Since the early 1990s, osseointegrated implants have demonstrated high rates of success due mainly to improved surgical protocols. As a result, restoration-related complications have increasingly become the focus of dental clinicians who wish to extend success rates even further.

Biomechanical elements associated with occlusion have been an increasing focus of treatment planning and coordination among clinicians. For many clinicians over the years, measuring dental occlusion forces has been an inexact science, requiring pressure-revealing articulation paper, waxes, and pastes. Dentists in many disciplines have needed a method for measuring simultaneous contact, biting time, and biting force.

In 1987, Tekscan, Inc. (South Boston, MA, www.tekscan.com) developed the T-Scan Occlusal Analysis System, a grid-based sensor technology, to meet the need of dentists for reliable measurements of occlusal biting forces on individual teeth. The latest iteration of this technology is the T-Scan® III: Dental Occlusal Analysis System, accompanied by version 5.0 icon-driven software.

The hardware for the system, a hand-held device with a flat, U-shaped pressure-measuring device, which fits into the patient’s mouth between the upper and lower teeth, produces measurements at a consistent rate of 100Hz. This sampling rate can be used to produce a frame-by-frame (equal to 0.01 seconds) T-Scan movie, which produces, in turn, a consistent data display.

The T-Scan III connects to the USB port of a Windows-based PC or laptop. Noteworthy are the system’s vivid graphics, which enable the clinician to see the balance or lack of balance in the patient’s bite pattern. The printable data provide superb information for patient files. The output displays the percentage force per tooth and a two-dimensional arch view that can be divided into quadrants. The software features a zoom graph window as well as a patient chart for customizing an arch model.

The T-Scan III has many applications in dentistry, including those crucial to implant placement: fixed...
Dental Implantology Update™ September 2007

Dental Implantology Update™ (ISSN 1062-0346) is published monthly by AHC Media LLC, 3525 Piedmont Road N.E., Building Six, Suite 400, Atlanta, GA 30305. Telephone: (404) 262-7436. Periodical postage paid at Atlanta, GA 30374. POSTMASTER: Send address changes to Dental Implantology Update™, P.O. Box 740059, Atlanta, GA 30374.

AHC Media LLC, in affiliation with Boston University Goldman School of Dental Medicine, offers continuing dental education to subscribers. Each issue of Dental Implantology Update™ qualifies for 1.5 continuing education units.

Customer Service: (800) 688-2421. Fax: (800) 284-3292. Hours of operation: 8:30 a.m. - 6 p.m. Monday - Thursday; 8:30 a.m. - 4:30 p.m. Friday, EST.

E-mail: customerservice@ahcm.com. World Wide Web: www.ahcm.com.

Subscription rates: U.S., $99 per year. Add $9.95 for shipping & handling. Students, $520 per year. To receive student/resident rate, order must be accompanied by name of affiliated institution, date of term, and the signature of program/residency coordinator on institution letterhead. Orders will be billed at the regular rate until proof of student status is received. Outside U.S., add $30 per year, total prepaid in U.S. funds. Discounts are available for group subscriptions. For pricing information, call Tria Kreutzer at (404) 262-5482. Missing issues will be replaced by customer service free of charge when contacted within one month of the missing issue date. Back issues, when available, are $100 each. For 18 continuing education units, add $96 per year.

Opinions expressed are not necessarily those of this publication. Mention of products or services does not constitute endorsement. Clinical, legal, tax, and other comments are offered for general guidance only; professional counsel should be sought for specific situations.

