Vol. 5, No. 2 September 1992

PROSTHODONTIC Insights

A Digest of Recent Trends, Techniques and Clinical Concepts of Dental and Facial Esthetics

Periodontally Hopeless Teeth Replaced With Osseointegrated Implants – The High Lip Line

Thomas J. Balshi, D.D.S., F.A.C.P.

One of the most difficult prosthetic treatments centers on patients who require replacement of teeth when a high smiling lip line creates a focal frame around the esthetic junction; the connection between mucosa and the dentition. For the past fifteen years we have categorized our patients according to smiling lip line as follows:

1. Class I: shows no maxillary tooth structure. These patients have excessively heavy lip musculature with a long upper lip.
2. Class II: shows 3/4 of the clinical crown and one millimeter of the interdental papilla.
3. Class III: shows the entire interdental papilla and one millimeter of marginal gingiva at the height of cervical contour, or above the CEJ.

continued on page 2

The Relationship of Cigarette Smoking to Impaired Intraoral Wound Healing

J.K. Jones & R.G. Triplett

Experienced surgeons have long implicated smoking as a risk factor for impaired healing. The catastrophic consequences of impaired wound healing in 15 patients, 5 smokers and 10 non-smokers, undergoing simultaneous intraoral bone grafting and implant placement provided the impetus for this review. Impaired wound healing was defined as dehiscence and/or infection resulting in loss of bone and/or implants. All patients received the same local anesthetic regime and wound care. All of the surgical procedures were accomplished by two experienced oral and maxillofacial surgeons over a 5 year period.

Eighty percent of smokers had impaired wound healing versus 10% in nonsmokers. Additionally, 80% of our problem wounds were in patients who admitted smoking in the perioperative period. Although other factors may have played a role, cigarette smoking is a potentially controllable risk factor strongly associated with problem wounds in this series of patients.

Based on our experiences, simultaneous intraoral bone grafting and implant placement is no longer offered as a treatment option to patients with continuing smoking habits. Smokers are also cautioned that any surgery involving extensive flap undermining carries a significantly increased risk for impaired healing and tissue loss.

J Oral Maxillofacial Surgery 50:237-239, 1992

The Acute Effects of Cigarette Smoke Exposure on Experimental Skin Flaps

J Nolan et al

The hypothesis that cigarette smoke exposure leads to increased tissue ischemia and thus flap necrosis is shared by many plastic surgeons. This paper summarizes our initial experimental work on the effects of tobacco smoke exposure on the viability of skin flaps postoperatively. Random vascular patterned caudally based McFarlane-type skin flaps were elevated in groups of Fischer 344 rats. Groups of rats were then acutely exposed on an intermittent basis to smoke generated from well characterized research filter cigarettes.

continued on page 5

Comparative Accuracy of Implant Impression Procedures

D. Assif et al

Dental implants are less mobile than teeth and implant prostheses are screwed precisely into position with metal-to-metal contact. If prostheses do not fit passively on implants, high stress concentrations will be produced when the gold alloy retaining screws are tightened. This can result in immediate patient discomfort, later fracture of the prosthesis or implant components, or eventual loss of integration. For these reasons a dental impression procedure must be accurate.

Four different impression procedures for dental implants were assessed

continued on page 6

4. Class IV: shows the excessively high lip line categorized as the "gummy smile" where two or more millimeters of gingival tissue is evident above the cervix of the teeth. These patients frequently appear to present with maxillary horizontal and vertical excess.

In treating patients with Class II, III and IV smile lines, the esthetic junction between the cervix of the teeth and the mucosa is critically important. Prosthetic restorations must take into account the frame created by the lips when the treatment plan is prepared.

Patients with advanced periodontal disease create an even more complex situation. Although swollen interdental papilla may maintain a reasonable esthetic appearance preoperatively (figure 1), the deep infrabony pockets (figure 2) bleeding on probing and the suppurative sulculi indicate tooth loss in the near future. When treatment planning the implant reconstruction of these patients, a consideration of loss of the interdental papilla as well as general apical loss of the mucosal tissues must be considered. Prosthetic treatment of these teeth is equally complex whether using traditional fixed prosthodontics or an osseointegrated implant supported prosthesis. With osseointegration however, one additional complicating factor lies with the long access angulation of the fixtures. Generally, bone loss and the normal anatomy of the premaxilla create a labial undercut which directs the apical portion of the fixture palatally (figure 11). If a screw retained prosthesis is planned, the long access inclination must be compensated at the abutment connection through use of angulated abutments (figure 4).

