Implant Realities

Achieving success in implant dentistry

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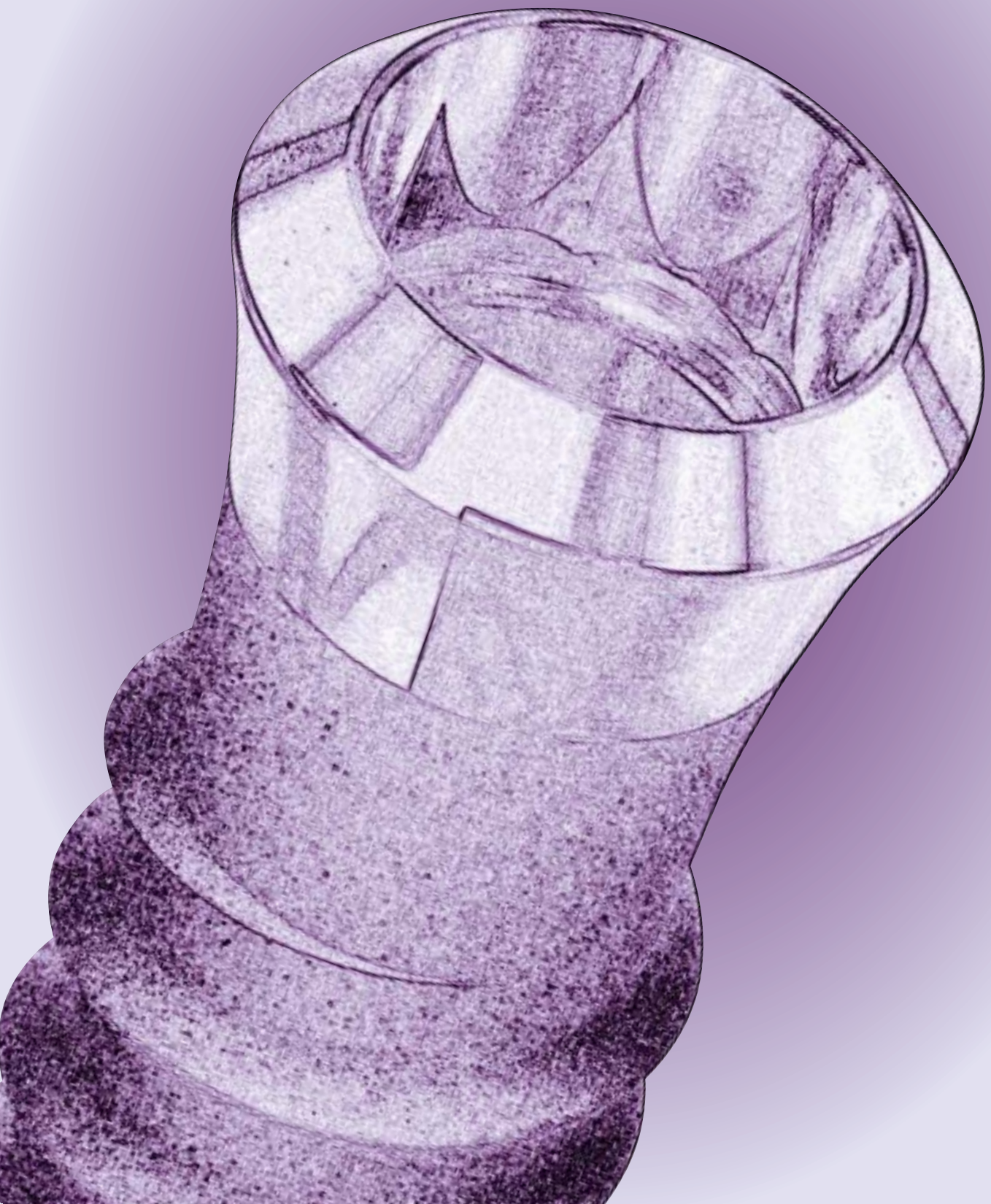

Feature Articles

In Every Issue

Welcome to *Implant Realities*

It is with some trepidation that this issue of *Implant Realities* is called the "esthetic issue." All too often, the discussion of esthetics at professional meetings is reduced to evaluation of the laboratory technician's artistry, and the clinical appearance shortly after prosthetic insertion, in an otherwise intact and unaffected dentition.

As conscientious clinicians understand, esthetics means much more than beautiful porcelain and an attractive post therapeutic photograph. While maximization of esthetic treatment outcomes is obviously intimately tied to the skills of the laboratory technician, it is also much more. Such therapeutic results are grounded in comprehensive diagnosis, case work up and treatment planning; recognition and resolution of all periodontal, endodontic, restorative and occlusal disease entities; idealization of adjacent soft tissue margins through elimination of incomplete passive eruption, root coverage procedures, or a combination of the two; implant placement in desired, case by case determined, positions; maximization of the stability of the hard and soft peri implant tissues through employment of specific implant designs; selection and execution of appropriate case driven restorative procedures; delivery of an esthetic, maintainable prosthesis; and placement of the patient on a comprehensive, regular maintenance program to ensure continued hard and soft tissue health.

The ITI implant is uniquely suited to address all of these challenges, as will become evident as you read this issue of *Implant Realities*. Rather than play the game of "guess which one is an implant," the discussions will focus upon the factors which must be comprehensively managed to ensure maximization of esthetic and biologic outcomes of therapy. We welcome your feedback!

Sincerely,

Paul A. Fugazzotto, DDS
Senior Editor, *Implant Realities*

Editorial: Do Unto Others

Paul A. Fugazzotto, DDS

"Ten percent of future practitioners will have a "boutique practice," while the other ninety percent of future practitioners will be imbibing tepid swamp water from a nuclear waste site."

I have lost track of the number of times I have heard a practice management consultant expound upon some variation of this theme. A "boutique practice" is nothing more than a practice characterized by ethical, conscientious therapy, a personal touch, and the willingness and ability of both the staff and the doctor to educate, motivate and communicate with each other and the patient. Assuming that the doctor demonstrates the appropriate outlook toward the office environment and patient care, this attitude must now be translated to, and instilled in, all members of the office staff.

It is imperative that all staff members understand the office philosophy regarding patient care. The term "patient care" refers not only to the delivery of therapy to help a patient with his/her oral health problems, but also encompasses all aspects of interactions between the office, the office staff, and the patient. The overused and hackneyed expression "The Practice Mission Statement" is indeed applicable. The mission statement in our office is simple yet comprehensive:

All Patients Should Be Treated at All Times with the Courtesy, Consideration and Helpfulness which We Would Expect for Ourselves.

Because I had significant opthamologic surgery performed when I was four years old, I see an ophthalmologist for regular maintenance care and examinations. After my original surgeon retired, I became a patient of the opthamologist who took over his practice at Massachusetts General Hospital. This man is personable, conscientious and highly respected. However, it soon became evident that he was consistently 45 minutes to 2 hours behind schedule. I mentioned this fact to him when I was in his examination room. Dr. X's response was that I should "tell the receptionist that I am a doctor. That way I won't have to wait." My restort was that if I did so I could very well suffer bodily harm from patients who had been waiting for their appointments, when leaving the doctor's examining room. A quick glance at the appointment book while the receptionist was making my next appointment demonstrated the fact that Dr. X was double and triple booked throughout the afternoon, after having performed surgical therapy in the morning. Despite Dr. X's obvious concern for my welfare and his clinical expertise, I switched my care to another well qualified opthamologist. Dr. X was not "the only game in town," and neither are we. My staff knows that we do not double book patients. In addition, while emergencies do occur, and unscheduled patients must be seen, every effort is made to remain on schedule throughout the day. If a patient is kept waiting in the reception area (we don't have "a waiting room"), the patient will have received a verbal apology from a front desk person, my assistant as the patient is seated, and myself as I enter the room. Obviously, such apologies would be meaningless if patients were not usually seen in a timely manner. Because it is obvious to patients that we strive to adhere to our schedule throughout the day, they are understanding when an emergency occurs.

The patient's first and last contact with our office is through our office staff. As with all other aspects of patient interactions, the staff is well educated concerning my expectations regarding both protocol and their attitudes toward patients.

A procedure as simple as answering the telephone will serve to either welcome a patient and set the tone for a pleasant, productive interaction, or annoy a patient and undermine his/her sense of worth in our office. A recent call to a colleague's office exposed me to an automated answering system which forced me to make three different menu selections to finally reach a human being. I rarely tolerate such menus when buying products if there is any other alternative, and would certainly not tolerate such an experience when trying to contact my healthcare provider.

The telephone at another office was answered in a staccato cadence as follows: "Dr. Y's office, hold please." I was put on hold and remained on hold for approximately 55 seconds. During the time I was on hold I was subjected to the inane chatter of a radio disk jockey, and a thirty second commercial spot for a discount dental center.

It is imperative that the person answering the telephone identify him or herself, and allow the patient to state his or her name and reason for calling, even if the call comes at a busy time at the front desk. Identifying oneself to the caller forges an immediate bond with the patient or potential patient. Allowing the patient to state his or her name and reason for calling gives the patient a sense of

well being from having stated their issue of need. Finally, by obtaining the patient's name before placing the patient on hold, the front desk person is able to call the patient back should the wait become frustrating and the patient hangs up.

Naturally, all patient questions should be answered in a pleasant, friendly and informative manner. A note should also be made by the front desk regarding patient questions, answers given, and subsequent discussion.

Front desk personnel, in addition to hygienists and assistants, must understand the indications, contraindications, and limitations of all forms of care you deliver. A questionnaire I sent to periodontal office staff a few years ago prior to giving a presentation dealing with periodontal therapy and management issues, included the question, "What do I do if my implants cause cancer?". Two respondents answered, "I didn't know implants could cause cancer." Such a response is disappointing and potentially dangerous. However, the fault lies not with the uninformed office personnel, but rather with the periodontist who owns the office. He did not fulfill his obligation to appropriately educate his office staff.

When we attend dental meetings, I do not send my front desk staff to courses which explain how to fill out insurance forms or answer the telephone. I am confident that the combined intelligence of my staff and myself are more than up to the task of solving such quandaries. Rather, my front desk personnel attend clinical courses to underscore both the rationales for therapies we provide, and the progressive nature of our clinical practice.

If a patient calls your office for information, or a patient in the office asks your front desk personnel their opinions of both the treatment you have proposed and its necessity (which they often will), your staff must be capable of answering any questions put to them in a confident and straightforward manner, to allay all patient fears.

Staff motivation occurs primarily through education and the development of a pleasant, fulfilling working environment. Our monthly office meetings usually consist of two parts. The first part of the meeting discusses various office concerns, be they large or small. I utilize the second half of the meeting as an opportunity to explain the rationale for various therapies being performed, to demonstrate the techniques, or to assess treatment outcomes, through short slide presentations.

Throughout the day, when radiographs are taken which demonstrate successful regenerative therapy or final implant restorations, I show them to the office staff. The before and after radiographs of various therapies are not presented to the staff to garner kudos. The purpose of such a pre and post therapy examination is to underscore the predictability and value of the therapy we perform for our patients.

It is imperative that this therapeutic value is continuously stressed to our staff members. A simple exercise demonstrates the importance of such an approach:

- Write down the weekly salary of your front desk staff members.
- Write down your fee for a single implant or an implant crown if you are a restorative dentist.
- Write down how much office time you spend performing the above mentioned therapy. Do not include time which is not seen by the staff, such as treatment planning, consultations, etc.

The compensation received for this hour or two of therapeutic chair time undoubtedly represents at least one week and possibly two or more weeks of salary to the front desk person who is expected to help convince the patient of the necessity and value of the treatment you have proposed. Assuming you employ ethical people, they cannot justify such therapy to an inquiring patient without fully understanding its necessity and value. All staff members must also fully understand both the doctor's expectations in regard to such patient interactions, and the fact that unmet expectations will result in staff member departure.

One of our regular study clubs consists of ten progressive restorative dentists, from three surrounding towns. We get together at our conference center to discuss practice management and practice growth considerations. One of the members of this group is a highly ethical, caring, genteel, qualified practitioner (Dr. Z). However, up until last year he was unhappy in his practice. Dr. Z felt that he was "constantly stressed out" and that he could never "implement all the things we talked about in our meetings" because Penelope (alias) continually disagreed with any new ideas he brought back to the office, and voiced this disagreement to all staff members. Penelope had been with the office prior to Dr. Z's having bought the practice a few years ago.

Despite the fact that Penelope was a kind person who genuinely cared about the patients in the office, she should not work with Dr. Z. After much discussion and cajoling, Dr. Z realized that he had to present an ultimatum to Penelope, couched in such a way that Penelope would decide to seek employment elsewhere. In the fourteen months since Penelope has left Dr. Z's practice, he enjoys practice much more, has less staff turnover, is more productive, and looks forward to going to the office each morning.

Doctor mindset and expectations, and their communication to the staff, are crucial to both the establishment of a pleasant productive, working environment and the successful multilevel, management of a clinical practice. Nowhere is this fact more evident than in the area of accounts receivable management.

A well run practice should be characterized by an accounts receivable which does not exceed 14 - 20 days of production (including outstanding insurance payments), and a pro-active approach to dealing with insurance companies. Our office account receivables have not exceeded 17 days of production in more than four years. This goal is accomplished in a simple, straight forward manner:

- I expect all patients to pay for therapy in full at the time the therapy is delivered. I do not look at the payments received at the end of the day and feel fortunate that the patient has paid for his surgical therapy that day. Rather, I demand explanation when payment has not been forthcoming.