Copyright © 2007 by AHC Media LLC. Dental Implantology Update™ is a trademark of AHC Media LLC. The trademark Dental Implantology Update™ is used herein under license. All rights reserved. Reproduction, distribution, or translation of this newsletter in any form or incorporation into any information retrieval system is strictly prohibited without express written permission. For reprint permission, please contact AHC Media LLC. Address: P.O. Box 740056, Atlanta, GA 30374. Telephone: (800) 688-2421. Senior Vice President: Brenda Mooney. (404) 262-5403, (brenda.mooney@ahcm.com). Associate Publisher: Lee Landerberger. (404) 262-5483, (lee.landerberger@ahcm.com). Managing Editor: Paula Cousins. (816) 960-3730, (paula.cousins@ahcm.com).
absorber), pulpal tissue (for thermal and pain feedback), the neck (for reducing stress on the ridge), a tapered root (which directs forces apically), the size and number of root (for surface area and support), lamina dura (cortical bone issues), and structural composition (flexing dentin). Understanding all the elements of occlusion relative to implant dentistry is crucial.9

Trial therapy enables a clinician to determine whether a bruxing habit is occlusal (treatable) or central nervous system-based (essentially untreatable). Trial therapy means altering or correcting the occlusion and then monitoring the response. The easiest way to accomplish this is with appliance therapy. To fashion a properly made appliance, the clinician has traditionally used a model mounted on a semi-adjustable articulator, with a face bow transfer of the upper arch to take a centric-relationship profile.9

Assuming that the patient’s habit is an occlusal one, the clinician can create an ideal occlusion on the appliance and then see what the patient’s response to the appliance is. The response will dictate which type of diagnoses is made. The appliance should be rigid and flat with an anterior discluding ledge. The patient wears the appliance for about three months, and then it is checked for the reproduction wear present; the teeth are then checked to see if there are any symptoms (for example, muscle or joint pain). If no wear is present on the appliance after three months based on the type of wear seen in the mouth, then the diagnosis is that of an occlusal bruxer.9

The first occlusal trigger to bruxism is joint pain, which, potentially, has at least three sources. Joint pain can cause patients to brux when they have pain. The next trigger for an occlusal bruxing habit is a centric premature tooth contact, which occurs prior to the condyle fully seating itself. This is the number one potential trigger to an occlusal muscle habit—a tooth contact that blocks a condyle from fully seating itself. Finally, there is an eccentric prematurity, when the teeth touch
where they are not supposed to in the back of the mouth, causing the muscles to contract inappropriately.9

Triggers of occlusal bruxing habits involve issues regarding the joint, the centric relation, and the occlusion. When diagnosing and treating occlusal issues, the clinician must consider the keystone muscles in the joint. Next, the clinician must identify the envelope of parafunction, and incorporate it into the occlusal treatment plan. The patient will have one habit or the other because the brain is telling the jaw to move a certain way every time. Central nervous system habits are either horizontal or vertical.9

Horizontal bruxers reveal wear facets that traverse across the buccal cusp of posterior teeth, across the cusp tips of canine, or across the incisal edges of an anterior tooth. They display a decrease in the overbite, a broad range of mandibular motion—left and right lateral excursions are very broad. These types of bruxers are difficult to treat because the clinician must account for the left side of the lower jaw and its potential contact on the right side of the upper and vice versa. Central nervous system horizontal bruxers need a permissive occlusal scheme, an occlusal scheme of shallow contact angles and shallow guidance that allows mechanical freedom for the bruxing habit. Such an occlusal scheme allows the teeth to survive the habit.9

The other type of central nervous system bruxer is the vertical bruxer. In this group, the wear facets are lingual of maxillary anterior teeth and facial of lower anterior teeth. There is an increase in overbite and a narrow range of mandibular motion. Luckily, this kind of bruxer is easy to treat with a special occlusal scheme. Central nervous system vertical bruxers require a lingual maxillary vertical stop 90° to the lower incisal edges and with enough overjet for the mandible to move during bruxing, with no incline centric stops. By providing a centric stop 90° to the central incisors on the lower, the clinician can keep these bruxers from wearing the centric stop down.9
A central nervous system horizontal bruxer should not be treated with implants. In this type of patient, occlusal forces indicate an inability to keep lateral forces off posterior teeth. In such cases, the dentist’s only alternative is to treat the caries and any other biological problems, and just maintain existing dentition.8

Dental Implants and the T-Scan III

The absence of a periodontal ligament around implants means an absence of cushioning to help absorb occlusal forces. Implant failure has often been associated with excessive occlusal forces acting on implant prostheses. Such forces can cause the loss of bone, cementation compromise, screw loosening, and failure of materials. The T-Scan III system enables the clinician to measure occlusal forces before implantation so that remediation of aberrant forces can be initiated.

