolerate immediate loading than we think?
- Does the implant type matter?
- Are surface characteristics important?
- If there is a dip, can we "eliminate" it?
- Or should we just avoid it all together?

Another possible curve with clinical implications

Let us look closely at this a little differently from other bone physiology research.

The descending line in Figure 1 may represent the loss of stability due to weakening osteonal bone as a result of the remodeling that occurs in injured bone. However, stabilization through the mineralization of the newly remodeled osteonal systems occurs approximately 160 days after the initiation of remodeling, Figure 2 of

this article. The time period necessary to reach full mineralization is believed to be at least 12 months after injury. [28, 36]

On the other hand, from the orthopedic literature, another type of bone (i.e., woven bone or callus) is described which begins to develop immediately after a fracture occurs. Stability created by this bone can be substantial within 50-60 days of injury.[37] This type of healing may represent the ascending line in our Figure 2.

However, clinically speaking, we must caution the use of this theoretical construct in conventional dental implant procedures. Callus or woven bone formation requires space.[41] By the nature of the procedure, space is typically not available since when placing conventional root-form implants, the objective of such placement is to create a congruent bone cavity which may include compression against the bone during the implant placement.

So without available space in the vicinity of the conventional dental implant for woven bone formation, the alteration of the surface designed to improve implant stability may not provide appreciable clinical benefits.[38]

Avoiding a "dip" all together

Conventional Brånemark protocols avoid the "dip" by prolonged waiting periods to insure tissues are healed and osseointegration is complete. This is a proven strategy to ensure adequate stability before loading. Is it also possible to avoid the "dip" by loading immediately (i.e., within 48 hours). In a recently published paper, Klinger et al questions whether early implant loading always leads to pseudointegration, as postulated by Brånemark's original protocol, or whether the waiting period of 3 to 6 months can be significantly shortened in specific clinical situations and refined surgical protocols.[39] This review paper discusses the principle that early loading induces bone growth.

The authors define micro- and macro movement and their important role in the early loading protocol. This concept is not unlike the concept of fracture healing in orthopedics. Limited movements promote callus formation and may result in mechanical stability.[36] Is it possible that immediate loading may actually improve stability rather than hinder it?

If there is a "dip" that may lead to instability, surface modifications may not be enough to overcome this. Initiating implant loading during the time of the proposed "dip" could be dangerous. Timing of the loading may be critical. Regardless of where the "dip" is located, most implantologists can agree that stability can be gained before it occurs; therefore, if one wants to load early, "immediate" loading is likely the safest time as opposed to some form of "early" loading that may occur during the unknown "dip" period.

From a practical perspective, immediate loading mandates that the dental office be in close contact with a dental laboratory as prosthetical work pieces must be in place, before reparative remodeling starts weakening the old bone structures (i.e., within 48 hours). The longer the time between operation and incorporation of the work piece, the more dangerous the han-

dling of the implant will be (e.g., tightening of screws and abutments may lead to undesired implant movements). So it may be that no delay or long delays in loading are the only potentially safe strategies to ensure successful osseointegration.

Justification for "immediate" loading

It has been reported that the remodeling activity of secondary osteons start after day three postoperatively. Osteonal remodeling is the bone`s mechanism of self repair after any type of insult (e.g., operations, injuries, fractures).[40]

Implant procedures can be construed as major injuries to the bone that ultimately will initiate a repair process. Further damage to the bone surrounding the implant may be caused by the placement of prosthetical work pieces (e.g., cementing, grinding in, etc.). This process may create micro cracks which initiate further remodeling. It is our belief that it is the remodeling of the bone that weakens it, rather than the chewing force. Hence, if "early" loading is our goal, we must focus on "immediate" loading by training our office team to supply the prosthetical work pieces immediately.

We should keep in mind that not only the regular mastication or parafunctional forces are a risk factor for instability of newly inserted implants but even larger forces may be possible when applying the prosthetical workpieces through the tightening of screws and abutments. The potential stress created by these interventions may be a greater risk for implant stability since remodeling beings three days postoperatively.

The theoretical "dip" period, wherever it may lie, may be a risky period for performing these manipulations. Further, we must leave the first (often provisional) work pieces in place for a prolonged period (e.g., minimum of 160 days) because it has been reported that primary mineralization of the osteonal system cannot be made faster and because we can not expect, as explained earlier, to find a mineralized callus-type bone around an endosseous dental implant for lengthier time periods, if at all, Figure 3.

Conclusion

The concept of immediate or early loading is not new. Moreover, many authors have reported success in immediate loading protocols with various implants systems – both root-form, blade-form and basal implant types. Without question, immediate loading protocols are best for the patient as long as implant longevity is not compromised. We need to strike a balance between immediate loading and implant protection to avoid failure. Perhaps our focus should not be to "eliminate the dip". Respecting the rules of physiological bony repair seems more reasonable than guessing where a dip is and trying to influence it.

Not knowing when the dip (or if) really occurs, we should approach immediate loading as just that – loading before a potential "dip" occurs. This requires rapid coordination with the office team to ensure work pieces are complete and placed immediately. Implant stability may actually be enhanced if loaded immediately because the prosthetical workpiece may serve as its own internal fixation device (similar to orthope-

dic implants). Several questions need to be answered.

- Are some implant designs better suited for more aggressive immediate loading?
- Can the surface provide any appreciable benefit as some have focused on in the past?