- An immediate explanation of why payment has not been forthcoming is sought from the front desk person who dealt with the specific patient. If satisfactory answers are not received from the front desk person in question, we have a discussion about why such an outcome is not acceptable. It is also made very clear that such an occurrence cannot be repeated.

- All front desk personnel understand my expectations regarding patient payment, and the fact that they will be held personally responsible for the patients they deal with on a given day.

- Specific systems have been put in place to aid my front desk personnel in obtaining full payment at the time therapy is delivered. These systems include a discount to the patient when payment is made in full the day of the treatment; payment sheets which the patient has filled out and signed at the time the appointment has been made; specific guidelines for payment plans which eliminate both protracted payment plans and the need to send bills to patients; and collection of the fee for therapy prior to a patient being seated for treatment.

While this is not the forum in which to discuss the specifics of the various aspects of our overall payment policy structure, I can confidently state that the systems we utilize are simple, logical and easy to implement.
Finally, all office personnel must be more than willing to pamper all patients at all times. Such patient accommodations include, but are not limited to:

- Greeting all patients by name with a smile when they enter the office. If the front desk personnel are on the telephone, they should look up, smile and wave to the patient as he or she enters the office.

- Helping all patients with all questions regarding insurance, payments, and therapy. Naturally, the front desk personnel are more than happy to fill out all insurance forms for patients, even if patients are receiving payments directly from their insurance companies.

- Patients kept waiting, or friends waiting for patients, are always offered a cup of coffee.

- All staff members are always more than happy to copy articles in the reception area magazines at any patient's request.

- All prescriptions are phoned into the pharmacy before the patient leaves the office, in an effort to minimize the patient's wait at the pharmacy.

- All patients are treated in a respectful, friendly, highly personal manner.

- All patients are called after surgery to ascertain their level of comfort, to answer any minor questions they may have, or to offer patients the opportunity to speak with the doctor.

All of us frequent specific restaurants, stores, and hotels. We choose to employ various services a second time, based in large part on the manner which we have previously been treated.

Everyone loves to be pampered. I love it. You love it.
Our patients deserve it.

Esthetic Restorations: Introducing the Esthetic Principle of "Frame of Reference"

Alan V. Sulikowski, DMD

Introduction

Implant dentistry is bound to merge with the esthetic principles which rule other treatment modalities. While osseointegration is predictable, the utilization of such therapies to produce restorations indistinguishable from the natural dentition requires a thorough understanding of many other principles found in nature.

The artistic aspect of imitating the beauty of nature remains partially undisclosed and not well understood. Appropriate management of the dental proportions of implant-supported restorations have always presented a challenge, especially in cases where the necessary guidelines are not present. Biological and bio-mechanical principles which affect dental implants and the peri-implant tissues must also be understood to effectively generate esthetic outcomes which rival the natural dentition.

This article will discuss the guidelines utilized for diagnosis and treatment of anterior restorations, focusing upon the management of the dental proportions.

Artistic and scientific principles for esthetic dentistry.

In dentistry, as in any form of art, there are certain rules and known principles which help the dental team produce restorations that mimic nature. An organized and systematic approach is needed to diagnose and resolve esthetic problems. There are several methods described in the literature for evaluating the esthetic principles of a smile.

However, some methods proposed are more difficult to quantify than others.

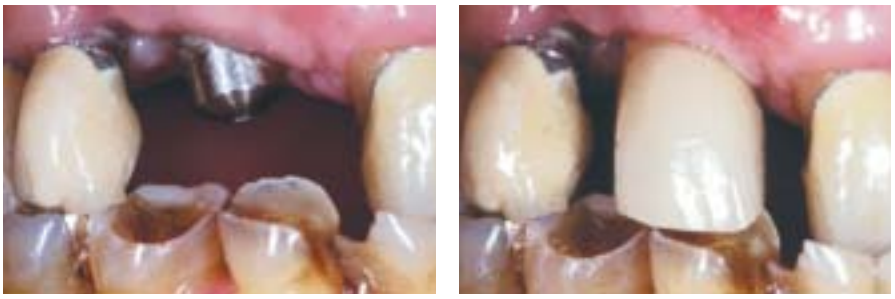

Figure 1 *The phenomenon of osseointegration has long been proven, yet by itself does not guarantee an esthetic result. In this clinical case, teeth #'s 6 and 7 were extracted and a hexed headed implant was placed in the area. The basic principles of prosthodontics were ignored. Unfortunately, the result is as expected.*

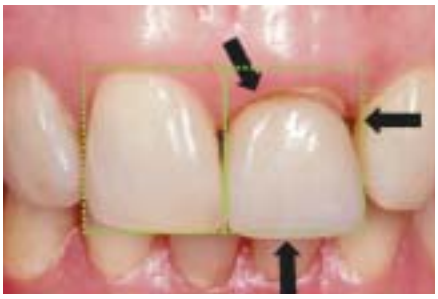

Figure 2 *Asymmetric central incisors: A crown was fabricated on tooth #9 without proper diagnosis of the spatial restorative needs. A frame of reference is utilized to disclose the correct proportion required.*

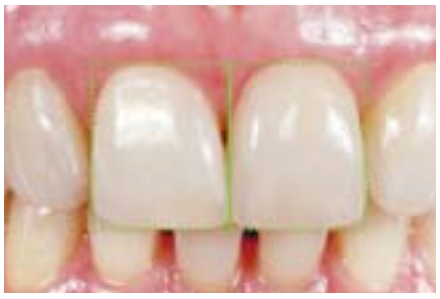

Figure 3 *The same tooth has been restored after careful modification of the frame of reference through periodontal plastic surgery.*

A list of the most common principles used includes:

1) Lip form

2) Symmetry

3) Axial inclination and location of the gingival zenith

4) Gingival architecture and outline

5) Incisal arrangement and embrasures

6) Tooth proportion

Development of the principle of "Frame of reference"

A frame of reference is a tool which defines the universe of what is to be created. Architects and graphic designers use frames of reference and rulers all the time, to be able to precisely change scale without changing the proportions of objects.
The frame of reference for the upper anterior sextant consists of six boxes, as shown in Figure 4.

Each portion of the frame of reference will be specific for a principle of smile design. The vertical and horizontal

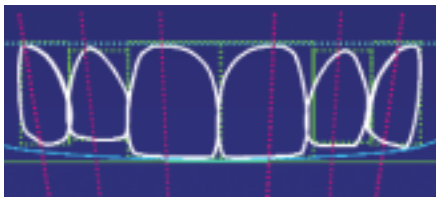

Figure 4 *An additive technique condensing all the esthetic factors required is pictured.*

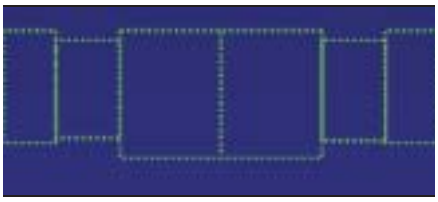

Figure 5 *The concept of frame of reference presented for the upper anterior sextant. All the pertinent factors are inherently considered in this formulation.*

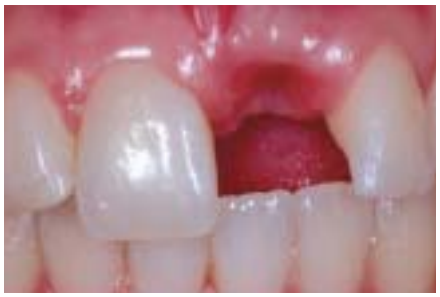

Figure 6 *A preoperative view of lost hard and soft tissues due to trauma.*

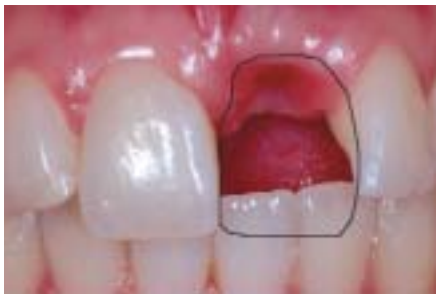

Figure 7 *Preliminary examination demonstrates collapse of the soft tissue contours, recession at the papillae, and a deformed defect that would not result in an esthetic prosthetic replacement.*

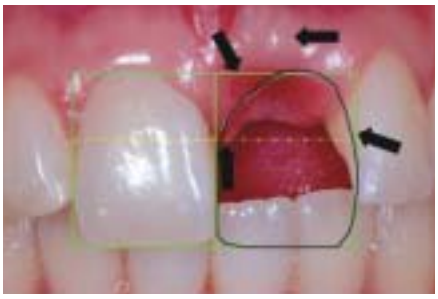

Figure 8 *Problem areas were identified and precisely located. Adequate soft and hard tissue contours will be reestablished through surgical means concurrent with implant placement.*

Figure 9 *The case has been completed. A frame of reference superimposed demonstration of reestablishment of papillary height, soft tissue contours, and an anatomic emergence profile.*

Figure 10 *Preoperative views of a fractured central incisor. Acute gingival inflamation and bone loss are evident. Normal adjacent structures make this a very difficult case to esthetically manage.*

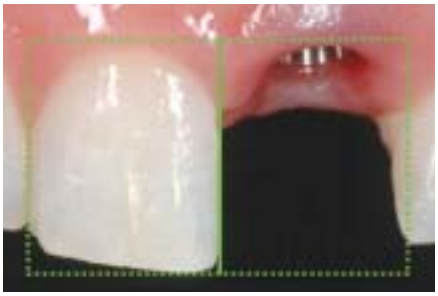

Figure 11 *Guided Tissue regeneration yielded new hard and soft tissue contours before implant placement. The implant was subsequently placed respecting the basic concepts of biologic width and tissue preservation.*

Figure 12 *The finished case demonstrating the symmetry required for an esthetic frame of reference.*

lines determine the midline, the symmetry, the gingival outline and the incisal arrangement. The boxes will determine the mesio-distal and gingivo-incisal space of a tooth, the tooth proportion, and the relation of the proportion of each anterior tooth to each other.

When this frame of reference is modified, all the parameters are modified at the same time, so that no parameter is overlooked in the process.
Every dentate patient already has a frame of reference given by the teeth and adjacent structures. If this frame of reference is deficient and has to be changed, a new frame of reference should be sketched. The frame of reference will provide a guideline for the 3 dimensional location of the final restoration. It provides a manner in which to visualize the proposed arrangement, and correct and idealize mesio-distal and gingivo-incisal distribution of the available space.

Pythagoras was the first person who recognized and documented the existence of certain pleasant proportions in the universe. He referred to this discovery as the Golden Proportion, and gave specific mathematical numbers to such phenomena. Although it is unreasonable to think that every human being will fit the same mathematical proportion, it is possible to utilize existing frames of references seen in pleasant natural dentitions. This is accomplished through computer imaging, and by transferring such information to a diagnostic wax-up or

tooth set up. Restorative-driven implant placement will respect such factors, and will allow the operator to enhance the esthetic outcome. This new set of invisible rules will be responsible for setting the stage for optimal treatment results. Ignoring the frame of reference will result in implant placements in less than ideal locations, and in most cases will compromise the esthetic and therapeutic outcomes.

The frame of reference will guide both the restorative driven implant placement and the esthetically driven implant restoration process.

Clinical case

A 21-year-old female patient presented seeking treatment 4 months after having suffered a trip and fall accident, which resulted in the loss of the upper left central incisor (Figure 6). The patient was wearing a transitional removable partial denture to replace the missing tooth.

Upon review of medical and dental history, the appropriate radiographs were taken and a thorough clinical examination was performed to evaluate the extent of the damage. Soft tissue injuries were evaluated (Figure 7). Tooth mobility and periodontal condition were evaluated. The frame of reference principle was applied to the preoperative images (Figure 8). A lack of papillary height and soft tissue recession was noted, due to the trauma suffered. Soft tissue contour collapse in the facial area was evident. Complimentary soft and hard tissue augmentation and soft tissue sculpting were needed. Emergence profile angle and depth were mathematically calculated.

After the restorative driven surgical phase of therapy, and subsequent prosthetic soft tissue sculpting, the final restoration was inserted, replacing the original contours (Figure 9). Super-imposition of the original presentation and the newly created stage demonstrates the difference in form which was achieved (Figure 10).

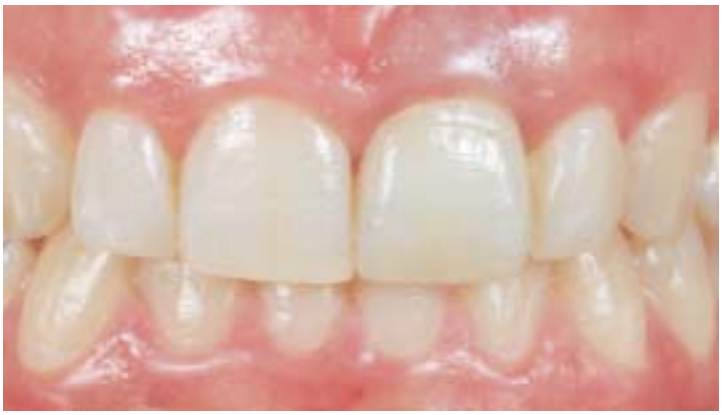

Figure 13 *A 6 month follow up. Soft tissue levels are stable and healthy.*

Tissue maturation will mimic the right side in time.

The same principles may be utilized for treatment planning and diagnosis of multiple unit implant restorations.

Conclusion

Contrary to the common belief that a good laboratory is the main determinant of esthetic success, attention to detail in treatment planning and precise implant placement, as well as, impeccable soft tissue manipulation are the factors that determine the set-up and frame of reference that will allow esthetic success. Form will supersede color in your esthetic restoration.