T-Scan III has a number of features that enable accurate measurement of occlusal forces. The first is “Center of Force,” which helps to indicate a balanced bite. T-scan can show “force movies” to indicate the before and after measurements, for example, of a patient biting into an intercuspated position. The software uses an icon to indicate the precise location of the balance of occlusion. Adjustments can be made until the patient’s “Center of Force” icon centers in the arch, showing a balance of occlusal forces. The technology also provides “Excursive Force Movies,” which can be used to remove traumatic interferences. These results can be used to load implants sequentially to preserve balanced occlusal forces.

As early as 1989, Tekscan’s original T-Scan technology received clinical tests to determine its accuracy in modeling the dental arch and in measuring the area and direction of force change over time.10 While light and early occlusal contacts could not always be detected, the new technology showed much promise for continued use in dentistry areas related to occlusal force measurements.

A 2002 study assessed the reproducibility of the T-Scan II system evaluations and results for complete denture wearers, including 13 dentate subjects and 14 complete denture wearers.11 This study involved the T-Scan II system. The study concluded that the T-Scan II provided acceptable reproducibility for evaluating occlusal contacts of complete denture wearers.

A 2006 study also involved the T-Scan II system and focused on sleep bruxism, attempting to evaluate the connection between occlusal factors and nocturnal parafunctional activities.12 Two groups (one with nocturnal parafunctional activity of mandible and a control group with no signs and symptoms of bruxism) were both analyzed using the T-Scan II system, revealing statistically significant differences of force distribution between the left and the right side of the arch for the bruxism group. The differences of the center of occlusal force were not significant, but the trajectory was longer in the bruxers. In addition, the significant difference of center of force position in relation to the center of the elliptic fields was not found in bruxers, but results revealed uneven distribution of the occlusal forces, which caused excessive attrition and tooth mobility. The study found a contributing correlation between occlusal factors and bruxism.

Summary

Though no single, specific occlusal pattern has been developed that is ideal for oral implantology, research suggests some general criteria for deciding on a particular occlusal pattern that will help reduce cuspal interferences and lessen horizontal or lateral forces on the fixtures. Anticipated occlusal and chewing forces need to be taken under consideration for any implant-supported prosthesis. In addition, opposing dentition, as well as potential parafunctional mandibular movements, should be noted. Tekscan’s T-Scan Occlusal Analysis System can help clinicians meet the needs of their patients for reliable measurements of occlusal biting forces. The T-Scan III System is Tekscan’s most recent attempt to help dental clinicians obtain consistent and useful occlusal data for the placement, analysis, and repair of dental implants.

References

9. Gittelson G. Occlusion, bruxism, and dental implants: Diagnosis


**Clinically Significant ABSTRACTS**


In the last two decades, several investigators have reported immediate placement of dental implants into extraction sockets achieving excellent results with a two-stage surgical procedure. Recently, immediate loading (IL) has become an emerging technique because it has been documented to be a successful and time-saving procedure. Regarding the possibility of immediate/early loading of implants placed in fresh extraction sockets, few reports are available. In addition, they are based on limited series with short follow up. Thus, this retrospective study was undertaken on a large series of postextractive IL implants.

