Immediate vs. early loading of dental implants: 3-year results of a randomized controlled clinical trial.

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Abstract

OBJECTIVES: The aim of the present study was to test whether or not immediately loaded implants exhibit the same survival rates as early loaded implants.

MATERIAL AND METHODS: Eleven patients with bilateral free end mandibles were randomly assigned to treatment either with immediately (test) or early loaded implants (control). Test implants received provisionals in occlusion on the day of surgery, control implants 6 weeks later. Parameters assessed included implant stability quotient (ISQ), plaque, prosthesis stability and radiographs at baseline (implant insertion), 1 and 3 years. The statistical analysis was performed by means of Student's paired t-test and Wilcoxon's signed-rank test. The level of significance was set at P<0.05.

RESULTS: After a mean observation period of 39.8 months (36.7-53.1), three test implants were lost in two patients resulting in a survival rate of 85% compared with 100% for control implants. At baseline, the mean marginal bone level was significantly higher at test implants (mean=0.36 mm, SD +/-0.5) compared with control implants (1.08+/-0.37 mm). For both test and control implants, the bone level significantly decreased from baseline to 3 years (test: 1.51+/-0.79 mm; control: 0.89+/-0.94 mm). The bone loss until 3 years was not significantly different between test and control group. There was no significant difference for ISQ both at test and control implants between baseline (test: 63.59+/-4.62 mm, control: 65.35+/-7.43 mm) and 3 years (test: 66.47+/-7.47 mm, control 68.80+/-8.75 mm).

CONCLUSIONS: Immediate loading was associated with a lower implant survival rate. Although the test implants were placed with increased sink depth compared with the control implants, the marginal bone levels were not different between test and control at 3 years.
Resonance frequency analysis of implants subjected to immediate or early functional occlusal loading. Successful vs. failing implants.


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Abstract

OBJECTIVES: The objective of this study was to analyze the development of implant stability by repeated resonance frequency analysis (RFA) measurements during 1 year in 23 patients treated according to an immediate/early-loading protocol. The objective was also to evaluate the possible differences between failing and successful implants.

MATERIAL AND METHODS: Eighty-one Brånemark System implants were placed in 23 patients for immediate/early-occlusal loading in all jaw regions. Thirty of the implants were placed in extraction sockets and 62 were subjected to GBR procedures. Apart from clinical and radiographic examinations, the patients were followed with RFA at placement, prosthesis connection and after 1-3, 6 and 12 months. Statistical analyses were carried out to study the possible differences between implants that failed during the study period and implants that remained successful.

RESULTS: Nine implants failed (11.2%) during the 1 year of loading. RFA showed a distinct different pattern between the implants that remained stable and the implants that were lost. The implants that failed during the course of the study showed a significantly lower stability already after 1 month.

CONCLUSION: Within the limitations of this study, it is concluded that failing implants show a continuous decrease of stability until failure. Low RFA levels after 1 and 2 months seem to indicate an increased risk for future failure. This information may be used to avoid implant failure in the future by unloading implants with decreasing degree of stability with time as diagnosed with the RFA technique.

Interventions for replacing missing teeth: different times for loading dental implants.

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Comment in:


Update of:
BACKGROUND: To minimize the risk of implant failure, osseointegrated dental implants are conventionally kept load-free during the healing period. During healing removable prostheses are used, however many patients find these temporary prostheses rather uncomfortable and it would be beneficial if the healing period could be shortened without jeopardizing implant success. Nowadays immediately and early loaded implants are commonly used in mandibles (lower jaws) of good bone quality. It would be useful to know whether there is a difference in success rates between immediately or early loaded implants compared with conventionally loaded implants.

OBJECTIVES: To evaluate the efficacy of (1) immediate (within 1 week), early (between 1 week and 2 months), and conventional (after 2 months) loading of osseointegrated implants, and of (2) immediate occlusal versus non-occlusal loading during the bone healing phase.