These questions should be explored in more aggressive animal studies that allow for natural mastication, biomechanical testing, and continued clinical studies comparing different implants

Figures

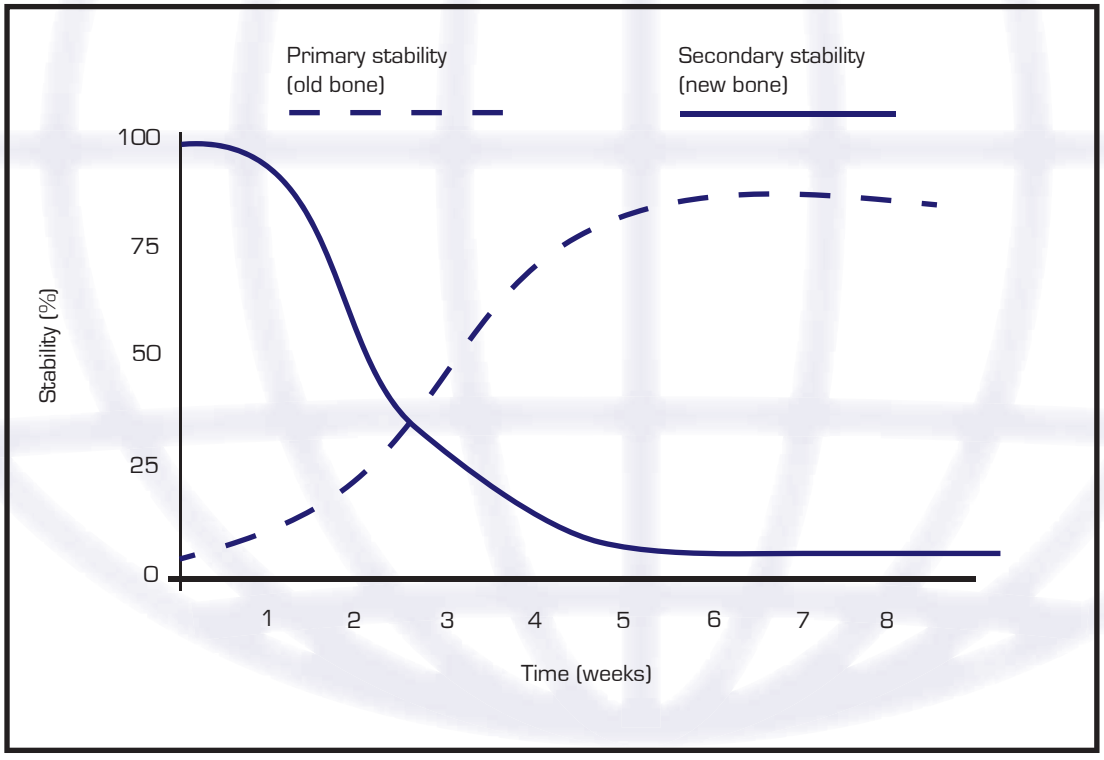

Fig. 1 : Reproduction of Fig. 2 in (31)

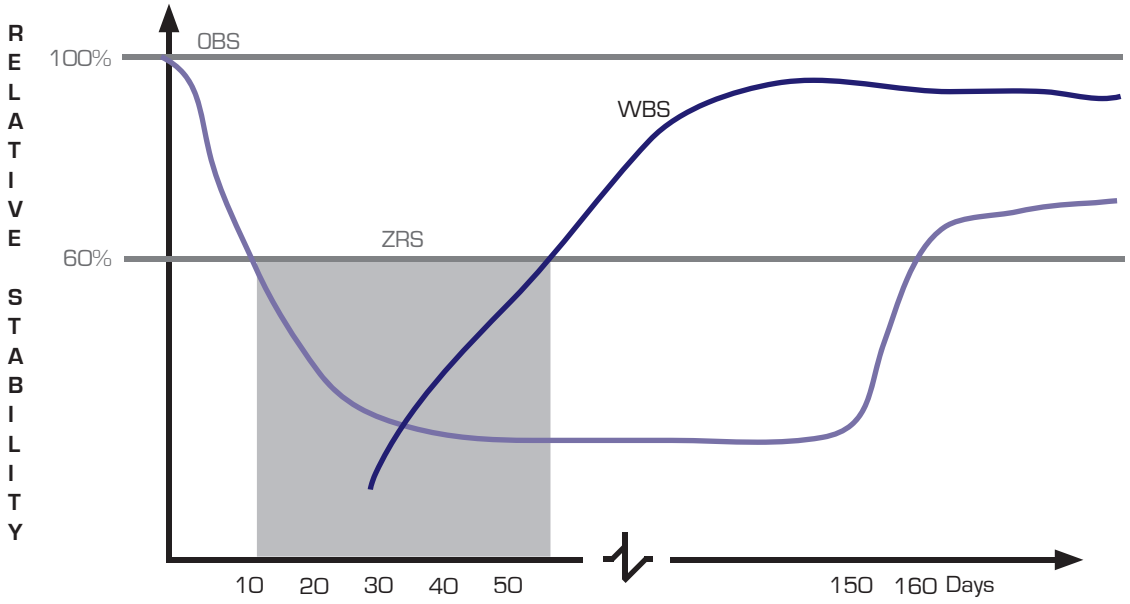

Fig. 2 OBS = Osteonal bone stability; WBS = Woven Bone stability; ZRS= Zone of reduced stability