Often with advanced periodontitis, maintenance of the remaining alveolar bone is critically important to obtain optimal fixture length. Placement of titanium fixtures immediately into the extraction sites in conjunction with guided tissue regeneration techniques is beneficial. Use of freeze dried bone to fill the void in the extraction site around the fixtures appears to be a reliable technique for bone generation, especially if the area is covered with a barrier material during the healing process.

continued on page 3

Figure 1: Preoperative clinical view.

Figure 2: Preoperative radiographic view.

Figure 3: Preoperative lateral cephalometric film.

Figure 11: Two year postop lateral cephalometric film.

Figure 4: Angulated abutments

Figure 5: Postoperative clinical view shows angulated abutment.

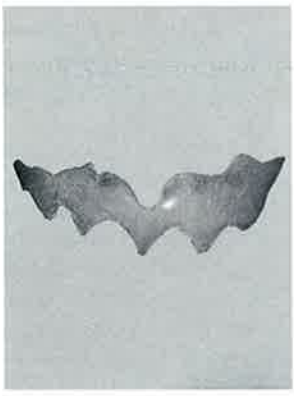

Figure 6: Gingival replacement unit.

Figure 7: Postoperative clinical view tissue integrated prosthesis with gingival replacement unit in place.

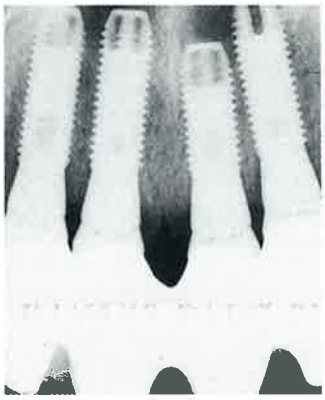

Figure 8: Periapical radiograph immediately following prosthesis delivery.

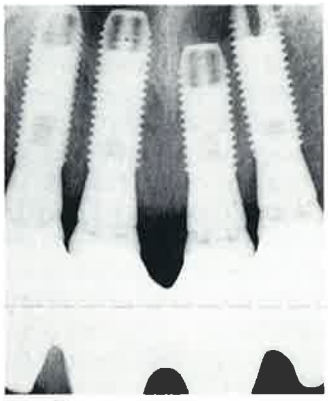

Figure 9: Periapical radiograph two years postop.

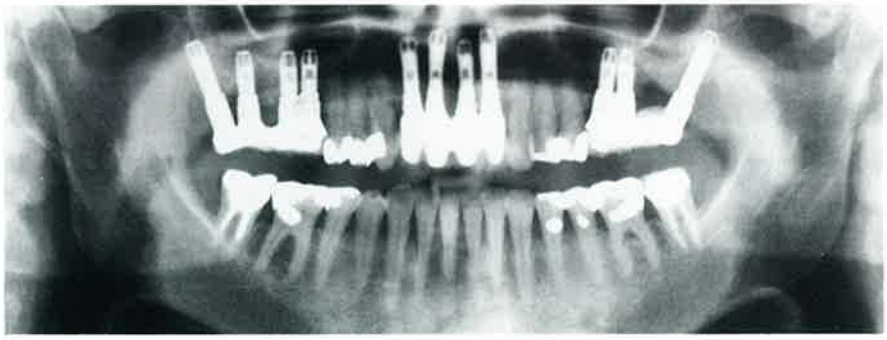

Figure 10: Panradiograph two years postop.

Following first stage surgery prosthodontic maintenance requires careful adaptation of the interim removable provisional restoration to avoid pressure on the bone grafted-sockets or disruption of the barrier material. Complete avoidance of contact with the mucosa during the first three weeks is strongly recommended, as well as the use of a soft lining for the next three months, followed by hard lining of the alveolar ridge area until the end of the treatment healing process.

When angulated abutments are used in the maxillary anterior the "knee" of the abutment is generally prominent and difficult, if not impossible, to hide with the fixed restorative materials. The angulation and undercut created by this abutment will not permit a hygienic covering of the visible titanium (figure 5). For that reason, a removable gingival replacement unit (figure 6) can be fabricated to create a two piece esthetic restoration. (figure 7).