SEARCH STRATEGY: The Cochrane Oral Health Group's Trials Register, CENTRAL, MEDLINE and EMBASE were searched. Handsearching included several dental journals. Authors of all identified trials, an Internet discussion group and 55 dental implant manufacturers were contacted to find unpublished randomised controlled trials (RCTs). The last electronic search was conducted on 4 June 2008.

SELECTION CRITERIA: All RCTs of root-form osseointegrated dental implants, having a follow up of 4 months to 1 year, comparing the same implant type immediately, early and conventionally loaded or occlusally and non-occlusally loaded. Outcome measures were: prosthesis and implant failures and radiographic marginal bone level changes.

DATA COLLECTION AND ANALYSIS: Data were independently extracted, in duplicate, by two review authors. Authors were contacted for details of randomisation and withdrawals and a quality assessment was carried out. The Cochrane Collaboration's statistical guidelines were followed.

MAIN RESULTS: Thirty RCTs were identified and 22 trials including 976 participants in total were included. Twelve trials compared immediate versus conventional loading, three early versus conventional loading, six immediate versus early loading, and one occlusally versus non-occlusally loaded implants. On a patient, rather than per implant basis, there were no statistically significant differences for any of the meta-analyses.

AUTHORS' CONCLUSIONS: It is possible to successfully load dental implants immediately or early after their placement in selected patients, though not all clinicians may achieve optimal results. It is unclear whether it is beneficial to avoid occlusal contacts during the osseointegration phase. Trends suggest that immediately loaded implants fail more often than those conventionally loaded, but less commonly than those loaded early. If a clinician wishes to load the implants early, it might be wiser to load them immediately (within 1 week) rather than waiting for 1 or 2 months. A high degree of primary implant stability (high value of insertion torque) seems to be one of the prerequisites for a successful immediate/early loading procedure. More well designed RCTs are needed and should be reported according to the CONSORT guidelines (www.consort-statement.org/).
Immediate functional loading in the maxilla using implants with platform switching: five-year results.

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Abstract

PURPOSE: Immediate loading in the maxilla is not a routinely recommended treatment concept; however, some clinical series have shown a high survival rate for nonfunctionally loaded implants. The purpose of this study was to demonstrate the prognosis for immediately loaded implants with a progressive thread design and platform switching placed in the maxilla with or without simultaneous augmentations using autogenous bone.

MATERIALS AND METHODS: Ninety implants were placed (six in each maxillary arch) in 15 patients. Immediately after surgery, the implants were loaded with a provisional acrylic resin prosthesis (immediate occlusal loading). Splinting of the implants with the provisional remained for 6 to 8 weeks of healing. In patients with augmented sites, a 3-month period of provisionalization was necessary to ensure implant stability; a soft/liquid diet was recommended for this intermediate transitional period. Definitive fixed restorations were then fabricated and delivered. Clinical and radiologic examinations of the implants were performed at various times.

RESULTS: After a mean loading period of 42.4 (+/- 19.15) months, only three failures were reported. This represented a survival rate of 96.66%. No complications, including inflammation or bone loss, were reported during the study period.

CONCLUSIONS: Based on these results, the immediate loading protocol in the maxilla can be used successfully when implant primary stability, cross-arch stabilization, and a soft diet for the initial stages of healing are considered.

Occlusal considerations in implant therapy: clinical guidelines with biomechanical rationale.

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Abstract

Due to lack of the periodontal ligament, osseointegrated implants, unlike natural teeth, react biomechanically in a different fashion to occlusal force. It is therefore believed that dental implants may be more prone to occlusal overloading, which is often regarded as one of the potential causes for peri-implant bone loss and failure of the implant/implant prosthesis.
Overloading factors that may negatively influence on implant longevity include large cantilevers, parafunctions, improper occlusal designs, and premature contacts. Hence, it is important to control implant occlusion within physiologic limit and thus provide optimal implant load to ensure a long-term implant success. The purposes of this paper are to discuss the importance of implant occlusion for implant longevity and to provide clinical guidelines of optimal implant occlusion and possible solutions managing complications related to implant occlusion. It must be emphasized that currently there is no evidence-based, implant-specific concept of occlusion. Future studies in this area are needed to clarify the relationship between occlusion and implant success.