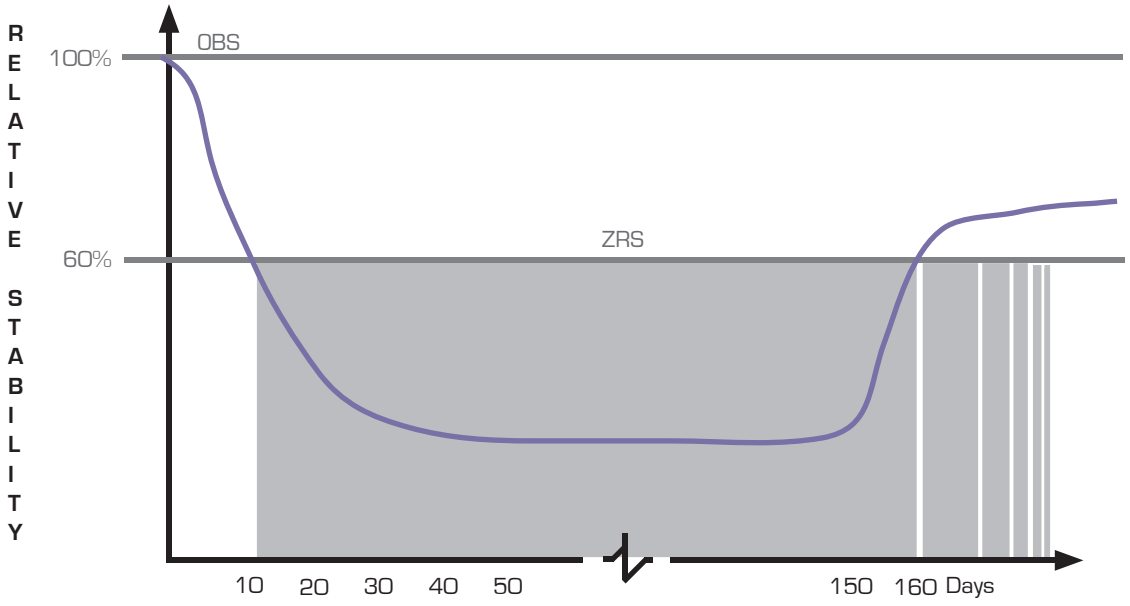

Fig. 3 In case that not woven bone stability is developing, the lowered osteonal stability is expected to persist until approx. day 160 postoperatively. This covers roughly the period which Brånemark et al proposed for late loading protocols

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Implantological treatment in a patient with hypodontia

Dr. Sigamr Kopp
Niklotstr. 39
D-18273 Güstrow

phone: +49 3843 21 45 53
e-mail: sigmar.kopp@implantfoundation.org

Abstract

The transosseous installation of basal dental implants and their cortical anchorage allows single step treatment under immediate load conditions, especially in patients with low amount of bone. Patients suffering from congenital hypodotia provide thin bone ridges due to the absence of adequate growth stimuli, so they are ideal candidates for basal implant treatment. A typical example is shown here.

Key words:

cortical anchorage, hypodontia, transosseous implant, basal implant, BOI

Introduction

Basal implants are often used in patients with vertical and horizontal bone deficits.[1, 2] Basal implants utilize the horizontal and cortical bone supply, rather than the bone marrow, and they allow immediate loading and functioning [1]. Due to their cortical anchorage the functional load is transmitted to highly mineralized, therefore resistant, and resorption stable cortical bone regions.

The desire of most patients for fast, minimally invasive, durable and cost worthy treatments may be faced best by treatment procedures providing immediate loading protocols. Immediate loading in conventional screw type implants has recently been evaluated with increasing results.[3, 4] A single-stage protocol has been standard in basal implantology for years.[5] So the use of basal implants seems to be first choice in cases desiring fast, minimally invasive, durable and cost worthy implantological treatments.

Case

A 17-year-old male patient was referred to our clinic for implant treatment. Preceeding orthodontic treatment modulated the arch while the second upper incisors were missing congenitally. In the absence of physiological forces, the horizontal bone supply was low and reduced in the area of interest, although the vertical bone supply was sufficient. Fig. 1

Alternative solutions like resin bounded bridges, conventional bridges and crestal implants in combination with prior augmentations were discussed with the patient and his parents, but were declined due to their unshakeable desire getting implant based crowns really as quick as possible. So we decided to use basal implants (BOI®) in a single step procedure, followed by an immediate load prosthodontic protocol.

Under local anesthesia, a full-thickness flap was elevated, and the vertical and horizontal slots for the implant insertion were prepared. Fig. 2, 3 Two single-piece triple-BOI®-implants with fixed abutments were inserted.Fig.4

Even though the bone ridge was very narrow, the cortical walls providing sufficient load-bear-

ing capacity were present. A good primary stability of the implant was achieved though using the maxillary vestibular and palatal cortical bone. The right implant was fixed by an osseous fixation screw.[Fig. 5-7]

To reduce bone resorption tendency in the vestibular maxilla and to mask extending parts of the base plates, primary augmentation is possible. However this patient refused this facultative treatment. The patient left the clinic after two hours of treatment with temporary plastic crowns. To allow healing of the soft tissues, the impression for the permanent crowns was performed six weeks later.[Fig. 8] The treatment was finalized by cementing metal-to-ceramic crowns. [Fig.9] This procedure allowed achieving immediate function as well as immediate aesthetics. The patient is satisfied with the short intervention, the clinical result and the low costs. Figures 10 and 11 show the patient`s condition after a follow-up period of 18 months in X-rays.