Site Development in the Esthetic Zone: A Multi-disciplinary Approach

Jay R. Beagle, DDS, MSD

Endosseous dental implants are widely recognized as the standard of care for the replacement of lost teeth. Initially reported upon in the literature for the rehabilitation of the edentulous patient, the use of osseointegrated implants has been shown to have equal or better success in the treatment of partial edentulism (1).

It is important to recognize the etiology of tooth loss for the patient prior to developing a reconstructive treatment plan. Generally, tooth loss as a result of caries, bruxism, endodontic failure, root fracture, or retained deciduous teeth does not compromise the alveolar bone. However, tooth loss due to periodontal disease or trauma may significantly affect the alveolar bone, resulting in a loss of hard and soft tissue dimensions required for ideal implant and prosthetic treatment. This issue becomes of critical importance when treating the maxillary anterior region with endosseous dental implants. Although adequate bone volume may be available for successful implant osseointegration, the loss of hard and soft tissue contours could unquestionably lead to compromised esthetics, phonetics, and maintenance for the patient.

When the loss of bone is evident in a buccal-lingual dimension, as often seen following trauma, a lateral ridge augmentation procedure can be performed with an autogenous block graft, as described by Buser and others (2, 3), for implant site development. Loss of vertical bone height as a result of periodontal disease, is more difficult to overcome with hard tissue grafting, and often may only be addressed with distraction osteogenesis, once the tooth is lost (4). Recognizing that a periodontally hopeless tooth is not a useless tooth, Salama et al (5) published a series of case reports, involving the orthodontic extrusion of periodontally diseased teeth to modify the local defect environment for implant site development. They incorporated the concept described by Ingbar (6) for forced eruption of teeth to correct periodontal defects by modifying the osseous and gingival topography. This technique provides predictable vertical augmentation of hard and soft tissue, optimal interdental and interarch restorative space, and a maintainable periodontal and esthetic outcome. With the use of light pressure (<30 grams), periodontally involved teeth can be extruded to shift the bone and gingival contours in a coronal direction, as a result of stretching the periodontal ligament to stimulate cellular changes which provide selective deposition of alveolar bone (7). Generally, ten days of activation are needed for each millimeter of desired tooth movement, followed by one month of stabilization for each millimeter of extrusion.

This paper will review one such multidisciplinary approach to treatment involving orthodontic extrusion, dental implant surgery, and restorative dentistry to replace a periodontally hopeless tooth in the esthetic zone.

Case Report

A 20 year-old African American female presented with the chief complaint of mobility and drifting of her maxillary left central incisor. The patient had previously undergone orthodontic treatment and localized periodontal therapy involving tooth #9, which had been diagnosed as suffering from juvenile periodontitis. Noteworthy was the circumferential osseous defect (Figure 1) which

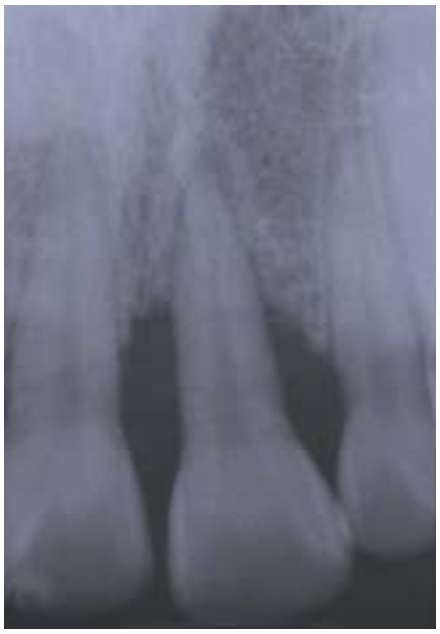

Figure 1 *A radiograph showing the circumferential osseous defect which exhibited probing depths of 10 mm.*

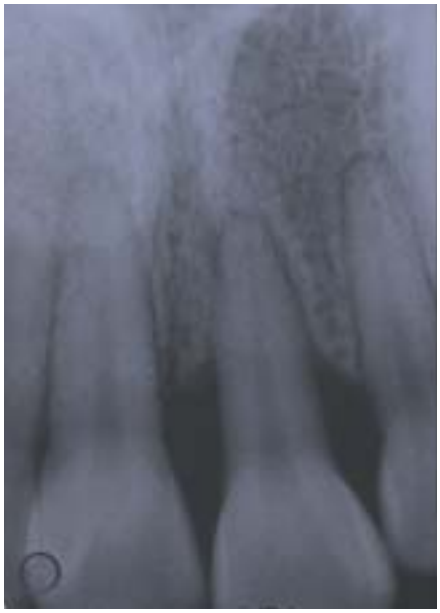

Figure 2 *A radiograph showing the extrusion process and leveling of the osseous defect, as planned.*

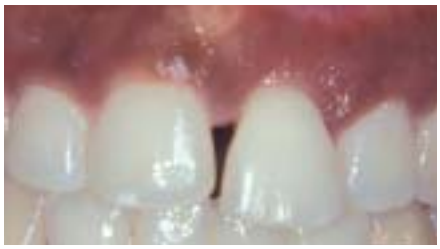

Figure 3 *This is an ideal site for implant placement.*

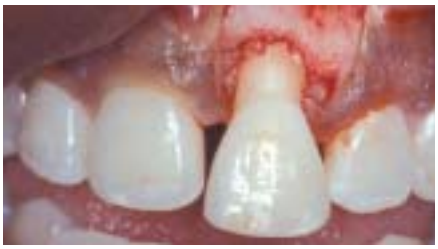

Figure 4 *Full-thickness mucoperioseal flap approach is employed.*

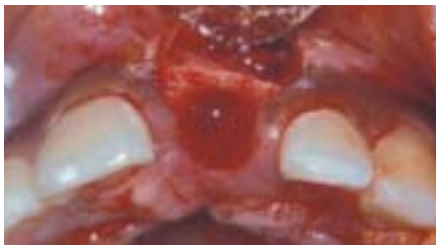

Figure 5 *Extraction of tooth #9 is carried out.*

Figure 6 *A 4.1 x 10 mm ESTHETIC PLUS ITI solid screw dental implant is inserted.*

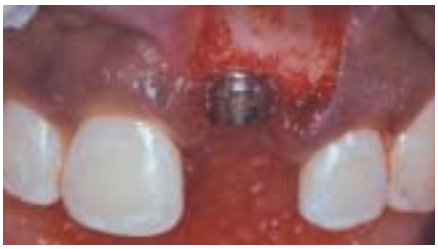

Figure 7 *The location of the implant shoulder is determined by the anatomical location of the adjacent cemento enamel junctions.*

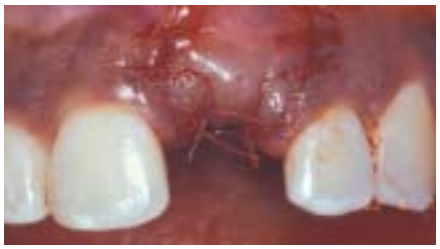

Figure 8 *A semi-submerged soft-tissue closure technique is utilized.*

exhibited probing depths of 10 mm. With a diagnosis of localized juvenile periodontitis, tooth #9 was deemed to have a poor long-term prognosis and extraction was recommended. Due to the presence of virgin adjacent teeth and a mid-line diastema, the primary prosthetic treatment option was to replace tooth #9 with an endosseous dental implant.

Due to the extent of the osseous defect, site development was necessary prior to implant placement. Orthodontic extrusion was decided upon, following consultations involving the prosthodontist, the surgeon, the orthodontist, and the patient. The tooth in question was to be extruded 4 mm to level the osseous defect. Following an 8 week period for stabilization, an extraction and immediate dental implant placement procedure would then be performed.

Orthodontic treatment was initiated in June of 2000 and was to have been completed eight months later. However, due to lack of patient compliance, orthodontic treatment was not finalized until March of 2002. During the first four months of orthodontic treatment, tooth #9 was intruded into the alveolus. The extrusion process then followed, leveling the osseous defect as planned, and creating an ideal site for implant placement (Figures 2 and 3). Frequent radiographic assessments were made throughout the extrusion process, as were frequent modifications of the incisal edge of the tooth.

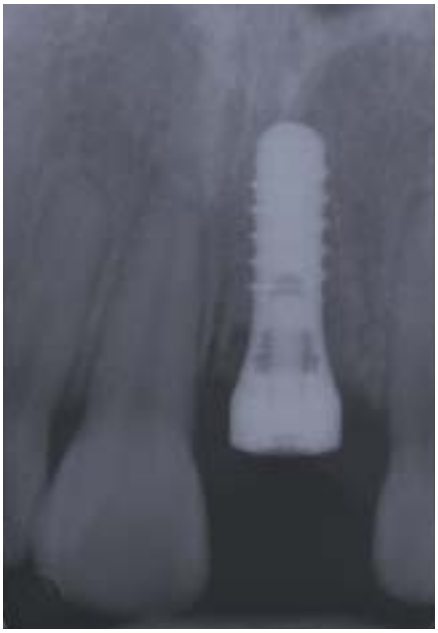

Figure 9 *Radiograph prior to release for restorative treatment.*

Utilizing a pre-surgical protocol as described by Buser (8), the immediate placement technique of this author (9), was employed, which included a full-thickness mucoperioseal flap approach (Figure 4), periotome extraction of tooth #9 (Figure 5), and the insertion of a 4.1 x 10mm ESTHETIC *PLUS* ITI solid screw dental implant (Figure 6). Noting the presence of altered passive eruption, the location of the implant shoulder was determined by the anatomical locations of the adjacent cemento enamel junctions of the adjacent teeth, rather than the heights of the gingival zeniths (Figure 7). Grafting of the horizontal defect dimension along the buccal aspect of the implant was accomplished with autogenous bone obtained during the osteotomy and the use of a resorbable membrane. A semi-submerged soft-tissue closure technique was utilized (Figure 8), and maintained for 12 weeks prior to the patient being released for restorative treatment (Figures 9 and 10).

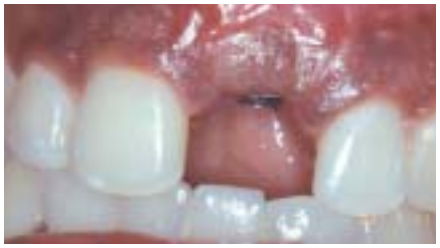

Figure 10 *The area is now ready for restorative treatment.*

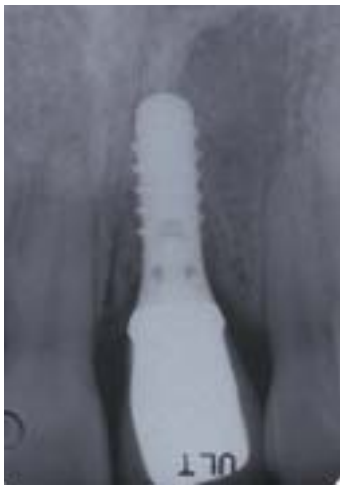

Figure 11 *A radiograph of the final screw-retained restoration.*

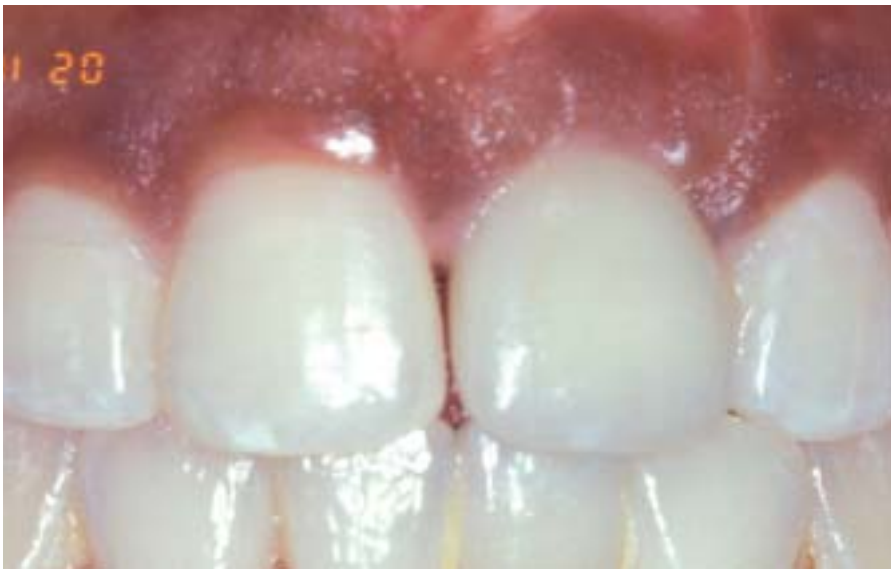

Figure 12 *The definitive metal ceramic crown is delivered as a screw-retained restoration, replicating the contours defined by the provisional restoration.*

Restorative therapy involved the placement of an octa abutment and fabrication of an acrylic provisional restoration. This restoration remained in place for two months in an effort to develop optimal soft tissue contours prior to obtaining a final impression. Final impressions were taken and the definitive metal ceramic crown was delivered as a screw retained restoration, replicating the contours attained by the provisional restoration (Figures 11 and 12).

Discussion

Too often in implant dentistry, clinicians get caught up in the ability to replace missing teeth with implants and lose sight of what the patient truly desires: not simply the replacement of a missing tooth, but tooth replacement which looks, feels, and functions like the tooth which was once present. This understanding is even more crucial when confronted with tooth replacement in the esthetic zone. Many times treatment sites are compromised due to previous trauma or periodontal disease, leaving atrophic hard and soft tissue contours (10). If these compromised profiles are not properly addressed with site development, an unesthetic result can occur despite the achievement of a functional success. It is therefore imperative to operate in a multi-disciplinary environment exploring all available options for a patient to achieve the ideal. In the above-described case report, a team approach combined the resources and knowledge of three dental specialties, resulting in the creation a functional, esthetic, and psychological success for the patient (11).