**Guidelines for occlusion strategy in implant-borne prostheses. A review.**

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**Abstract**

Medium- or long-term failure of endosseous dental implants after osseointegration, when it has occurred, has been associated in the great majority of cases with occlusal overload. Overload depends ultimately on the number and location of occlusal contacts, which to a great extent are under the clinician's control. Much of our current understanding of occlusal contacts in this context is based on concepts derived from non-implant-borne prosthetics and has not been rigorously tested. The present article reviews occlusal contact designs and offers occlusion strategy guidelines for the main types of implant-borne prostheses.

**Fixture design and overload influence marginal bone loss and fixture success in the Brånemark system.**

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**Abstract**

It has been documented that the long-term clinical outcome of the Brånemark system is very favourable. However, failures do occur before and after loading. This study examined the differences in marginal bone loss between standard and self-tapping fixtures and attempted to explain excessive marginal bone loss or loss of osseointegration during the first 3 years of loading. Marginal bone loss (scored on long cone radiographs) and fixture failure rate were compared for different fixture designs. For standard fixtures, in comparison with self-tapping fixtures, the failure rate was clearly higher before as well as after loading. However, for successful fixtures no difference in marginal bone loss was observed. For the conical fixtures an increased marginal bone loss around the smooth part was observed. The effect of fixture overload, marginal bone height and loss of osseointegration was examined in 69 patients.
with 1 and 15 patients with 2 fixed full prostheses, and in 9 patients with an overdenture in the upper jaw. Excessive marginal bone loss (more than 1 mm) after the first year of loading and/or fixture loss correlated well with the presence of overload due to a lack of anterior contact, the presence of parafunctional activity and osseointegrated full fixed prostheses in both jaws.

Implant loading protocols for partially edentulous maxillary posterior sites.

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Abstract

PURPOSE: To evaluate early and immediate loading of implants in the posterior maxilla and to investigate whether there is a difference in success rates, survival rates, and peri-implant parameters, including marginal bone level changes.

MATERIALS AND METHODS: A comprehensive systematic review of the literature was conducted. The selection of publications reporting on human clinical studies was based on predetermined inclusion criteria and was agreed upon by two reviewers.

RESULTS: Twelve papers were identified on early loading (two randomized controlled clinical trials [RCTs] and 10 prospective case series studies). Six papers were found on immediate loading (one RCT, four prospective case series, and one retrospective study).

CONCLUSIONS: Under certain circumstances it is possible to successfully load dental implants in the posterior maxilla early or immediately after their placement in selected patients. The success rate appears to be technique sensitive, although no study has directly assessed this. A high degree of primary implant stability (high value of insertion torque) and implant surface characteristics play an important role. It is not possible to draw evidence-based conclusions concerning contraindications, threshold values for implant stability, bone quality and quantity needed, or impact of occlusal loading forces. As for the impact of the surgical technique on implant outcome in different bone densities, no studies prove significant superior results with one technique over another. Well-designed RCTs with a large number of patients are necessary to make early/immediate loading protocols in posterior maxilla evidence based, but ethical and practical considerations may limit the real possibility of such studies in the near future.
Implant loading protocols for the partially edentulous esthetic zone.

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Abstract

PURPOSE: The scientific evidence related to different or novel implant loading (primary objective) and directly associated implant placement (secondary objective) protocols developed for the anterior maxillae of partially edentulous patients was reviewed.

MATERIALS AND METHODS: A comprehensive search of electronic databases and a hand search of six relevant journals was performed. The principal outcome variables were implant survival, implant success, and esthetic appearance. Concerning esthetic treatment outcomes, articles were specifically screened for the presence of objective evaluation parameters and patient satisfaction assessment.