Discussion

Basal implants have proved to be enduring and sufficient for all indications. The innovative design of BOI® hinders the implant rotation in bone during the bone softening by osteoclasts activity in the remodelling process.[6] That`s why a true immediate loading may be applied to BOI® even in single crowns.[1,7,8] The very small demand for available bone qualifies BOI® to be good for minimally invasive and fast treatment. The aesthetic results are comparable to other systems and alternative, multiple-step procedures.[1] The vertical bone loss around the implants, well known in crestal implantology, is not present in basal implants. By the thin implant shaft penetrating the gingiva, periimplantitis development is hindered. So the aesthetic and functional results are stable for years.[1, 2, 9] Augmentations prior to the implantation can typically be avoided by the use of basal implants. With the physiological stimulus by basal implants on present bone, remodelling leads to new vital bone in areas of load transmission.[1] Amendments are seldom but easy to handle by skilled and trained basal implantologists.[1, 10]

Conclusion

The transosseous installation of basal dental implants and their cortical anchorage leads to fast rehabilitation and high aesthetic results.[1, 2] Also patients with small depressed bone ridges in the absence of adequate growth stimulus benefit by the use of basal implants. The surgery is done within one single session, temporal or sometimes permanent crowns or bridges are installed on the same day. To keep patient encroachment and costs to a minimum, the use of basal implants should be considered or at a minimum, be part of the clarification of facts for potential treatments as decided by german courts.[1, 9]

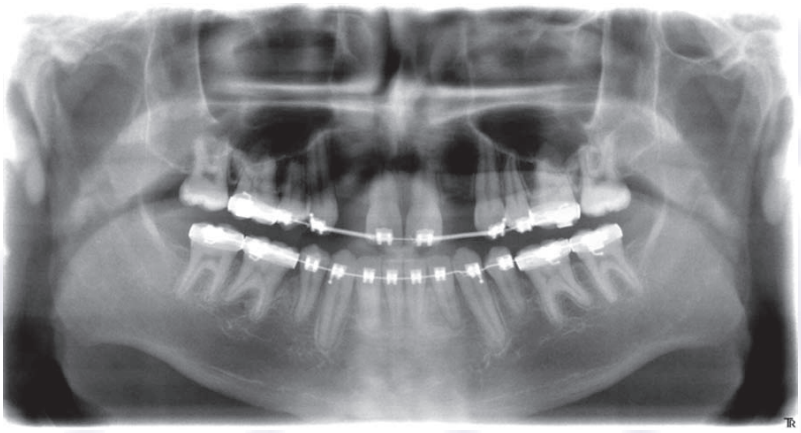

Figure 1. Panoramic view shows only horizontal deficits at the implant site.

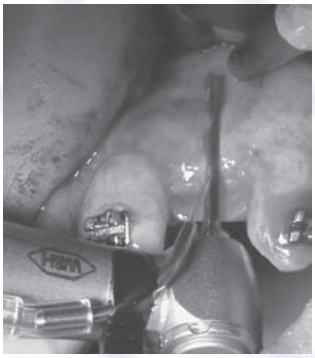

Figure 2. The vertical cut determines the horizontal position of the implant.

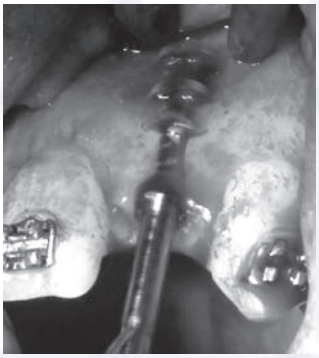

Figure 3. The cut with the implant congruent combicutter provides the correct hight of the implant as well as the correct implant bed.

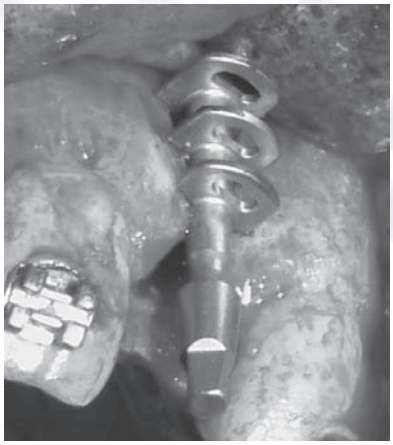

Figure 4. The implant will be inserted with careful tapping from vestibular side.

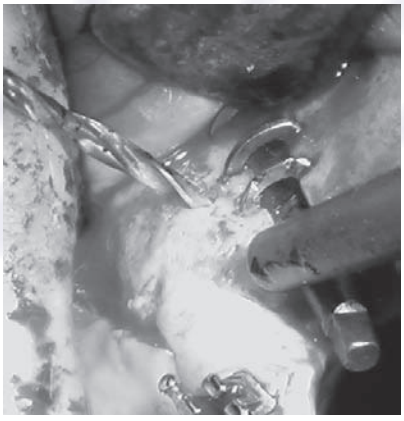

Figure 5. Primary stability may be improved by bending the horizontal parts of the implant or by horizontal screwing. Here the cavity for the SSF® bone screw will be prepared.