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Esthetics: Cement Versus Screw-retained Restorations

Gary Solnit, DDS, MS

Long term esthetic restorations on implants require a healthy, stable surrounding mucosa. Cochran and others have shown that the ITI implant system is designed to accommodate for the development of a normal "biologic width" around the implant following appropriate healing. If pre-machined implant-restoration interfaces encroach upon this biologic width, crestal bone loss will occur. Although the microgaps present when pre-machined components are utilized are minimal, the body reacts to such encroachment. Components designed for use with cement-retained restorations have demonstrated larger microgaps than their screw retained counterparts (1).

The advent of simplified restorative components such as the solid abutment has been accompanied by complications, including residual subgingival cement. While the effects of retained cement surrounding restorations on natural teeth has been well documented, the catastrophic results of such occurrences around osseointegrated implant restorations are only beginning to be understood. The surrounding tissues often become severely inflamed, resulting in compromise or loss of the implant.

Because of the problems associated with biologic width invasion, retained residual cement and large microgaps, restorative dentists must have a thorough understanding of the potentials and limitations of all options for the restoration of implants in esthetic areas of the mouth. Restorative dentists must know when to utilize a cement-retained restoration, how to properly cement such a restoration, how to alter the level of the margins of a cemented restoration, and when to employ a screw-retained restoration.

Utilization of a solid abutment and a cement-retained crown is both cost effective and simple. Such an option is especially attractive, as the restorative procedures involved are similar to those used for natural teeth. The introduction of snap-on plastic components has rendered implant impressioning procedures simpler than conventional preparation and impression procedures for natural teeth.

However, simplicity sometimes leads to carelessness. The restorative dentist must assess the depth of the implant to be restored. While an ITI implant may be 2 - 3 mm below the soft tissue margin on its buccal or lingual aspects, the architecture of the interdental soft tissues often result in the restorative margin being 5 - 6 mm below the soft tissue margins mesially or distally. Even the most careful clinician may not be able to properly remove residual cement in these deeper areas (Figures 1 - 3).

Restorations which show signs of unexplained chronic inflammation often reveal a tiny piece of residual cement upon inspection with the Perioscope (Figure 4).

In areas where microgaps are deeply subgingival, this effects of retained residual cement are rapid, severe, and often highly damaging to an esthetic restoration.

When an ITI implant is positioned in a shallower bed of soft tissue, with the deepest microgap position 2 - 3 mm below the soft tissue margin, strategies exist which aid in the complete removal of excess cement if a cemented restorative approach is to be considered. Anesthesia is always necessary, to ensure that both the patient and the dentist are comfortable carry-

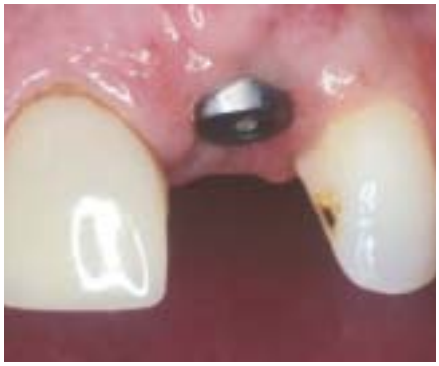


Figure 1 *An ITI implant replaces tooth #9. Note the surrounding tissue healthy prior to final impression.*

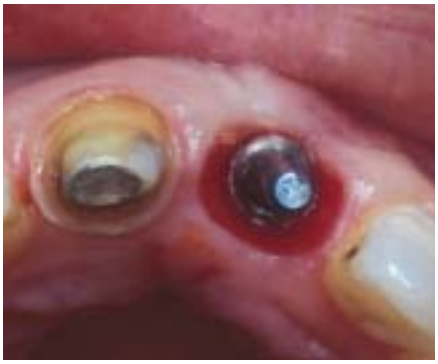


Figure 2 *Utilization of the solid abutment to restore #9. Note the deep lingual and proximal microgaps.*

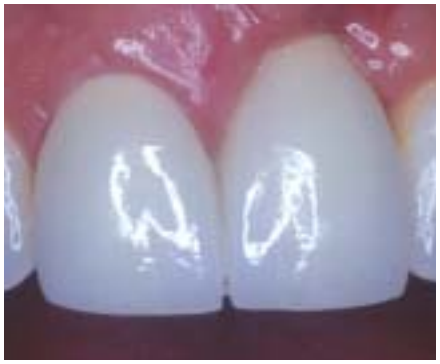


Figure 3 *A severe inflammatory response and gingival recession. Residual cement was discovered surrounding the final restoration.*

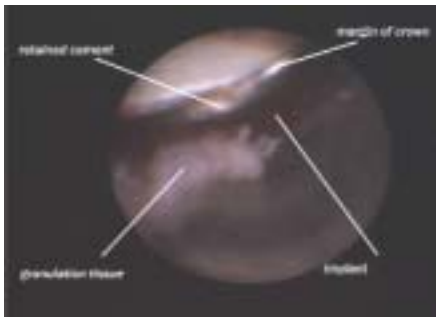


Figure 4 *A perioscope image of retained residual cement surrounding an implant restoration which presented with chronic inflammation. The cement was not detectable clinically.*

Figure 5 *Seating the final restoration over an analog prior to final cementation. Most excess cement is extruded prior to seating the restoration intra-orally.*

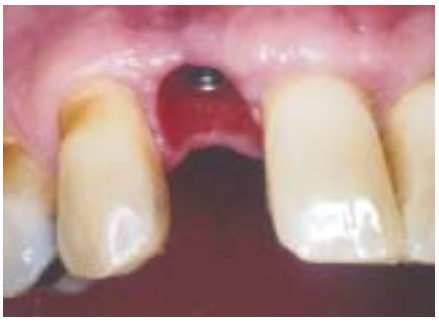


Figure 6 *Very deep placement of an ITI implant. Cemented margins will be positioned 1 - 2 mm below the soft tissue margin with the use of a custom abutment. The machined margins of the abutment remain deep below the tissue.*

Figure 7 *The final restoration seated on custom abutment. Notice the integrity of the margin of restoration. By raising the margin to 1 - 2 mm below the soft tissue margin, cement removal is more easily achieved.*

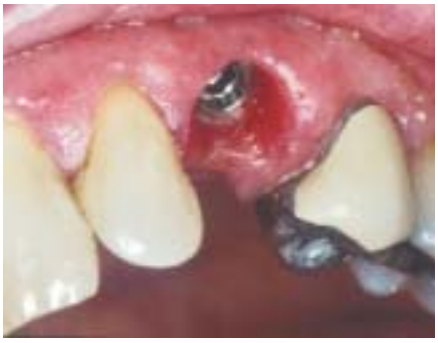


Figure 8 *Deep placement of an implant in the esthetic zone. A custom abutment is necessary.*

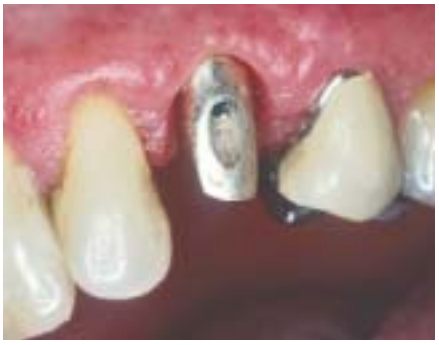


Figure 9 *The custom abutment in place. Cement margins are now more accessible.*

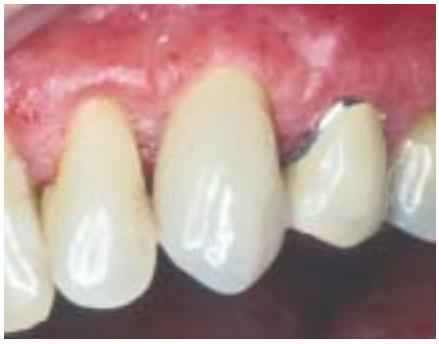


Figure 10 *The final restorations in place. All residual cement has been easily removed and the soft tissue are free from inflammation.*

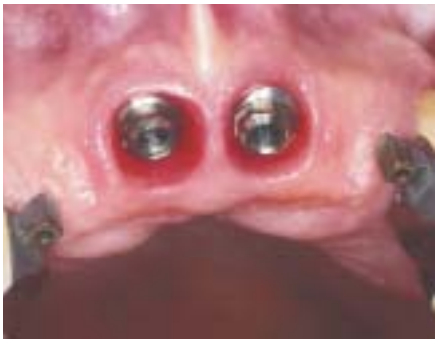


Figure 11 *Two ITI implants are to be restored with a direct screw-retained restoration.*

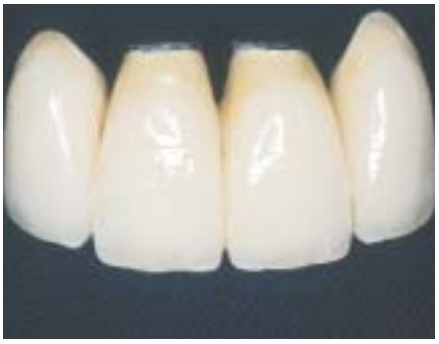


Figure 12 *The final restoration has a machined microgap below the tissue with a conservative metal collar.*

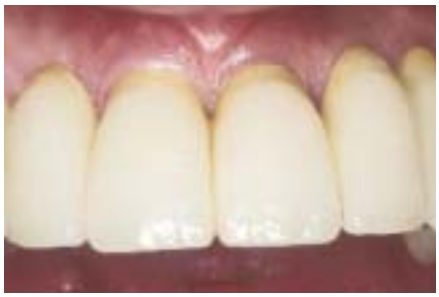


Figure 13 *The final screw-retained restoration after 2 years in place. Notice stable surrounding soft tissue.*

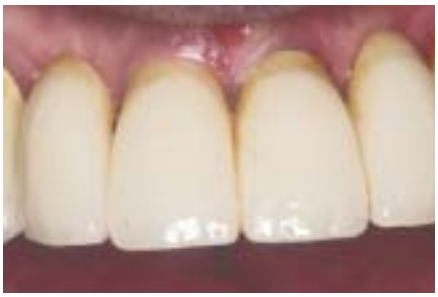


Figure 14 *A 9-year follow up of the screw-retained restoration*.

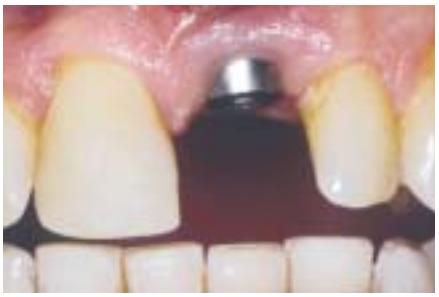


Figure 15 *An ITI implant replaces tooth #9. The soft issues will be expanded utilizing a screw-retained provisional restoration.*

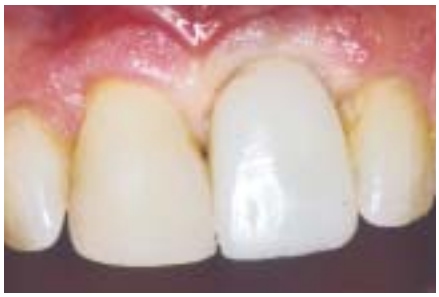


Figure 16 *Screw-retained provisional restoration driven to place to expand the surrounding soft tissue.*

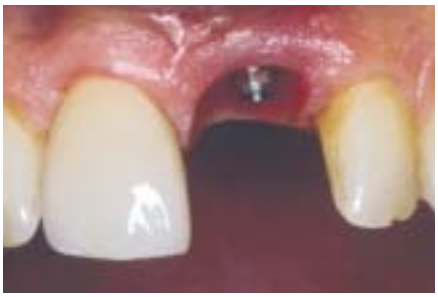


Figure 17 *ITI implant ready to receive final screw-retained restoration. Tissue has been expanded by the provisional restoration.*

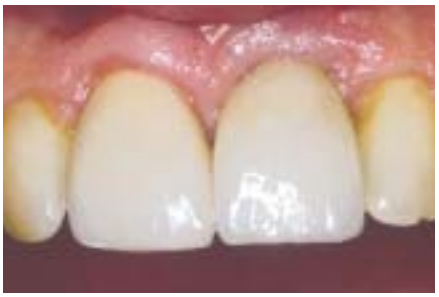


Figure 18 *Final screw-retained restoration immediately after delivery.*

ing out thorough scaling around the implant.

Extruding all excess cement on an analog prior to seating the final restoration on the implant intraorally will help minimize the amount of residual cement present (Figure 5). Because a cemented restoration on a solid abutment is a metal to metal interface, a minimal cement film thickness is desirable. Some cements, such as zinc phosphate and glass ionomer, have been shown to be more easily removed around implants. Their use is therefore recommended, as opposed to more tenacious cement such as reinforced glass ionomers, resins, or polycarboxylate cements (2).

Off-angle placement of an implant in an esthetic area often dictates that the restorative dentist fabricate a custom abutment to prevent unsightly screw access openings. A custom abutment is also strongly advised when an implant is placed deeply below the soft tissue margin. A solid abutment and a directly cemented restoration are not indicated in such a situation.