RESULTS: The analysis of the literature on immediately restored or conventionally loaded implants in the esthetic zone revealed an initial survival rate of 97.3% after 1 year (10 prospective cohort studies and one case series). For periods of 1 to 5 years, the survival rate was 96.7%. These survival rates are consistent with previous reports on more traditional loading modalities. However, for immediately placed implants with immediate restoration and occlusal loading, the survival rate dropped by approximately 10% (four studies). Success criteria such as stable crestal bone levels, soft tissue recession, and probing depth could not be evaluated on the basis of the available literature.

CONCLUSION: There is a paucity of prospective cohort studies addressing patient-centered outcomes. No parameters specific to immediate loading protocols were available for evaluation. In order to validate or reject such implant protocols for use in the esthetically sensitive anterior maxilla, long-term clinical trials should routinely include objective esthetic criteria that comprehensively embrace the pertinent elements of "pink and white esthetics" in the form of readily used indices.

The influence of controlled occlusal overload on peri-implant tissue. Part 3: A histologic study in monkeys.

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Abstract

The influence of experimental occlusal overload on peri-implantitis in monkeys (Macaca fascicularis) has been examined to explain the pathology of the disease that develops in the
tissue around osseointegrated implants. In the first article of this series, it was reported that bone resorption was not observed around implants when occlusal trauma was produced by a super-structure that was in supraocclusal contact with an excess occlusal height of approximately 100 microns, provided there was no inflammation in the peri-implant tissue. In the second part of the study, experimental inflammation was created in the peri-implant tissue, and occlusal overload was produced by a superstructure with an excess occlusal height of 100 microns. Notable bone resorption was observed around the implant with the passage of time. These results suggested that, in addition to the control of inflammation in peri-implant tissue, traumatic occlusion may play a role in bone breakdown around the implant. In the present study, while the peri-implant tissue was kept in an inflammation-free state, bone level changes around the implants were investigated when various levels of traumatic force were exerted. The supraoccluding prostheses were defined as excessively high by 100 microns, 180 microns, and 250 microns, respectively. The heights were determined with an image analysis device, and the bone responses around the implants induced by the traumatic forces were investigated. The results showed that bone resorption around implants tended to increase with 180 microns or more excessive height of the superstructure. This suggests that the threshold of excessive height of the superstructures at which peri-implant tissue breakdown may start is approximately 180 microns. It is also suggested that there is a possibility of bone resorption around the implants caused by excess occlusal trauma, even when there is no inflammation in peri-implant tissue.

The influence of controlled occlusal overload on peri-implant tissue. part 4: a histologic study in monkeys.

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Abstract

PURPOSE: The purpose of this study was to observe, after removing occlusal trauma and conducting plaque control, possible macroscopic and histologic changes in peri-implant tissue that had deteriorated resulting from experimental peri-implantitis, and to investigate the necessity for treatment procedures for peri-implantitis.

MATERIALS AND METHODS: Four monkeys (Macaca fascicularis) in good general health were used in this experiment. Three months after the second premolar and the first molar were extracted from the right mandible, 2 IMZ experimental implants were placed in each monkey. After a 3-month osseointegration period, a second surgery was conducted, followed by making an impression for fabrication of the prosthesis. Excessive occlusal height of the prosthesis was adjusted to 250 microm, and the experiment was continued for 8 weeks after placement of the prosthesis. Three models were created: (1) A superstructure with an excessive occlusal height was used for 8 weeks without any brushing (positive control, model P); (2) after the first 4 weeks with a prosthesis with excessive occlusal height and no brushing, the superstructure was removed and not used for the last 4 weeks while brushing was conducted (experimental model, model E); and (3) for 8 weeks, a prosthesis with an appropriate occlusal height was used with brushing (negative control, model N).
RESULTS: When these 3 models were compared with each other, macroscopic findings indicated inflammation only in model P. Mobility of implants was not seen in any model. Histopathologic observations revealed a slight difference between model E and model P in terms of the degree of inflammatory cell infiltration in the connective tissue.