The gingival replacement unit replaces lost gingival tissue and restores ideal esthetics for patients with a high smile line. Having the ability to remove this prosthesis and expose the titanium abutments (figure 5) also permits optimal oral hygiene which in turn helps maintain a healthy mucosa and ideal bone response (figures 8, 9, 10 & 11).

When four individual teeth are replaced by four osseointegrated implants, the recommended prosthetic reconstruction is a splinted mechanism. Although single tooth restorations have worked successfully there are no long term clinical studies which would indicate how long single fixtures supporting crown restorations will last. The splinting effect of the solid multiunit casting helps distribute the loading forces among all of the osseointegrated fixtures rather than just one when occlusal contacts are encountered. Open cervical embrasures are critical to the design of any splinted prosthetic restoration and must permit access for oral hygiene.

■

Strategies for the Placement of Implants Into the Edentulous Maxilla

M. Reitzik

The availability of bone often dictates the positioning of the implants in the edentulous maxilla. Atrophy of the bone supporting the premolar and molar teeth together with progressive pneumatization of the antra usually precludes these sites for implant placement. This leaves the premaxilla as the usual implant bearing site. This has major biomechanical disadvantages.

Two factors must be considered: 1) Bite forces are greatest in the canine, premolar and first molar areas during mastication; and 2) Implants withstand axial loading far better than lateral loading.

This may explain why short implants confined to the premaxillary area may fail when placed in inadequate bone (i.e. quality or quantity*). This has been observed in patients with a heavy bite and an over-cantilevered prosthesis.

Patients with severe atrophy affecting the whole alveolar ridge provide the practitioner with an uncluttered slate on which to plan the osseous rehabilitation of the maxilla. Implants should be placed in the bony areas supporting the canine to first molar section of the proposed prosthesis. This corresponds to the anterior two thirds of the antra together with the canine eminence just anterior to the antra.

In patients with extreme atrophy, a bilateral sinus lift bone graft will provide sufficient support for three or four implants on each side. Two separate posterior bars will adequately support a full upper prosthesis. Some prosthodontists prefer a single bar connecting all the implants. A fixed prosthesis is also possible as an anterior cantilever supported by posterior implants and is much safer than a posterior cantilever supported by premaxillary implants.

In those patients with sufficient height but insufficient thickness of bone in the canine incisor part of the alveolus, a buccal onlay graft to thicken the alveolus should be combined with an inlay graft into the anterior part of the sinus to support the implants. Eight implants, from the central incisor to the second bicuspid region on each side, will suffice to carry any prosthesis (ending with a single bicuspid sized cantilever*).

An alternative approach in these patients is to graft both antra in the usual way and to add a small buccal onlay graft in the canine region on each side if either eight or ten implants are planned.

**Editor's notes*
Academy of Osseointegration, Feb. 27-29, 1992, Vancouver BC Canada

Combined Onlay Iliac Augmentation and Sinus Bone Graft Using Simultaneous Implant Fixation and e-PTFE in Highly Resorbed Maxilla

O. T. Jensen

Six patients with extreme atrophy of the maxilla with the majority of the maxilla having 0-3 mm of vertical bone available over the entire alveolar residuum were treated with Iliac bone grafting and osseointegration. One patient had a chin bone graft. A corticocancellous horseshoe-shaped graft was fixated with Brånemark implants in conjunction with sinus and nasal lifts. Particulate graft was used to fill all defects. E-PTFE was used to cover grafted surfaces laterally in four patients. The implants were exposed at 6-7 months postimplantation. A total of 48 implants were placed (eight in each patient). Forty-three implants integrated and were in function 1-3 years after placement. Bone graft incorporation occured in all cases. At least half of the graft resorbed by the second year in the case where e-PTFE was not used. Graft resorption in the e-PTFE group was much reduced but varied from 0 to 25% at 1-2 years after placement. Three implants were lost

continued on page 5

PROSTHODONTIC Insights

is published by Prosthodontics Intermedica and distributed without charge to qualified individuals. Please request a subscription on your organization's letterhead.

Fixed, Removable, Maxillofacial and Implant Prosthodontics

Prosthodontics Intermedica
467 Pennsylvania Avenue
Fort Washington, PA 19034 U.S.A.
Telephone: 215-646-6334

Failures and Complications in 92 Consecutively Inserted Overdentures Supported by Brånemark Implants in Severely Resorbed Edentulous Maxillae: *A Study from Prosthetic Treatment to First Annual Check-up*

By T. Jemt et al

The objective of this study is to present early failures and complications in a group of patients treated with overdentures supported by implants in severely resorbed maxillae.