A custom abutment may be fabricated using the synOcta® abutment or the conventional octa abutment, and should be carefully designed to raise the cement margins to an accessible level. Meticulous margination and fit allow the restorative margins to be positioned 1 - 2 mm below the soft tissue margin, ensuring ease of cement removal on all axial surfaces of the restoration (Figures 6 - 10). If the surface of the custom abutment is polished, the final restoration can be cemented with temporary or permanent cement. It should be noted that a temporarily cemented restoration on a rough surfaced custom abutment is often more difficult to remove than a permanently cemented restoration on a polished custom abutment.

Clinicians advocate a plethora of designs of custom abutments and the use of various cements. Unfortunately, this is an area of implant dentistry which requires many more evidence based and long term studies before conclusions may be drawn. The intimate fit of the components of the ITI implant system make it unlikely that a custom abutment will loosen. Except in the event of porcelain fracture, the need for later retrieval of an implant restoration on an ITI implant is not as likely as when utilizing other implant systems and restorative approaches.

In esthetic areas of the mouth, a screw-retained restoration, following careful surgical planning and placement, represents the maximization of fit, retrievability and long term predictability (Figures 11 - 14). A screw retained restoration is superior to a cemented restoration when the interproximal depth of the implant restorative interface exceeds 3 mm. Machined components fit intimately, and there is no possibility of leaving residual cement below the soft tissue, when a screw retained restorative approach is employed (Figures 15 - 20).

Soft tissue management with a screw retained provisional restoration is superior to that of a cemented provisional restoration, as the provisional restoration can be driven to place, expanding the soft tissues to help attain the necessary soft tissue con-

tours, without the attendant risk of driving temporary cement deeply into the soft tissue bed. Provisional restorative margins are often superior when pre-machined titanium abutments are utilized, as opposed to the margins possible when employing direct provisional restoration techniques on a solid abutment (Figure 21).

The use of a synOcta® abutment or a conventional Octa abutment provide the simplest approach to a screw retained restoration in esthetic areas of the mouth. If implant angulation discrepancies preclude the use of direct screw retention, the transversal screw system may be employed. A synOcta® level impression is taken, and the transversal screws are incorporated into the laboratory procedures. While the transversal screw does require greater inter dental space lingually, it offers the benefit of machined components and retrievability.

Provisionalization is more difficult in situations which require a transversal screw. Finally, if the restorative dentist is attempting to avoid the potential complications often found when cementing a provisional restoration deeply subgingival, alternatives include a provisional custom abutment or no provisional restoration at all.

Conclusions

There is no question that cemented implant restorations offer a cost effective approach to restoring implants in esthetic areas of the mouth. However, careful attention to the relationship of the implant-restoration interface to both the bone crest and circumferential gingival soft tissue margins must be critically evaluated. The restorative dentist must strategically plan the final restoration, considering the potentially catastrophic effects of retention of residual cement around osseointegrating implants. When the depth of the implant restoration interface does not exceed 2 - 3 mm bucco-lingually, labio lingually or mesio distally, a solid abutment and a cemented restoration are an acceptable option.

When the depth of the implant restoration interface is greater than 3 mm on any aspect of the implant, a screw-retained restorative approach may offer superior long term soft tissue stability, and thus superior esthetics.

The human body recognizes the encroachment upon the dimension necessary for biologic width by machined components, and reacts by re-establishing an appropriate dimension between the implant restorative interface and the crestal bone, through the phenomenon of crestal bone loss. The body's response to ill fitting restorative margins, retained residual cement, or encroachment upon the dimension necessary for biologic width appears to be more severe when dealing with implants than with natural teeth.

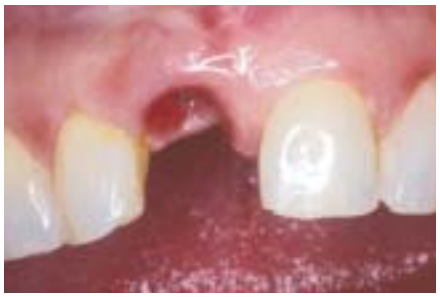


Figure 19 *Missing tooth #8 replaced by an implant. Note deep placement and need to expand tissue.*

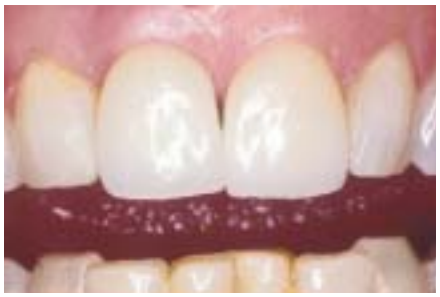


Figure 20 *The final screw-retained restoration tooth #8 and an adjacent porcelain veneer. This is a direct emerging restoration, after surrounding soft tissues were expanded by the provisional.*

Figure 21 *Two screw-retained provisional restorations will replace #8 and #9. Note the integrity of the machined interface.*

Perioscope image courtesy of Roger Stambaugh, DDS, Los Angeles, CA.
Figure 12: Labwork courtesy of Harry Shinozaki;
Figures 18, 20: Labwork courtesy of Carlos Puga

Anatomic Soft Tissue Model

Frank L. Higginbottom, DDS

Introduction

Implant supported restorations have provided patients in the United States with improved function for over two decades. Initially intended to restore function to patients without regard to appearance or esthetics, today a significant number of implant restorations are fabricated for the partially edentulous patient, many in the anterior sextants of the mouth. Anterior restorations often need to emerge from deeper implant placement positions than traditional non-submerged implant sites in the posterior areas of the mouth, to meet patient desires and expectations. Acceptable esthetic clinical results are characterized by closed interdental spaces, proper gingival height and volume, and duplication of the subgingival form of the natural tooth being replaced. Such mimicking of the natural tooth performance is accomplished through the fabrication of a "emergence profile" provisional restoration.

This article will discuss the various methods which have been utilized to fabricate an implant analog model resembling natural tooth subgingival contours. An "Anatomic Soft Tissue Model" will be demonstrated which ensures the most accurate fabrication of a soft tissue model for use in such a situations.

Techniques

All dental implant restorations begin with an impression of an implant abutment system or the implant directly. The laboratory will next construct a working model in one of several ways:

1. **Unaltered stone model.** An implant analog is attached to the impression. The impression is poured in type 4 die stone and a crown is fabricated. The subgingival area leading to the implant shoulder is not altered. Therefore, to achieve full restoration contour supragingivally, a ridge-lapped restoration is often necessary. This was the technique usually employed in the early stages of the evolution of implant dentistry.

2. **Altered stone model.** An implant analog is attached to the impression. The implant impression is poured in type 4 die stone. The dentist or the laboratory technician arbitrarily shapes the subgingival portion of the working model with flame-shaped diamonds to emulate naturally occurring contours. Such an approach is often adequate in posterior regions of the mouth, where esthetic demands are less.

3. **Unaltered soft tissue model.** An implant analog is attached to the impression. Prior to pouring the implant impression, a separating medium is applied and a soft tissue mask or polyvinyl impression material is injected around the analog. This technique results in a model which mimics the subgingival contours of the impression coping. This model may not exactly resemble the anatomic shape of the tooth, but is a more precise approach than the unaltered stone model.

4. **Altered soft tissue model.** An implant analog is attached to the impression. Prior to pouring the implant impression, a separating medium is placed and a soft tissue mask or polyvinyl impression material is injected around the analog. The dentist or technician will alter the subgingival portion of the model with a flame-shaped diamond prior to crown fabrication. The peri-implant space is widened to correspond to a shape which will sculpt the soft tissues to match natural tooth subgingival form.

5. **Custom Impression Coping.** (Keith & Martin) The restorative procedure begins with abutment connection and provisionalization. An anatomical provisional is placed to shape the tissues. No impression is taken. After 2 - 4 weeks, the

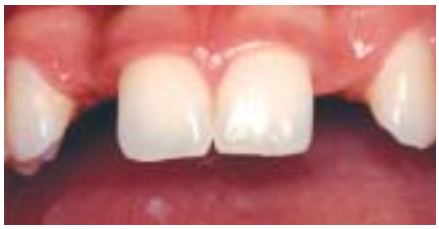


Figure 1 *A patient presents with congenitally missing lateral incisors. Proposed treatment includes placement of implants and guided bone regeneration.*

Figure 2 *Temporization copings for crowns are pictured.*

Figure 3 *Temporization copings have been roughened by sand-blasting.*

Figure 4 *Temporization copings have been shortened to 2mm above the retentive wings.*

Figure 5 *Temporization copings have been opaqued to block out metal.*

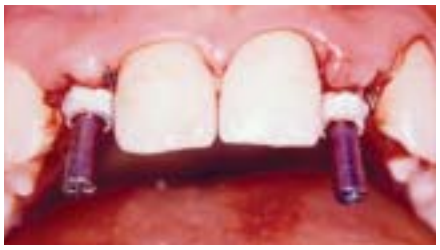


Figure 6 *Six months post operatively, the membranes are removed, and subepithelial connective tissue grafts and octabutments are placed. Temporization copings are inserted with guide pins. The copings will be picked up with autopolymerizing resin.*

Figure 7 *The unaltered, screw retained provisional restoration has been removed from the mouth. Note the subgingival contours of the restoration are deficient.*

Figure 8 *Autopolymerizing resin is added to the restoration on a laboratory analog to attain the desired subgingival contours.*

Figure 9 *The completed emergence profile provisional restoration is pictured.*

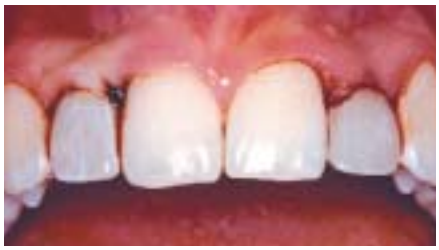


Figure 10 *Completed provisional restorations are in place, on the day uncovering and abutment connection. No impression is taken at this appointment.*

Figure 11 *Mature tissue is noted around the provisional restorations after 3 months of healing. Final impressions will be taken at this appointment.*

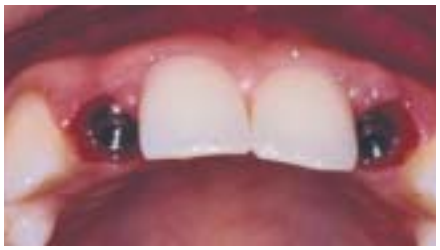


Figure 12 *A mature peri-implant space shaped by "Guided Tissue Shaping," utilizing emergence profile provisional restorations, is evident.*

patient is recalled for soft tissue evaluation. If the soft tissue contours are satisfactory, the provisional restoration is removed and fixed to an implant analog. The analog and temporary crown are embedded in polyvinyl, and the provisional restoration is removed and replaced with an impression coping. Acrylic resin is added to the impression coping to fill in the subgingival shape vacated by the provisional restoration, and a final impression is taken using the custom impression coping. A soft tissue model is now poured in the laboratory. This technique produces an intimate duplicate of the subgingival shape in the mouth.

Anatomic Soft Tissue Model

Prior to the initiation of restorative therapy an impression is taken at the implant level or of the appropriate abutment. An "Emergence Profile" provisional restoration is fabricated in accordance with the clinician's three-dimensional judgment, with care being taken to recreate the subgingival shape of the tooth being replaced. Interproximal contours must support the interdental papillae. However, it is most important to not overcontour the facial form, so as to avoid apical migration of the soft tissue margin. (Figures 1 - 12) The patient is dismissed and recalled in 2 - 4 weeks. During the time that the patient's soft tissues are adjusting to the shape of the provisional restoration, the working model is created. The subgingival portion of the model is hollowed out to over compensate for the shape of the provisional restoration (Figures 13 - 15). Polyvinyl adhesive is placed in the sulcus created in the working model. If gingival form is deemed satisfactory, a pencil line is traced on the provisional restoration at the level of the free gingival margin. The provisional restoration is removed and placed on the modified working laboratory model and seating is checked.

Figure 13 *An unaltered laboratory working model.*

Figure 14 *A flame shaped laboratory diamond is used to shape the sub-gingival space. The space should be opened to accept the provisional restoration.*

Figure 15 *The completed altered cast: Space has been provided for the provisional restorations to fit passively.*

Figure 16 *The provisional restorations are tried on working cast. Note the spaces created for soft tissue material.*

Figure 17 *Polyvinyl adhesive is applied to the working model.*

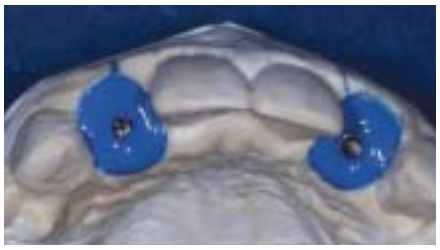


Figure 18 *Polyvinyl impression material is injected into the spaces created on the working model.*

Figure 19 *Provisional restorations are seated on the working cast.*

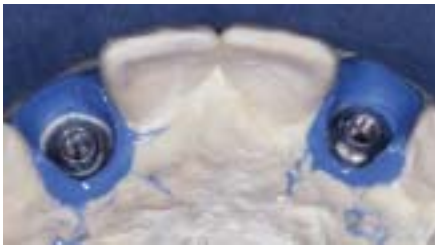


Figure 20 *The "Anatomic Soft Tissue Model" is formed by the "Emergence Profile Provisional Restorations."*

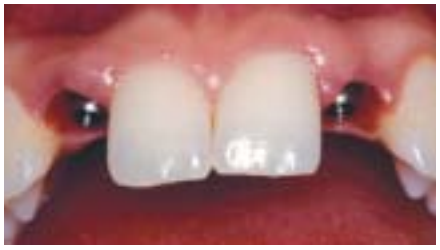


Figure 21 *Mature "Peri-implant" spaces are created by the emergence profile provisional restorations.*

The provisional restoration is removed from the model and soft tissue material is injected into the space created in the model. The provisional restoration is then reseated on the model. The excess soft tissue material is wiped away from the facial margin of the restoration to the pencil line duplicating the gingival height. The provisional restoration is removed after the impression material sets. You now have an "Anatomic Soft Tissue Model" to use in the fabrication of an esthetic restoration (Figures 16 - 22).