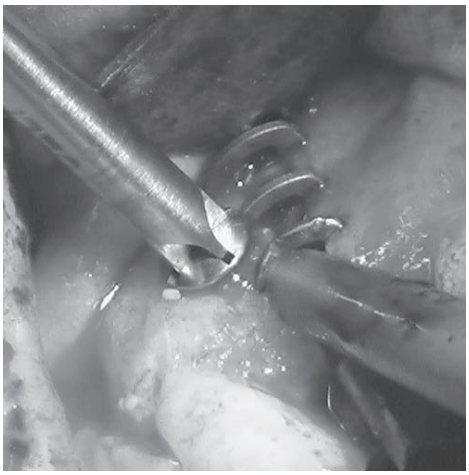

Figure 6. Osseo synthesis screws provide good stability as known from internal fracture fixation.

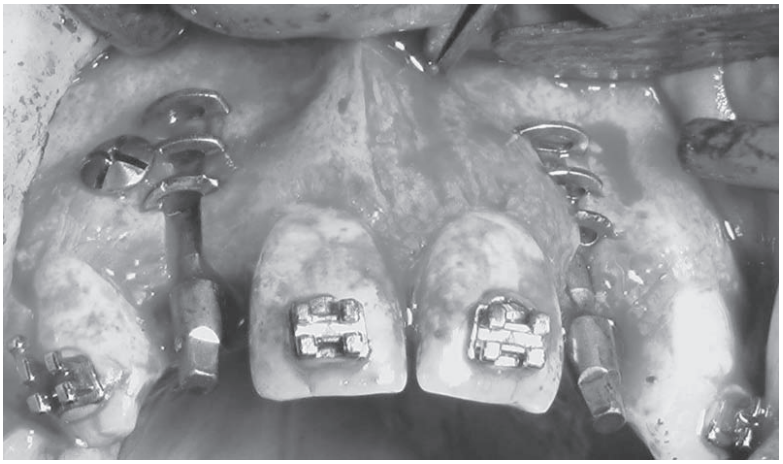

Figure 7. Inserted basal implants show primary stability. Primary augmentation in the area of the base plates would have been an additional option.

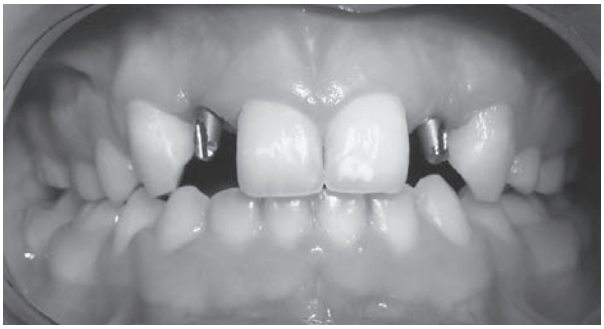

Figure 8. The inserted implants are stable, the gingiva is healed and the impression can be done.

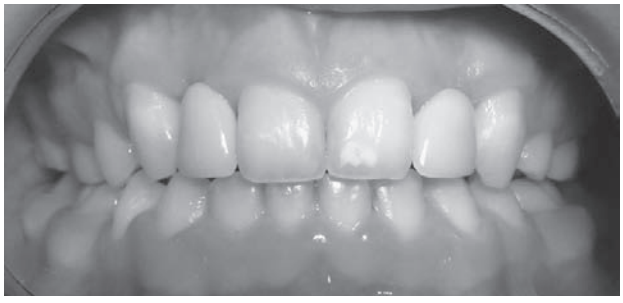

Figure 9. Clinical view of the cemented crowns 18 months post-operatively. The mucosa shows no inflammation, and the implants are unmovable.

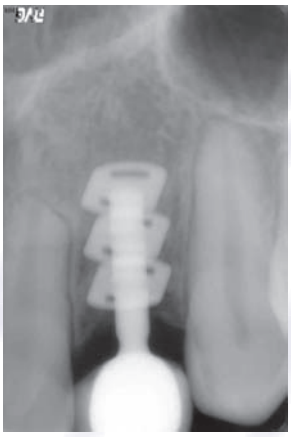

Figure 10. Control X-ray of the left laterals implant 18 months postoperatively. Bicortical anchorage cannot be assessed by this projection, but the bone structure seams to be homogenous.

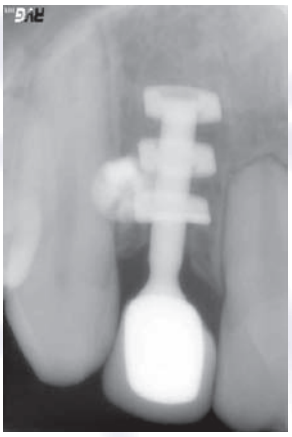

Figure 11. Control X-ray of the right 18 months postoperatively. The bone screw may stay permanently in the bone.

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Case report

Immediately Loaded Maxillary Reconstruction Using Basal and Crestal Implants, With

Delayed Esthetic Adaptation of the Bridge-work

Henri Diederich, Dr. med. dent.
51, av. Pasteur
2311 Luxembourg
Luxembourg

Phone: +352 225815-31 e
E-mail:hdidi@pt.lu

Abstract

A 63-year-old male patient received a maxillary full -arch reconstruction on immediately loaded implants. Due to the prior extraction of several residual teeth, pronounced bone remodeling and soft-tissue recontouring was expected. This necessitated adaptation of the tissue side of the bridge after four months.