Overdentures were inserted in 92 severely resorbed maxillae and followed for 1 year. The dentures were supported by a total of 430 implants. Of these, 69 (16%) became loose and were removed during the follow-up period. However, out of the 69 failed implants, 58 were 7mm long. The mobile implants caused 7 complete failures of the overdenture treatment. ***Postinsertion maintenance was more extensive for the overdentures than for fixed prostheses supported by implants.***

Other problems observed included: (1) inflamed mucosa around implants; (2) fatigue fractures of acrylic resin; (3) retentive clips failed; and (4) decubitus ulcers near denture flange.

None of the overdentures caused any diction problems, but four patients (4.4%) complained of an irritating resonance from vibrations of the overdenture when they talked and/or sang.

This study indicates that it is possible to treat severely resorbed edentulous maxillae with overdentures supported by osseointegrated implants and achieve a good prognosis in short-term perspectives. However, compared to patients with more bone, the present study group showed a higher failure rate for the individual implants as well as for the prostheses.

In summary, overall postinsertion maintenance was found to be more extensive for overdentures. Whether these differences will be consistent in the long-term perspective can only be determined by careful follow-up in the future.

Int J Oral Maxillofac Implants 1992; 7:162-167

Cigarette Smoke Exposure *(continued)*

Previously developed smoke inhalation exposure protocols were employed using a Maddox-ORNL inhalation exposure system. Rats that continued smoke exposure following surgery showed a significantly greater mean percent area of flap necrosis compared with sham-exposed groups or control groups not exposed.

Whole fresh cigarette smoke is composed of both liquid (particulate) and gaseous phases. While each of these phases contains thousands of individual constituents, we speculate that the two constituents most likely to be responsible for the observed effects are carbon monoxide (gas phase) and nicotine (particulate phase). The primary toxic effect of carbon monoxide is celluar hypoxia or anoxia.

The principal action of nicotine relevant to this study is vasoconstriction, which can predispose to thrombotic microvascular occlusion and subsequent tissue ischemia. Nicotine also stimulates carotid and aortic body chemoreceptors and causes the release of catecholamines from adrenergic nerve endings and from the adrenal medulla. The net effect of these actions is to increase heart rate and blood pressure and therefore oxygen demand at a time when the ability to supply the needed oxygen is impaired. The resulting tissue hypoxia may ultimately manifest itself as an increase in flap necrosis or, in some circumstances, total flap loss.

While carbon monoxide and nicotine are presumed to play the major role in the production of tissue ischemia, many of the other smoke constituents could be important factors. Although many questions are yet to be answered, including work on possibly reversing the deleterious effects of smoking, we believe that for many interrelated and complex reasons, smoking in the perioperative period increases tissue ischemia and the risk of flap necrosis.

Plastic and Reconstructive Surgery, April 1985:544-551

Combined Onlay Iliac Augmentation and Sinus Bone *(continued)*

in the non-e-PTFE patient and two implants were lost in one patient who had no sinus-nasal wall present on the side of implant loss and had intrasinal wound breakdown in the postoperative period.

The average vertical bone volume increased from 0 to 3mm preoperatively to 10 to 22mm as measured 1-2 years post implant placement in the e-PTFE group. The non e-PTFE group was 3 to 12mm three years post implant placement.

Final dental restorations were either fixed or removable with all implants splinted together. The technique is a synthesis of various reconstructive technical efforts that appear to improve prognosis for bone graft and implant incorporation

Academy of Osseointegration, Feb. 27-29, 1992, Vancouver BC Canada

Implant Impression Procedures *(continued)*

on a laboratory model to simulate clinical practice. The accuracy of producing stone casts with brass implant analogs was measured against a standard prosthetic framework. The fit of the framework on the casts was tested by manual and visual judgement and by microscopic measurement. The measurement data supported the judgements.

Two observers manually and visually assessed the passive fit of the 60 casts to the standard framework. When transfer copings were splinted together with acrylic resin (groups 1 and 2), all 30 stone casts were judged to fit the framework passively and were deemed clinically acceptable.

When the transfer copings were oriented together by the polyether impression material (group 3), two casts were judged to be inaccurate and two were questionable. Eleven of the 15 casts were judged to be passive and clinically acceptable.