Conclusions

The demanding nature of esthetic procedures around dental implants requires appropriate visualization, attention to detail and customization of procedures for each individual patient. The subgingival contours of the "emergence profile provisional restoration" are customized for each patient. The emergence profile provisional restoration maintains, guides and shapes the "peri implant" space through guided tissue shaping (GTS). Appropriate capturing of this space will only occur with an anatomically shaped emergence profile restoration.

The emergence profile provisional restoration may be utilized to transfer information regarding final gingival form to the laboratory model. Such clinician to laboratory communication is essential for maximization of the esthetic outcomes of therapy.

Figure 22 *A view of final screw retained emergence profile restorations 7 years post placement.*

Surgical Impressions to Contour Gingiva for Optimal Esthetics of Anterior Implant Restorations

Jeffrey Ganeles, DMD; Frederic J. Norkin, DMD; Julio Sekler, DMD, MMSc; Michael Hahn, MDT

Successful implant dentistry in the esthetic zone requires more than osseointegration. The definition of success must include optimal cosmetic results, in addition to biologic health. Patient demands for natural-looking restorations place significant burdens upon surgeons, restorative dentists and dental technicians to provide optimal esthetic results. Healthy, properly contoured peri-implant tissues are critical prerequisites to the creation of natural looking tooth replacements.

Soft tissue contours, the framework for the final ceramic or ceramo-metal restoration, are primarily dictated by the underlying alveolus, implant position, adjacent teeth and the design of the implant restoration. In the traditional referral model of implant dentistry, the implant surgeon returns the patient to the restorative dentist with an integrated implant and a cylindrical cover screw or healing cap in place. The gingiva is shaped in a corresponding cylindrical architecture. A final restoration placed in this environment often does not look natural, as teeth do not have circular cross-sections at their gingival margins.

The process of converting the cylindrical implant emergence profile to that of a tooth form is now the responsibility of the restorative dentist, and is accomplished through gingivoplasty, provisional fabrication and contour finessing over a number of appointments. This tedious, time consuming, inefficient (and unprofitable) method of peri-implant tissue development gradually molds the gingiva to the proper shape, allowing for fabrication and placement of a highly esthetic restoration. Failure to create the appropriate gingival architecture compromises the final esthetic outcome.

An efficient, effective alternative to the above process is to combine surgical and restorative procedures to initiate the gingival contouring process earlier in treatment. Pro-active pre-surgical planning, communication and preparation can greatly improve the efficiency of the team, while providing optimal results. The following case presentation will illustrate how a surgical impression combined with appropriate laboratory procedures are sequenced to transfer tissue contour from the restorative dentist to the technician and surgeon, optimizing efficiency and esthetic outcomes.

Case Report

A 27-year-old female was referred for replacement of her symptomatic maxillary right central incisor. The patient traumatized this tooth as a child. Despite numerous attempts at conventional and surgical endodontic treatment, intermittent pain and swelling occurred. Poor esthetics was also evident. Clinical and radiographic evaluation revealed the patient's dentition to be otherwise intact and healthy. Tooth #8 was tender to percussion and exhibited a periapical radiolucency.

Since significant alveolar damage was anticipated from previous disease, trauma and surgery, a treatment plan was developed employing tooth extraction, followed by delayed implant placement with simultaneous alveolar repair. The implant was to be submerged to maximize alveolar regenerative results. During the healing period, a transitional removable partial denture was anticipated. To further accelerate the course of treatment, a surgical impression was planned at the time of implant placement, allowing the laboratory to create a provisional restoration to be placed at the time of implant exposure surgery.

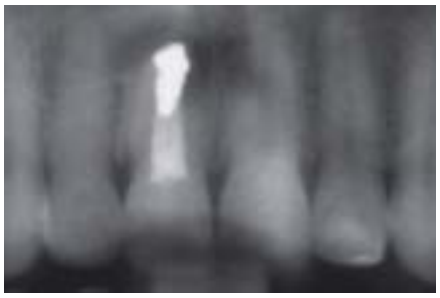


Figure 1 *A pre-treatment radiograph demonstrates a large periapical lesion on tooth #8.*

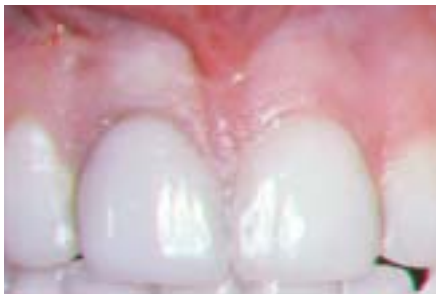
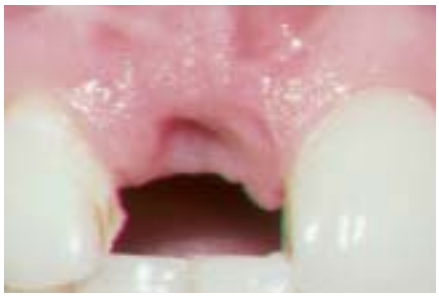


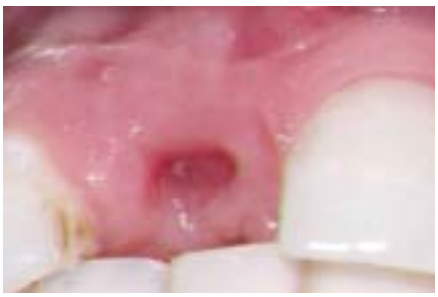
Figure 2 *Good gingival marginal contours and normal papillae surround tooth #8.*

The preoperative radiographic and clinical conditions of tooth #8 are evident in Figures 1 and 2.

Tooth #8 was extracted without raising a flap. A collagen sponge was inserted into the socket to facilitate clot formation. No additional socket preservation or grafting was done at this time. An acrylic transitional removable partial denture was placed and contoured to provide light pressure on the gingiva.

Four weeks after tooth extraction, the patient returned demonstrating significant horizontal, and slight vertical, collapse of the alveolar ridge (Figures 3a and b). Sufficient socket closure had





Figures 3a & b *Significant horizontal and slight vertical collapse of the alveolar ridge are noted four weeks after tooth extraction.*

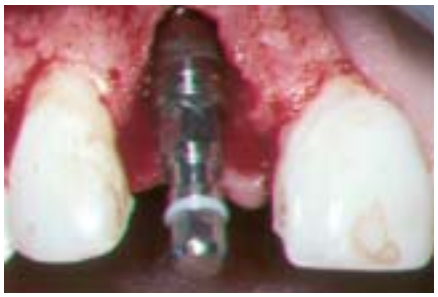


Figure 4 *4.1 x 12 mm ESTHETIC PLUS implant was placed according to accepted protocol, in an ideal three dimensional position.*

Figure 5 *A standard synOcta® impression coping and positioning cylinder were snapped into place on the implant.*

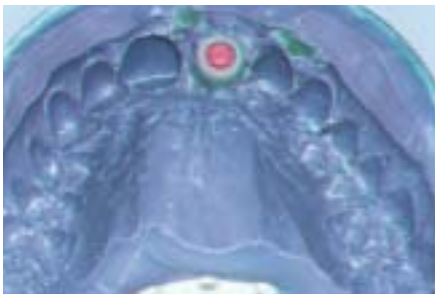


Figure 6 *A maxillary impression was taken.*

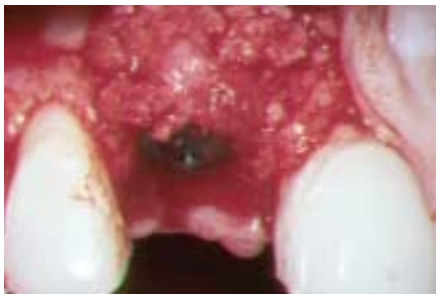


Figure 7 *Autogenous cancellous bone was harvested from the maxillary tuberosity and condensed around the implant to help reform the lost alveolar process.*

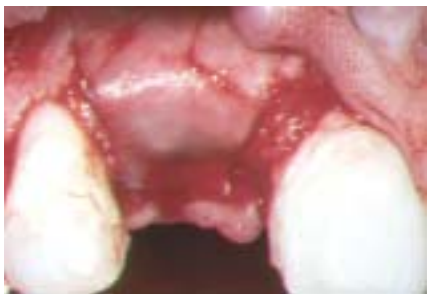


Figure 8 *A collagen membrane was adapted to cover the bone graft.*

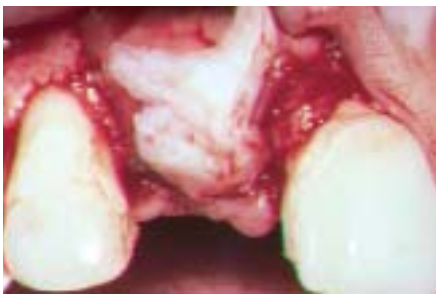


Figure 9 *Gingival connective tissue was harvested from the maxillary tuberosity, positioned on top of the collagen membrane, and secured.*

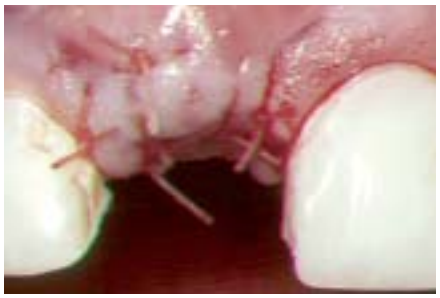


Figure 10 *Final suturing was accomplished.*

occurred to permit implant and alveolar augmentation surgical procedures to proceed.

Full thickness flaps were elevated and the socket was again thoroughly debrided. An SLA surfaced ITI 4.1 x 12 mm ESTHETIC *PLUS* implant with an internal octagon was placed according to accepted protocol, to an ideal three dimensional position (Figure 4) using a surgical guide. Implant depth was determined by aligning the most coronal aspect of the implant shoulder with the apical height of the buccal osseous curvature of the adjacent teeth.

A standard synOcta® impression coping and positioning cylinder were snapped into place on the implant (Figure 5). After verification of full seating of the impression coping, a closed-tray, full arch, medium body, elastomeric impression was taken to register the position of the implant within the dental arch. (It should be noted that an open tray technique with a screw-retained synOcta® impression coping sometimes offers advantages over the pictured procedure, when implants are not exceptionally stable at the time of placement surgery.) An effort was made to avoid direct contact of the impression material with the implant surface.

Once the impression material had set, the tray was removed, and alveolar repair surgical procedures were carried out. A large closure screw was placed on the implant to cover the implant shoulder and support the contours of the bone graft. Autogenous cancellous bone was harvest-

Figure 11 *A screw retained provisional restoration with optimal subgingival contours will help guide the future gingival architecture.*

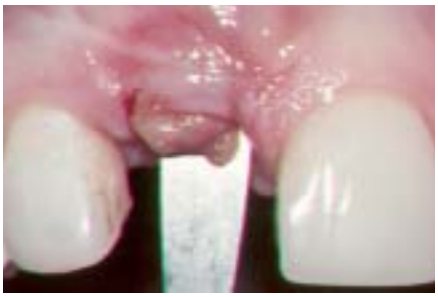


Figure 12 *Crestal gingiva was de-epithelialized and tucked internally under the facial gingiva using a "roll" technique to augment horizontally and simulate a root eminence.*

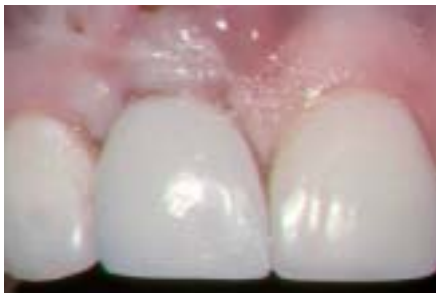


Figure 13 *The provisional restoration was inserted to blanch and mold the gingiva.*

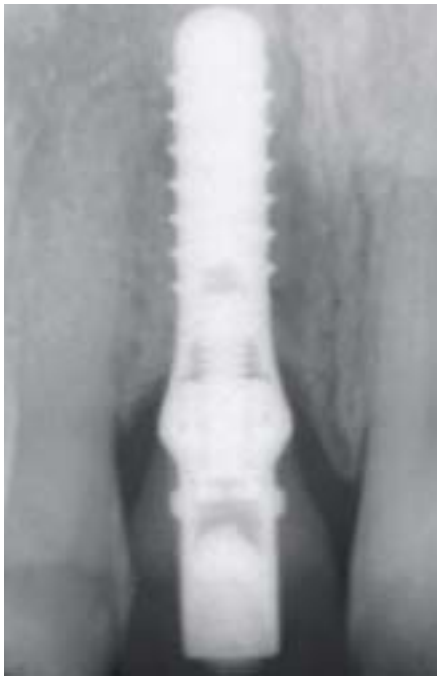


Figure 14 *Bone crest is at the the top of the SLA surface of the implant, leaving the smooth, machined collar to traverse the soft tissue.*

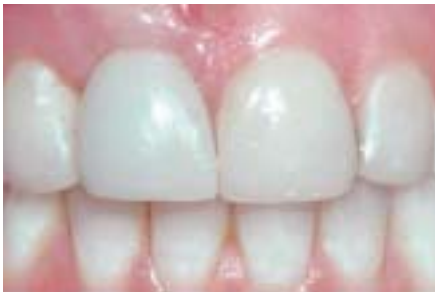


Figure 15 *Provisional restoration after 12 weeks.*

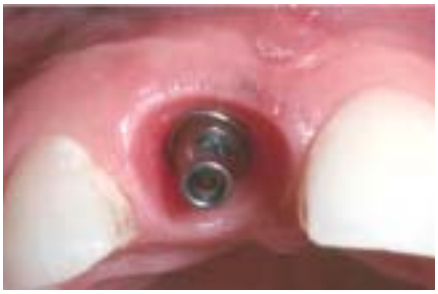


Figure 17 *Triangular gingival architecture.*

Figure 16 *Final ceramo-metal crown was completed with minimal adjustments or patient chair time.*

ed from the maxillary tuberosity and condensed around the implant to help re-form the lost alveolar process (Figure 6).