DISCUSSION: No difference was found in the degree of bone resorption. Partial tearing was observed at the contact region between epithelial tissue and implant surfaces.

CONCLUSIONS: (1) The contact between implants and epithelial or connective tissue is fragile; (2) inflammation and occlusion must be controlled more prudently than in the case of natural teeth; and (3) once peri-implantitis has progressed, the control of occlusion and inflammation is probably not sufficient to promote the healing mechanism.

Influence of forces on peri-implant bone.

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Abstract

Occlusal forces affect an oral implant and the surrounding bone. According to bone physiology theories, bones carrying mechanical loads adapt their strength to the load applied on it by bone modeling/remodeling. This also applies to bone surrounding an oral implant. The response to an increased mechanical stress below a certain threshold will be a strengthening of the bone by increasing the bone density or apposition of bone. On the other hand, fatigue micro-damage resulting in bone resorption may be the result of mechanical stress beyond this threshold. In the present paper literature dealing with the relationship between forces on oral implants and the surrounding bone is reviewed. Randomized controlled as well as prospective cohorts studies were not found. Although the results are conflicting, animal experimental studies have shown that occlusal load might result in marginal bone loss around oral implants or complete loss of osseointegration. In clinical studies an association between the loading conditions and marginal bone loss around oral implants or complete loss of osseointegration has been stated, but a causative relationship has not been shown.

Mechanical and technical risks in implant therapy.

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Abstract
PURPOSE: To systematically appraise the impact of mechanical/technical risk factors on implant-supported reconstructions.

MATERIAL AND METHODS: A MEDLINE (PubMed) database search from 1966 to April 2008 was conducted. The search strategy was a combination of MeSH terms and the key words: design, dental implant(s), risk, prosthodontics, fixed prosthodontics, fixed partial denture(s), fixed dental prosthesis (FDP), fixed reconstruction(s), oral rehabilitation, bridge(s), removable partial denture(s), overdenture(s). Randomized controlled trials, controlled trials, and prospective and retrospective cohort studies with a mean follow-up of at least 4 years were included. The material evaluated in each study had to include cases with/without exposure to the risk factor.

RESULTS: From 3,568 articles, 111 were selected for full text analysis. Of the 111 articles, 33 were included for data extraction after grouping the outcomes into 10 risk factors: type of retentive elements supporting overdentures, presence of cantilever extension(s), cemented versus screw-retained FDPs, angled/angulated abutments, bruxism, crown/implant ratio, length of the suprastructure, prosthetic materials, number of implants supporting an FDP, and history of mechanical/technical complications.

CONCLUSIONS: The absence of a metal framework in overdentures, the presence of cantilever extension(s) > 15 mm and of bruxism, the length of the reconstruction, and a history of repeated complications were associated with increased mechanical/technical complications. The type of retention, the presence of angled abutments, the crown-implant ratio, and the number of implants supporting an FDP were not associated with increased mechanical/technical complications. None of the mechanical/technical risk factors had an impact on implant survival and success rates.

Mechanical complications of dental implants.
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Abstract
Adverse occlusal forces can result in mechanical complications of implant components. While unacceptably high incidences of mechanical failures have been reported for the two-stage external hex screw-type implant systems, the standard-diameter ITI solid-screw implant does not seem to be vulnerable to these problems. The 8 degrees Morse taper has eliminated abutment screw loosening and fracture. The incidence of prosthetic screw loosening has been minimized by the 45 degrees bevel on the implant shoulder and by the 1.5 mm vertical abutment walls. The design of the standard-diameter solid-screw ITI implant and the material used in its fabrication (cold worked type IV cp titanium) have eliminated fixture fracture. However, because there have been some reported instances of fractures involving reduced-diameter and hollow implants, these designs should be used with caution.