When smooth transfer copings were used (group 4), they remained on the implants when the impression was removed. The copings were then unscrewed from the implants and replaced in the impression. Only seven of these 15 casts were judged to be clinically acceptable; eight of the 15 were judged unacceptable. The standard framework was seen and felt to rock on the abutment analogs of these eight casts.

The most accurate and reliable impression procedures used acrylic resin to splint implant transfer copings together. There was no difference in accuracy between the use of alginate in a modified stock tray and a polyether material in a custom tray. The acrylic resin splint was the most notable factor in production of accurate casts. When the four groups were compared, all 30 of the splinted casts in groups 1 and 2 were judged to be acceptable, whereas only 18 of the 30 nonsplinted casts in groups 3 and 4 were acceptable.

For the average dental laboratory and office, which probably uses a manual method to assess framework acceptability, this reliability is valuable.

From this study it appears that dentists who are experienced in implant procedures can detect discrepancies in framework of about 30 µM. This is under ideal conditions of a standard framework on a dry stone cast on the bench. The ability of dentists to assess accuracy of fit in the most mobile environment of the mouth is probably not as good.

The least accurate casts made from acrylic resin splinted transfer copings were more accurate than the best of any casts made by the other two procedures. Compared to an elastic impression material, the strength and large surface area of an acrylic resin splint effectively resist displacement, as well as rotation, of transfer copings in the impression during the handling required for implant cast construction.

The least accurate, and most variable, impression procedure consisted of removing the impression from the transfer copings on the implants, followed by the replacement of the copings in the impression (group 4). Not only were there larger vertical abutment gaps, but there were also "tilted abutments". Only one side of the analog contacted the framework. The framework would probably be considered acceptable unless examined under magnification.

When a dentist assesses the fit of a framework on implants, four situations can exist:

1. If the framework does not fit then it is sectioned and reassembled or remade. If impression procedures are used that can consistently make casts with less discrepancy than can be detected, the chances are that there will be few remakes.
2. When the framework does not fit and it is undetected, stress will develop when the screw is tightened, causing screw binding, damage to the internal threads of the abutment, fracture of components, or delayed loss of integration.
3. Sometimes the patient notices some pressure when the framework screws are tightened yet the framework is considered acceptable. Dentists can perceive differences of 30 µM when assessing framework fit, where as implant patients have occlusal perception in the range of 15 µM or less. *If the patient reports a feeling of pressure, it could mean the framework accuracy is in this 15-30 µM range.*
4. The framework may be judged acceptable and be perfectly comfortable for the patient.

The tolerable total discrepancy of a framework on five implants is unknown. It is probably more important to have a small discrepancy of less than 10 µM at each abutment.

Int J Periodontal Rest Dent 1992; 12:113-121
Editor's comment: Altough not included in this study, the use of plaster impression material in place of acrylic resin, has produced clinically acceptable results on a routine basis.

A Comparison of Torsional Ductile Fracture In Implant Coronal Screws

McGlumphy et al

Little data is available on the optimum torque values necessary to assemble an implant prosthesis. The purpose of this study was to calculate the torsional fracture levels of implant coronal screws to facilitate the calculation of optimum torque values. Test screws were placed in split collets and mounted in a screw testing fixture (Greenslade, Inc..) Clockwise torsional forces were placed with a torque driver (DCI, Inc.) until ductile fracture occurred (N=4/sample). Mean ultimate torque values were calculated and compared utilizing ANOVA and Tukey's Studentized Range Test. Optimum tensioning can be calculated by 75% of torque to yield. The results are at right.

The results of this study suggest that optimum torque values are dependent on screw alloy and diameter and should be individually calculated for each screw type.

AADR Abstracts, 1992

Screw	Mean Torsional Fracture (N-cm)	Sig Diff	75% Torque to Yield (N-cm)
Core-Vent -TSF	111.8 (10.8)	A	83.8
Omniloc Retaining	78.2 (1.58)	B	58.7
Integral Hex	70.1 (3.55)	B	52.6
Integral Cross	69.0 (0.64)	B	51.7
Steri-Oss Coping	55.6 (2.58)	C	41.7
C-V Hexloc	52.3 (4.12)	C	39.2
31-UCLA	39.7 (2.60)	D	29.7
Brånemark Single	39.4 (2.11)	D	29.5
IMZ 11 mm	22.1 (0.46)	E	16.6
Brånemark Gold	16.6 (0.67)	F	12.4