Key words

Diskos® implants, immediate loading, immediate implant placement

Introduction

When teeth in the aesthetic zone are scheduled for extraction and replacement by implants, this poses a combination of challenges: First, it is often difficult to anchor conventional implants because the buccolabial or buccopalatal dimensions of the extracted tooth roots are is greater than the dimensions of the implants. In addition, intense bone remodeling and soft-tissue recontouring occur, which makes it difficult to achieve a lasting aesthetic result quickly. In our clinic, we combine a single-stage surgical approach with a two -stage prosthetic approach to solve this problem.

Case Description

Having been in function for 15 years, the full-arch maxillary bridge of the 63 -year -old patient repeatedly became mobile due to increasing attrition of the residual teeth.

Further re-cementing appeared impossible, so we proposed the extraction of all teeth, followed by the insertion of implants. A one-stage surgical protocol was evaluated. The patient insisted on receiving a fixed restoration immediately and did not even accept a temporary removable denture. The residual teeth were severely decayed with various infected roots. The bone supply in the distal mandible was limited.[Fig. 1]

An impression over the old bridge was taken, and a splint was fabricated in the laboratory that later allowed the delivery of a fixed temporary. The surgical procedure was performed with local anesthesia. All maxillary teeth were removed and infection residue, cysts, and other soft tissues were removed from the bone.

Triple BOI® implants (EDDDS 7 H6) were in-

serted in the maxillary canine areas, and multicortical support was achieved. A double- BOI® implant was placed at the site of the maxillary right second premolar and a single-base-plate BOI® implant at the site of the maxillary right first molar. Surgical instruments for screw implants were used to prepare the implant beds for Allfit –TPG® screw implants in the maxillary anterior region and in both tubero-pterygoid regions. TPG® implants were originally designed strictly for use in the tuberopterygoid region but we have found them usefull, easy to insert, and extremely stable when used in other maxillary areas as well. Finally an Allfit-KOS® one piece screw implant was inserted in the region of the maxillary left first premolar.

Immediately after the implants had been placed and the soft tissues closed and sutured, the impression was taken. In immediate loading protocols, we either place the abutments immediately, – thus avoiding distortion of the remodelling bone after day 3 postoperatively, – or we place a screw-retained bridge on the TPG® implants. In many cases, there is no other option than screwing the bridge onto the tuberopterygoid screws because the path of insertion does not allow a cemented structure to be seated evenly on heavily angulated abutments.

External threaded basals implants (Diskos®) are usually equipped with a cementing abutment. The final restoration will be cemented onto the basal implants and the KOS® or BCS® screw and screwed onto the TPG® implants.

The patient received a fixed temporary denture connected only to the cementing posts and a medication of penicillin 2 g p.o. and Celestron chondrose 2 ml s.c. was given to forestall swelling.

The sutures were removed at the next appointment, before trying in the metal framework. The bridge was delivered on day 10 postoperatively. It was secured on the cementing abutments with temporary cement and on all TPG® implants with prosthetic screws. The patient reported no pain, but there was visible swelling on the right side of the face for 4 days postoperatively.

The patient was instructed to avoid hard food for two months and to select only foods that can be crunched with a single soft bite. He was also instructed to use both sides of the bridge with the same frequency and strength and to contact us immediately, if equal bilateral usage was not possible.

Any premature contacts and slight changes in the occlusal plane were adjusted monthly during the following nine months. After four months, the re-contouring of the soft tissues seemed to have been arrested.

The bridge was removed after an overimpression had been taken, and a new temporary restoration was inserted for two days. During those two days, the dental technician adapted the tissue side of the bridge, using white and pink ceramics. This second stage of laboratory work satisfied the patient`s esthetic needs; the bridge was inserted and cemented with definitive “Panavia” cement.

Discussion

Immediately placed and restored implants in the maxilla often require two stages of laboratory procedures if the fabrication of a second bridge is to be avoided – the reasons are speech impairments due to shrinkage and re-contouring of the soft tissues, as well as changes in esthetic appearance.

For this reason the bridge is cemented temporarily during the first phase of use, accompanied by regular stability checks. Temporarily cemented restorations are prone to loosening. Especially since patients who had not worn fixed restorations before the intervention or who experienced very gradual bridge mobilization may often be unaware that their implant- supported bridge has loosened. Early loss of implants due to overloading may be the result. The inclusion of tuberopterygoid screws improves the stability of the implant / prosthetic system dramatically. On the other hand,- if the temporary cement fails, this does not mean- that the screws will loosen as well. In these situations, the entire masticatory load may rest on those implants that the restoration is connected to by screws, again posing a risk of (screw-type) implant loss.

In conclusion, regular check-ups and patient instruction are required, if bridges are cemented with temporary cement. A two-stage prosthetic protocol is appropriate if teeth are extracted in the anterior maxilla. Today, the use of basal implants (BOI®, Diskos®) allows us to perform all the necessary surgical steps in one single session.