A collagen membrane was adapted to cover the bone graft (Figure 7). Gingival connective tissue was harvested from the maxillary tuberosity, positioned on top of the collagen membrane and secured with resorbable sutures (Figure 8). Periosteal relaxing incisions were made in the buccal flap to facilitate graft coverage and wound closure. Final suturing was accomplished with a layered closure technique using resorbable horizontal mattress sutures apically and interrupted sutures superficially (Figure 9). The patient's transitional removable appliance was adjusted to prevent pressure on the ridge.

The maxillary impression was delivered to the dental laboratory with a mandibular model and appropriate shade information to fabricate a provisional restoration (Figure 10). The technician was instructed to create a restoration with optimal subgingival contours, to guide the future development of the gingival architecture (Figure 11). An ITI titanium synOcta® crown provisional cylinder was used as a core for a screw-retained, composite resin provisional restoration. Note that the customary sequence, in which the technician is instructed to follow gingival contours carefully formed by the dentist clinically and communicated via soft tissue models, was reversed in this instance.

Ten weeks after implant placement surgery, the patient returned for implant uncovering, and provisional restoration placement to initiate gingival contouring. The surgical site had healed uneventfully, although minor buccal resorption was noted. During

the second stage surgery, additional facial gingival soft tissue augmentation was accomplished using a "roll" technique to establish a "root eminence." Coronal gingiva was de-epithelialized, and tucked internally under the facial gingiva to augment the soft tissues labially, and create the illusion of a root eminence (Figure 12). Following suturing of the "rolled" gingiva apically, the provisional restoration was inserted to blanch and mold the gingiva as it was gradually tightened to place (Figure 13).

A radiograph confirmed appropriate seating and excellent marginal integrity of the provisional restoration. Bone crest is at the top of the SLA surface of the implant, leaving the smooth, machined implant collar to traverse the soft tissues (Figure 14).

The soft tissues were allowed to heal and mature with the provisional restoration in place for approximately 12 weeks. The patient was then referred to her restorative dentist for final impressions and fabrication of the final restoration (Figure 15).

The procedures for fabricating the final restoration included the customary hard and soft tissue models to communicate the desired tooth contours to the technician. The restorative dentist delivered the final ceramometal crown at the second appointment, with minimal adjustment or patient chair time (Figure 16). To optimize the esthetic result, it was decided to use the synOcta® transversal screw abutment system. This approach provided for the precision of screw retention in the deep subgingival interproximal areas, while avoiding a screw access hole in the coronal aspect of the restoration.

Three months after delivery of the final restoration, the crown was removed to observe the gingival form and to assess health. Figure 17 demonstrates the lack of inflammation consistent with the excellent biocompatibility of the implant restoration, and clearly demonstrates the triangular gingival architecture developed using the technique described in this article. Such gingival architecture mimics the subgingival contours of a natural central incisor.

One year after completing the implant crown, the patient decided to replace the stained porcelain veneers on her other incisors (Figures 18 and 19). The final result, after completing the aforementioned dental procedures, is one of excellent esthetics and a stable soft tissue complex surrounding the implant.

Discussion

Successful implant dentistry in the esthetic zone mandates development of the soft tissue complex to mimic that of the natural teeth. It is critical to realize that few patients lose maxillary anterior teeth without damaging the underlying alveolus. The surgeon must often utilize reparative and regenerative procedures in conjunction with, or prior to, implant surgical procedures. Traditionally, implant surgeons consider their "jobs" finished when they return a patient to the restorative dentist with the soft tissues cylindrically shaped around a circular healing cap, on an integrated implant. Unfortunately, no teeth in the human dentition demonstrate a cylindrical root form in cross section, at or near their cementoenamel junctions.
In such a scenario, the task of forming natural gingival contours falls to the restorative dentist. Through a series of time consuming appointments spent creating and modifying provisional restorations, he or she can gradually form acceptable gingival emergence and papillae, and overall gingival contours. Failure to complete this often-uncompensated process may lead to an unsatisfactory esthetic result for the patient. Unfortunately, neither the need for tedious gingival manipulation, nor a final unesthetic emergence, leave the patient or the restorative doctor satisfied.
The procedure described above helps to alleviate these concerns. Taking a surgical implant impression allows the technician to create a provisional restoration with appropriate subgingival contours to positively influence emergence profile from the time of initial loading of the implant, and can be applied in clinical situations in which the implants are submerged or non-submerged. Instead of attaching cylindrical healing caps, surgeons initiate gingival contouring at second stage surgical procedures. If the implant does not require surgical exposure, the restorative dentist may place the laboratory fabricated provisional restoration to begin the gingival modeling process at the first visit after the patient is released from the surgeon. Having a provisional restoration pre-fabricated in the laboratory minimizes chair time for both the restorative dentist and patient.

There is no compromise of the final result when using the surgical impression technique. Rather, optimal esthetics may be obtained quickly

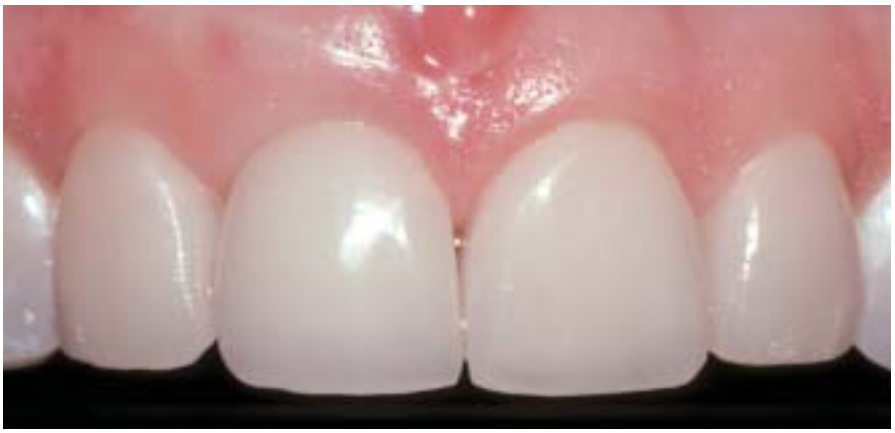


Figure 18 *One year post-op.*

and more efficiently, saving the patient office visits and reducing the number of hours of restorative doctor time. A change in our thought processes must occur if we are to apply this technique, as periodontists and oral surgeons must become familiar with implant impression components, materials and techniques. Surgical time may be increased 5 - 10 minutes, depending on the impression materials employed, and familiarity of the surgeon with the implant impressioning technique. Technicians must anticipate proper subgingival contours in restorations, instead of conforming to soft tissue models of already formed peri-implant sulci.

Summary

Implant success in the esthetic zone combines optimal cosmetics, sound biologic principles, time efficiency, predictability and simplicity. Anticipatory pre-operative team planning should be combined with a redistribution of traditional roles to allow surgeons to take impressions, and technicians to help form gingival contours. Patients and treating doctors will reap the benefits of consistent, successful treatment results and greater overall satisfaction.

The authors would like to acknowedge Drs. Joel Gale and Ronald Cohen for their restorative dentistry performed on this patient.

Figure 19 *Two years post-op.*

Practical Implant Pearls

Scott E. Keith, DDS, MS

Making Stress-Free Implant Impressions

Accurate impression making is critical to the success of fixed prosthodontics. As implant procedures become more routine in the average general practice, predictable impression taking for implant restorations is as important. This practical implant pearl reviews the various implant impression techniques and demonstrates a simple stress free method of "open-tray" impression making.

Dental impressions can be made with a variety of materials and methods, based upon one's clinical preference. Most clinicians agree an elastomeric silicone impression material such as polyvinyl siloxane provides the best working properties for use in traditional and implant prosthodontics. As important as the material utilized is the method by which the impression is made. While some clinicians may find occasional success with quadrant trays and dual-arch impressions, experience and studies have shown that full-arch impressions achieve the most predictable results. To minimize the amount of adjustment required to insert a final implant prosthesis, an efficient doctor will use a custom impression tray, especially for impressions for multi-unit restorations.

Once the impression material and tray type are chosen, it must be decided if the final implant abutment will be placed prior to impression taking. Implant impressions are made at the level of the implant body or the abutment. For most single-unit cases in the posterior region, the restorative approach calls for a solid abutment. The abutment is placed and torqued to 35 Ncm (Figure 1). A plastic snap-on transfer coping (Figure 2) and color coded positioning cylinder (Figure 3), allow accurate transfer of the implant and abutment position to the master cast with a standard closed tray impression technique (Figure 4).

For more complex cases, an impression of the implant body is possible using synOcta® impression copings prior to final abutment selection (Figure 5). In cases where tissue depth, implant angulation, or restoration design needs to be verified in the laboratory, the fixture level impression is an excellent option. A snap-on transfer coping and a red synOcta® "plunger" (Figures 6 & 7) are "picked up" in the set impression material. Sometimes, a screw-retained impression coping is selected due to clinician preference (Figure 8). Screw-retained copings offer a high degree

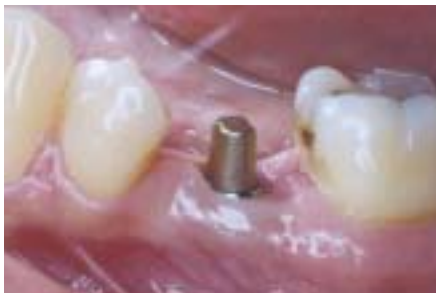


Figure 1 *Solid abutment in place.*

Figure 2 *Solid abutment impression components are pictured.*

Figure 3 *An impression transfer cap and positioning cylinder are in place.*

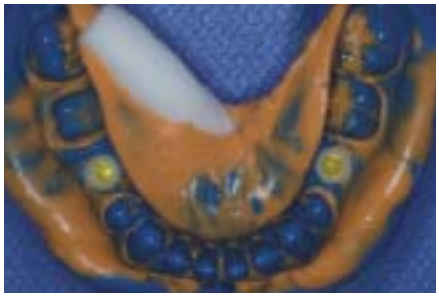


Figure 4 *A polyvinylsiloxane impression has been taken.*

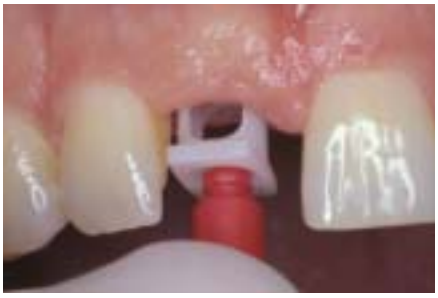


Figure 5 *synOcta® impression components are in place.*

Figure 6 *Low viscosity wash material is applied.*

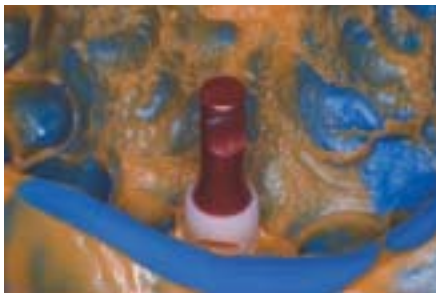


Figure 7 *A synOcta® analog is placed in set impression.*

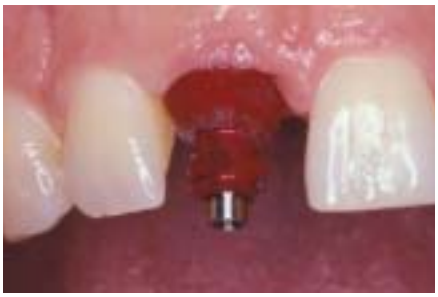


Figure 8 *A customized screw-retained impression coping is seated.*

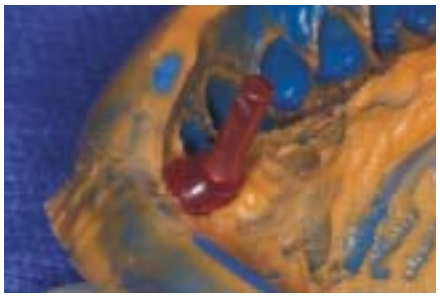


Figure 9 *The emergence profile of the restoration is transferred to impression.*