**Zhang Y, Song J, Shi B, et al. Combination of scaffold and adenovirus vectors expressing bone morphogenetic protein-7 for alveolar bone regeneration at dental implant defects. Biomaterials 2007 Jul 28; Epub ahead of print.**

The current rapid progression in tissue engineering and local gene delivery systems has enhanced applications of osseointegration in dental implants. In this study, porous chitosan/collagen scaffolds were prepared through a freeze-drying process, and loaded with an adenoviral vector encoding human bone morphogenetic proteins (Ad-BMP7).

These scaffolds were evaluated in vitro by scanning electron microscopy, and human periodontal ligament cells were seeded in this scaffold. Reverse transcription-polymerase chain reaction (RT-PCR) was used to determine the expression levels of osteopontin and bone sialoprotein. Alkaline phosphatase (ALP) activity was also determined. Then these scaffolds were implanted into defects on both sides of the mandible.

Three months later, the animals were sacrificed and non-decalcified sections were evaluated histologically. Histomorphometric analyses were performed at the bone-implant interface using the image obtained by confocal laser scanning microscopy.

Results indicated that the scaffold containing Ad-BMP7 exhibited the higher ALP activity, and the expression of osteopontin and bone sialoprotein were up-regulated. After implanting in defects around implant, the bone formation in Ad-BMP7 scaffolds was greater than that in other scaffolds at four or eight weeks.

This study demonstrated the potential of chitosan/collagen scaffold combined with Ad-BMP7 as a good substrate candidate in bone tissue engineering.
conventional and bone-condensing dental implant techniques.

Single-tooth dental implants were placed by both conventional and bone-condensing techniques in 14 patients with bilateral missing teeth. DEXA was used to calculate bone mineral density (BMD) and bone mineral content (BMC) before and six and 12 months after implant placement. Furthermore, photodensitometry of periapical radiographs was also assessed.

The success rate was 92.9% for the conventional technique and 71.5% for the bone-condensing technique. The BMD was observed to be significantly higher six and 12 months after implant placement. The BMC and photodensitometry were significantly increased six months after implant placement but showed no further increase after 12 months.

There were no significant differences in BMD, BMC, and photodensitometry between the two implant placement techniques. However, success rate of the conventional technique was greater than the bone-condensing technique, which may be the result of trabecular fracture associated with the bone-condensing.

The purpose of this article was to review and summarize the literature regarding the success of alveolar bone augmentation in osteoporosis.

The study design includes a literature review of relevant preclinical and clinical articles that address the association between osteoporosis and alveolar bone augmentation.

Increased rate of complications such as resorption of bone graft, non-integration of bone graft, delayed healing time, and implant failure in augmented bone especially in the maxilla may be associated with compromised bone health.

Despite the decreased success rate, osteoporosis is not an absolute contraindication for bone augmentation and dental implant placement. The modifiable risk factors for osteoporosis should be eliminated before surgery.


The purpose of this study was to investigate the difference in optical appearance of the soft tissues labial to dental implants and to analyze the effects of titanium implant neck colors transmitted through the marginal mucosa.

Fourteen patients with 15 Straumann® single implant replacements in the maxillary anterior region were recruited. Color measurements of the peri-implant mucosa of test sites and the gingivae of contralateral or adjacent natural teeth as controls were made at the facial aspect of the teeth using a spectrophotometer. The color data (CIELAB color coordinates; L*, a*, b*, and C*) in five incremental areas of 1 x 2 mm from the gingival margin toward the apical direction were obtained.

A significant difference existed (P < 0.01) between the test site and the control site on the mean L*, a*, b*, and C* values in all five incremental areas (area 1-5). In contrast, there was no significant difference in the mean a* values. Discrepancies between color distributions of soft tissues were stronger in areas close to the gingival margin and decreased toward the apical direction. The mean color difference ∆E between the test site and the control site was 7.7 in area 1 and decreased toward area 5 with a value of 6.5. However, there was no statistical difference in each of the mean values of differences in optical data, ∆L*, ∆a*, and ∆b*, when five incremental areas of the control and the test sites were compared.