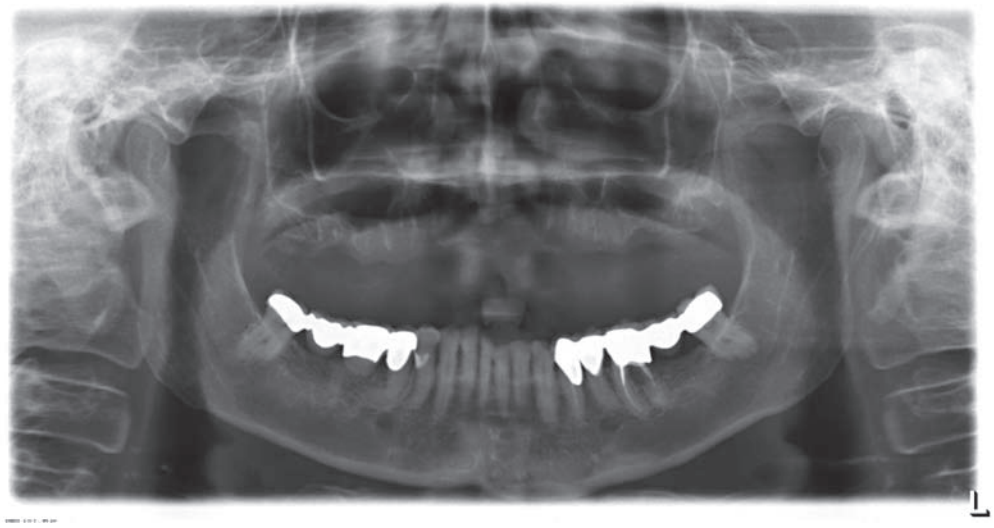


Fig. 1: Preoperative OPG showing residual maxillary teeth and pronounced atrophy in the molar area.

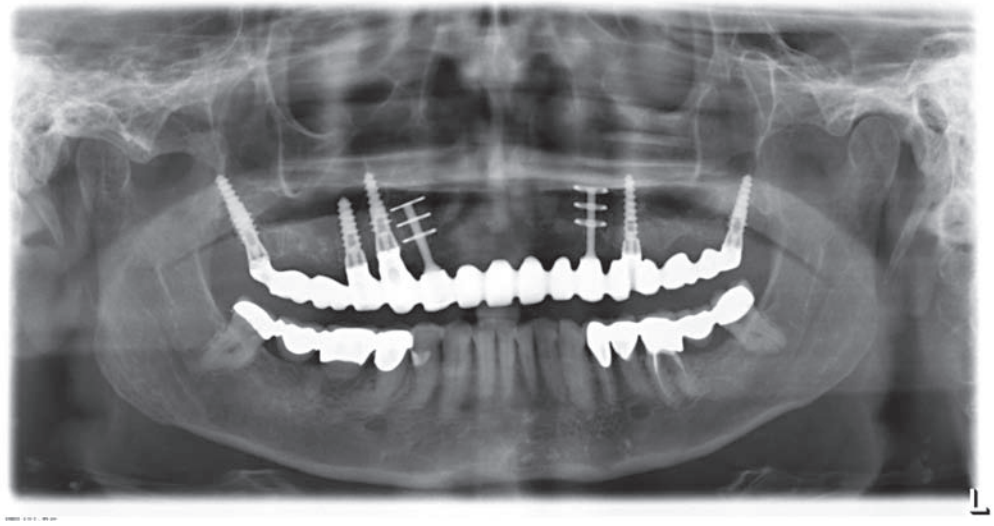


Fig. 2: Postoperative radiograph showing the basal and crestal implants, splinted by an immediately loaded fixed bridge. Basal and crestal implants were chosen based on the available vertical and horizontal bone and the situation at the extraction sites.

Research in Context – Part II

Be a Cynic! Learn How to Read the Implantology Literature Critically

Study Types and Bias – Who Shows Favoritism?

Teaser

Not all study designs are created equal. Some designs are inherently better at minimizing bias that always threatens to undo a study. In this issue of Implant Directions, learn the strengths and weaknesses of the common study designs that you are most likely to encounter.

Text

The goal of a clinical trial assessing treatment is to obtain the most accurate and unbiased effect of the treatment. One important way to help minimize bias is to select the best study design to accomplish your purpose. There are three frequently used study designs we will discuss today: the randomized controlled trial, the cohort study and the case-series.

Study Design

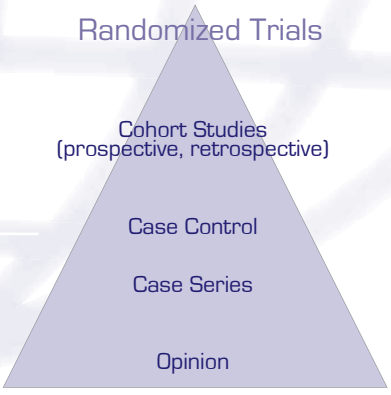
When comparing two treatments, the comparison groups should be comprised of participants who are similar in all respects, with the exception of the particular treatment(s) that is being studied. The best method to achieve this similarity between groups is that of random assignment.

The randomized controlled trial (RCT) provides the strongest evidence for safety and effectiveness and is considered the gold standard for therapeutic studies.