It was observed that the color of soft tissue around the titanium implant was significantly different compared with the gingiva of natural teeth. Significantly lower values of CIELAB color coordinates, L* and b* were found in the peri-implant soft tissue.


The clinical follow-up of atrophic jaws treated with augmentation procedures and dental implants was demonstrated and evaluated over a period of five years.

In total 50 patients (24 male and 26 female) from the department of maxillofacial surgery of the Friedrich Alexander University Erlangen-Nuernberg who received an augmentation procedure were prospectively evaluated. The mean age was 59.1 years (females) and 56.9 years (males). Prior to implant placement, all patients received augmentation with autogenous bone or a bone substitute and were reconstructed using a fixed or removable implant borne rehabilitation.

Overall, 293 implants from five different systems were used; 10 implants on eight patients were lost...
in the observation period. Three implants were lost during the healing period and seven after prosthetic rehabilitation. This leads to a cumulative survival rate of 96.6%. The success rate was 94.04%, according to the criteria defined by Karoussis et al. After 12 months, an overall resorption rate of 26.4% was found in the area of augmentation; at five years the rate mounted to 31.67%.

Comparing the resorption rates in maxilla and mandible the vertical loss was 35.88% and 26.05%, respectively. Comparing the posterior and anterior augmentation areas the vertical loss was significantly (P: 0.048%) higher in the posterior with 38.72% compared to 28.26% in the anterior region.

Measurement of the sulcus fluid flow rate (SFFR) demonstrated a significant (P = 0.03) correlation with bone resorption, meaning that higher SFFRs showed higher rates of vertical resorption. Additionally, a high SFFR correlated with higher pocket depths and reduced keratinized peri-implant gingival rates. ▼


Implants may be placed penetrating the oral mucosa (one-stage procedure) or can be completely buried under the oral mucosa (two-stage procedure) during the healing phase of the bone at the implant surface. With a two-stage procedure the risk of having unwanted loading onto the implants is minimized, but a second minor surgical intervention is needed to connect the healing abutments and more time is needed prior to starting the prosthetic phase because of the wound-healing period required in relation to the second surgical intervention. The objective of this review was to evaluate whether a one-stage implant placement procedure is as effective as a two-stage procedure.

The Cochrane Oral Health Group’s Trials Register, The Cochrane Central Register of Controlled Trials, MEDLINE, and EMBASE were searched. Hand-searching included several dental journals. Authors of all identified trials, an internet discussion group, and 55 dental implant manufacturers were contacted to find unpublished randomized controlled trials (RCTs). The last electronic search was conducted on Jan. 15, 2007.

All RCTs of root-form osseointegrated dental implants comparing the same two-piece osseointegrated root-form dental implants placed according to one- vs. two-stage procedures with a minimum follow-up of six months after loading were eligible for inclusion. Out-come measures were: prosthesis failures, implant failures, marginal bone level changes on intraoral radiographs, patient preference including aesthetics, aesthetics evaluated by dentists, and complications.

Screening of eligible studies, assessment of the methodological quality of the trials and data extraction were conducted in duplicate and independently by two review authors. Authors were contacted for missing information. Results were expressed as random-effects models using mean differences for continuous outcomes and risk ratios for dichotomous outcomes with 95% confidence intervals. Heterogeneity was to be investigated including both clinical and methodological factors.

Three RCTs were identified and two trials including 45 patients in total were included. On a per patient basis, rather than per implant basis, there were no statistically significant differences.

The number of patients included in the trials was too small to draw reliable conclusions; however, it appears that the two procedures did not show clinically significant differences. If these preliminary results will be confirmed by more robust trials, a one-stage procedure might be preferable since it avoids one minor surgical intervention and shortens the waiting time to provide the final restoration. There might be specific situations though, such as when optimal implant stability is not obtained at placement or when barriers are used in conjunction with implants, in which a two-stage approach might be preferable. ■