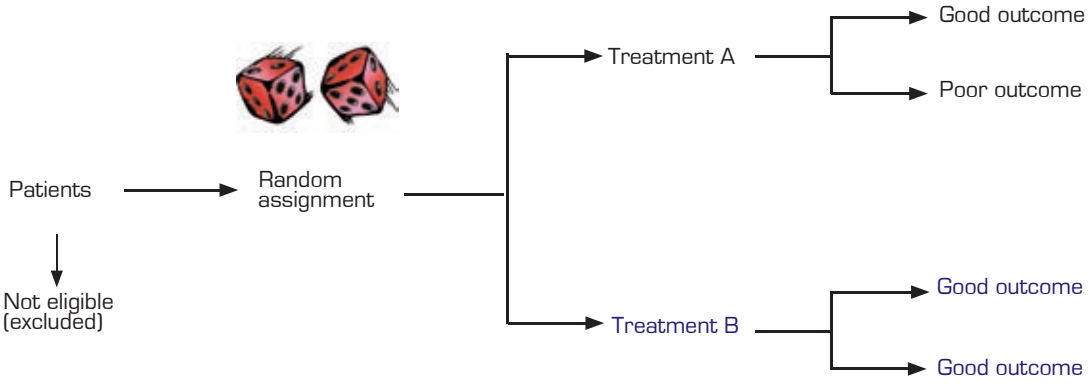
RCTs are characterized by:

- A group of patients randomly assigned to an experimental group to receive a treatment such as surgery, or to a control group (no treatment, placebo or an active alternative).
- Minimizing confounding (known and unknown).
- Offering the most solid basis for an inference of cause and effect compared with the results obtained from any other study design.

Hierarchie of Evidence



The RCT study design looks like this:



Cohort studies are characterized by:

- Comparing the outcomes of patients whose treatment differs "naturally", i.e. not as the result of random assignment. For example, comparing the outcomes of two types of implants, one done routinely by you (e.g., BOI® implant) and one done routinely by your colleague (e.g., screw-type implant) constitutes a cohort study.

- Identifying study participants BASED ON TREATMENT, and then their outcomes are compared. In our example, the groups are formed based on the treatment they received, BOI® vs. standard screw-type implant.
- The ability to establish a temporal relationship between the treatment and the outcome because the treatment precedes the outcome.

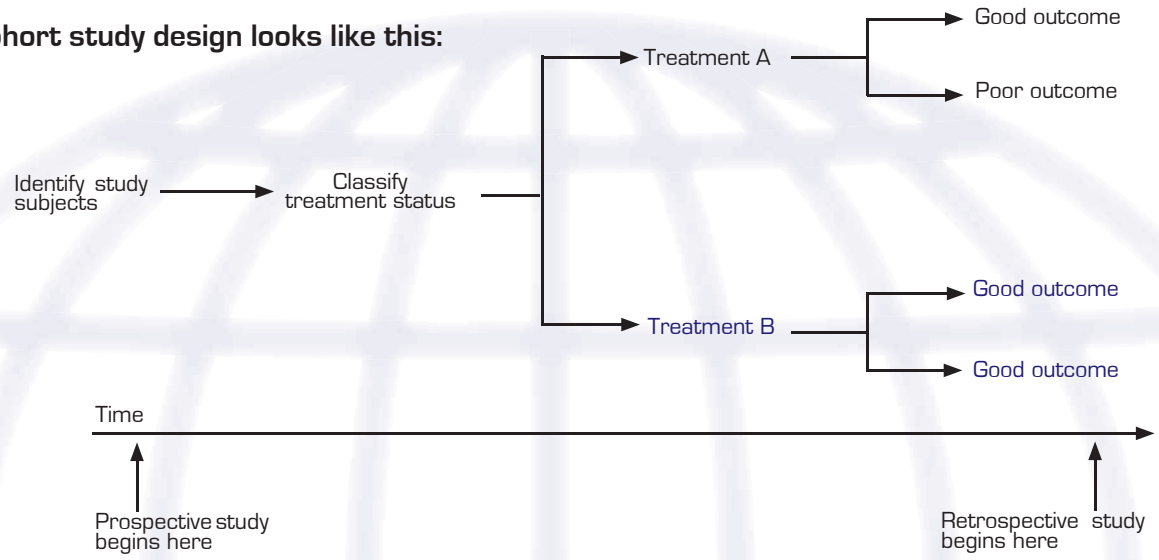
- The potential imbalance of prognostic factors (those factors that may influence outcomes apart from the treatment) between the two groups. This is one of the biggest problems with cohort studies. Some examples of factors that might have an influence on outcome that might be imbalanced between groups include age, overall health or physical condition, smoking status and bone quality.

Cohort studies may be divided into those that are prospective and retrospective.

→ Prospective cohort studies determine treatment at the beginning of the study with follow-up for outcome to occur in the future.

→ Retrospective cohort studies, on the other hand, are characterized by the treatment and outcome having already occurred at the time of study initiation.

The cohort study design looks like this:



Case series are characterized by:

- Collection of multiple noteworthy clinical occurrences.

- Cases that experience a novel treatment. For example, you have developed a novel way of inserting your implant. You have done 48 cases with your technique, and now you report the outcomes from your procedure on these cases.

- Unusual cases, either those with atypical characteristics or those with unusual signs and symptoms. One example would be a group of patients who had extremely poor bone quality that ordinarily would not be candidates for implants. You now have 3 year follow-up in 25 of these patients and you want to report on the results.

- A lack of hypothesis or a comparison group. This is the biggest weakness of a case series. Without a contemporary comparison group, it is not possible to know with certainty what the outcome would be if the patient received a different treatment. As a result, most case series help to generate hypotheseis, not answer clinical questions of efficacy or effectiveness.

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Random Assignment: Let chance be your friend.

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

Direct submissions to:
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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.