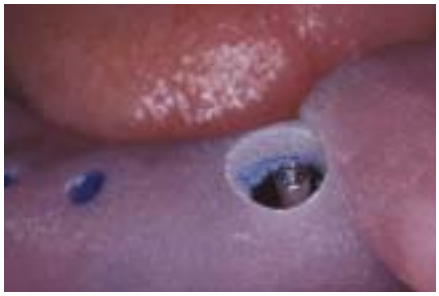


Figure 10 *An open tray impression technique is anticipated.*

Figure 11 *A long synOcta® guide screw is placed.*

Figure 12 *A narrow neck impression coping is in place.*

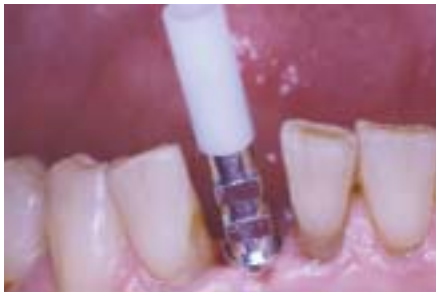


Figure 13 *An octa modeling aid is utilized to extend the guide screw.*

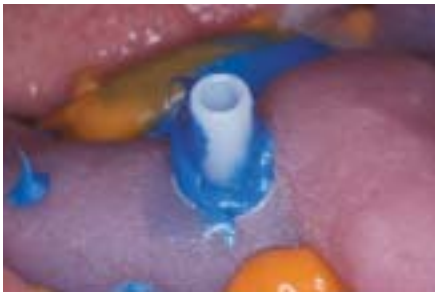


Figure 14 *The impression tray is seated intra-orally.*

Figure 15 *SCS driver access to the guide screw is ensured.*

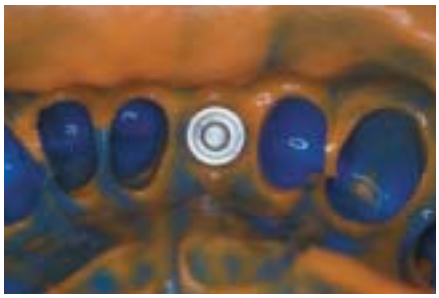


Figure 16 *An NNI coping has been picked up in impression.*

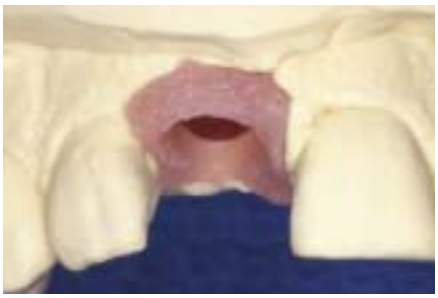


Figure 17 *A master cast is fabricated from a custom impression coping.*

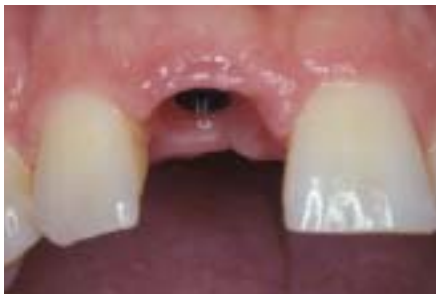


Figure 18 *A clinical view of the peri-implant sulcus.*

of precision, accuracy, and the ability to be customized to duplicate the emergence profile of provisional restorations (Figure 9).

The use of a screw-retained impression coping requires access to the guide screw through an opening in the impression tray (Figure 10). It is sometimes difficult to locate the guide screw through excess impression material as the tray is seated. Use of an extra long guide screw eliminates this problem (Figure 11). When using a standard screw-retained coping, a modification will greatly simplify the task of open-tray implant impressions. Placing a plastic waxing sleeve (octa modeling aid) over the end of the guide screw (Figure 12) extends the length of the screw (Figure 13). A cot-

ton pellet is placed into the exposed end of the sleeve and the impression tray is seated. Since the sleeve easily protrudes from the opening in the tray excess unset material is removed and access to the guide screw is assured (Figure 14). Once the impression material has set, the plastic guide sleeve is removed with a hemostat and an SCS screwdriver is used to loosen the guide screw (Figure 15). After the guide screw is completely removed, the final impression is carefully retrieved from the patient's mouth (Figure 16).

An accurate impression is essential if the dental laboratory is to create a master cast which duplicates the clinical situation (Figures 17 & 18). Through the use of a quality working cast, the technician may assist in case planning, abutment selection, and fabrication of a well fitting and esthetic restoration (Figure 19).

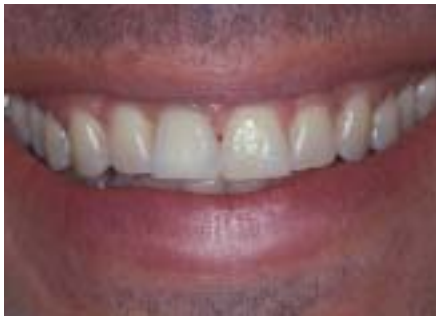


Figure 19 *The completed implant restoration of tooth #8.*

Transforming Treatment with Guided Bone Regeneration Part 2: Selection of Appropriate Materials

Paul A. Fugazzotto, DDS

Introduction

The efficacy of Guided Bone Regenerative (GBR) therapy in the regeneration of lost alveolar bone is well established.

Numerous articles document predictable bone regeneration utilizing autogenous, allograft and xenograft materials, in conjunction with a variety of covering membranes, at the time of tooth extraction; to rebuild atrophic alveolar ridges bucco lingually and apico oclussally; and to cover implants, which become fenestrated or dehisced at the time of insertion, with new hard tissues. In addition, autogenous bone block grafts have been employed without covering membranes to rebuild atrophic ridges. The literature has also demonstrated implant success under function in regenerated bone, following use of autogenous or non-autogenous materials, comparable to the functional success rates of implants placed in non-regenerated bone.

As GBR therapy has evolved, discussions have focused less upon the technical execution of GBR procedures, and more upon the elucidation of realistic expectations following GBR therapy; the need or lack of need for GBR therapy in specific clinical scenarios; and the simplification of GBR therapy through the utilization of resorbable membranes. Unfortunately, such discussions are often rife with manufacturer claims and counter-claims, and run the risk of losing sight of the conceptual prerequisites of successful GBR therapy. While GBR therapy must always be performed in the context of a comprehensive diagnosis, case work up, and multifactorial treatment plan, the site specific prerequisites for maximizing treatment outcomes following GBR therapy include the following:

I. Appropriate flap design and suturing to ensure attainment and maintenance of passive primary closure throughout the course of hard tissue regeneration.

II. Complete debridement of the site to be augmented.

III. Decortication of the regenerative site if appropriate.

IV. Clot isolation and protection through membrane placement.

V. Selection of an appropriate membrane to ensure precise recreation of the desired morphology of the none to regenerated.

VI. Membrane stabilization.

VII. Control of overlying post operative forces.

There is no doubt that implants may be placed in fresh extraction sockets and successfully osseointegrated without the use of overlying membranes. This is especially true in the presence of a small horizontal defect dimension between the implant body and the surrounding alveolar walls. However, as demonstrated by Covani et al, such a treatment approach results in bucco lingual remodeling, and ridge collapse of varying degrees. While such collapse is not significant in many cases, in other scenarios this collapse may result in the need for soft tissue augmentation procedures to maximize the esthetic outcomes of therapy. Numerous studies have demonstrated that the use of an appropriately chosen covering membrane at the time of insertion of implants into fresh extraction sockets helps avoid such extraction socket remodeling.

Definitions of Success

The definition of success following GBR therapy is itself a topic of much discussion. Initially, GBR therapy was deemed successful if it afforded adequate bone for ideal prosthetic positioning of the desired implant or implants. If a fenestration or dehiscence was present after such ideal implant positioning, a second GBR procedure was performed around the implant at the time of insertion. If GBR therapy was performed around implants placed in non-regenerated host bone which demonstrated dehiscences at the time of placement, GBR therapy was deemed successful if the previously exposed implant surface was covered by regenerated hard tissues.

Increased expectations following GBR therapy led to a “second generation” definition of GBR success. Ridge augmentation procedures were now deemed successful if ideal implant positioning led to no fenestrations or dehiscences of the implant body. Fenestrated or dehiscenced implants placed in post bone were deemed successfully treated with GBR therapy if hard tissues were regenerated of sufficient thickness to withstand functional forces over time. While such a definition of success certainly demanded more of GBR therapy than initial definitions, the clinician was still often faced with an esthetic compromise, mandating soft tissue augmentation to effect acceptable implant esthetics. Guided Bone Regenerative therapy at the time of tooth extraction, while considered successful, often resulted in some resorption of the buccal “lip” or line angle of the extrac-

Figure 1 *The maxillary right central incisor is longitudinally fractured.*

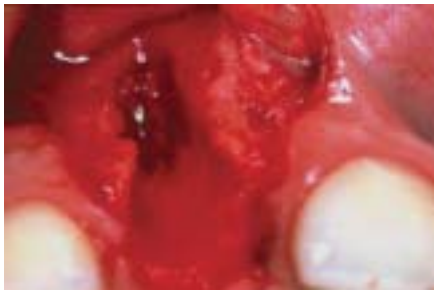


Figure 2 *Extensive alveolar destruction is evident following tooth removal and defect debridement.*

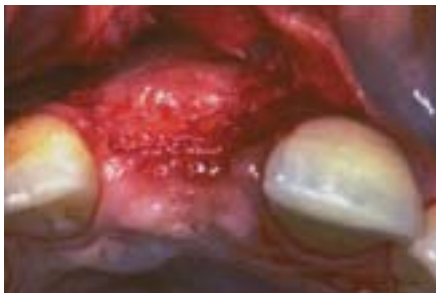


Figure 3 *GBR therapy has resulted in complete regeneration of the buccal line angle of the alveolar ridge. Note bone regeneration in an area previously unoccupied by bone.*

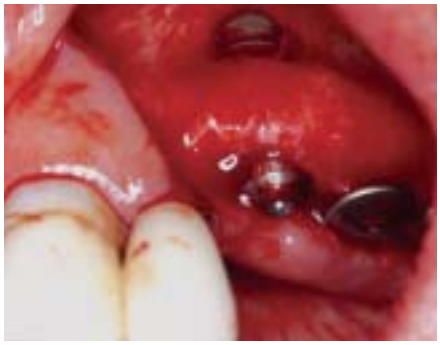


Figure 4 *Ideal implant positioning has resulted in significant exposure of the "apex" of the implant.*

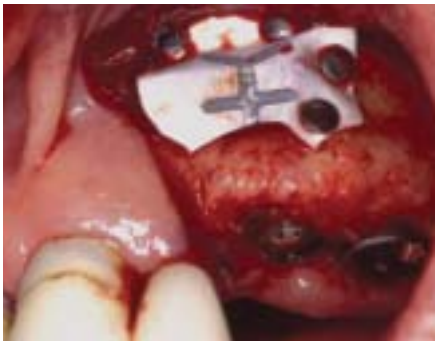


Figure 5 *A covering membrane is placed over particulate grafting material and secured with fixation tacks.*

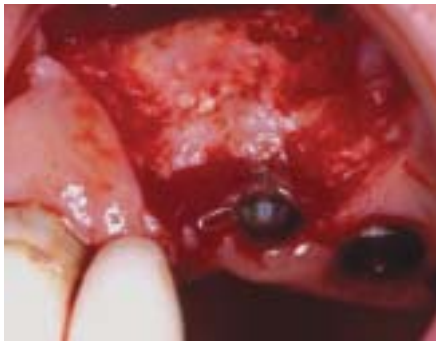


Figure 6 *Membrane removal demonstrates bone regeneration precisely conforming to the contours of previously secured overlying reinforced membrane.*

tion socket.

In addition, an implant of less than ideal diameter often had to be placed in augmented posterior ridges. The art of and science of Guided Bone Regeneration therapy has evolved to a level which requires a "third generation" definition of success:

I. GBR therapy at the time of tooth extraction should result in complete regeneration of an ideal alveolar ridge form, with no collapse or resorption of the buccal and/or palatal aspects of the extraction socket alveolus (Figures 1 - 3).

II. When fenestrated or dehisced implants are treated with GBR therapy, the resulting regenerated alveolar bone on all aspects of the previously exposed implant surfaces should be of sufficient dimension to predictably withstand functional forces over time (Figures 4 - 6).

III. Edentulous ridges augmented through GBR therapy should exhibit a sufficient dimension of bone to allow placement of ideally sized implants in a given tooth site, without the generation of fenestrations or dehiscences around the implants. Residual bone on the buccal and lingual aspects of the inserted implants should be of sufficient dimension to withstand functional forces over time (Figures 7, 8).

If the aforementioned definitions of successful GBR therapy is accepted, then it becomes obvious that material selection is both defect specific, and graft specific.

The role of defect morphology in material selection

Defects treated with GBR therapy are either space maintaining or non-space maintaining.

A space maintaining defect is defined as a defect with sufficient residual alveolar bone in the appropriate positions to support a secured, overlying membrane with no danger of membrane collapse. Examples of such defects would be a dehisced or fenestrated implant whose body is totally within the buccal-palatal confines of the alveolus; or an extraction socket which demonstrates intact, uncompromised alveolar bone on its perimeter. In such cases, extraction socket alveolar morphology may exhibit minor narrow defects within intact alveolar bone mesially and distally, to fully support a covering membrane. A clinician must honestly and critically assess such defects before declaring them space maintaining.

A non-space maintaining defect is one that does not demonstrate sufficient alveolar bone for complete support of a covering membrane, without the aid of the underlying graft materials.

A space maintaining defect may be treated utilizing a resorbable or non-reinforced non-resorbable secured

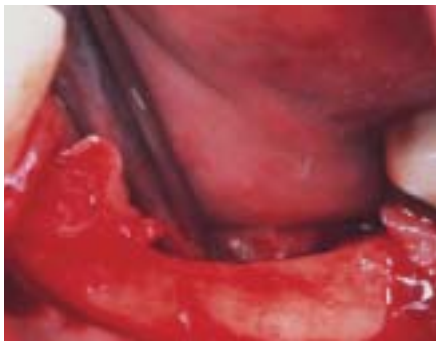


Figure 7 *Flap reflection demonstrates severe buccal lingual ridge atrophy.*

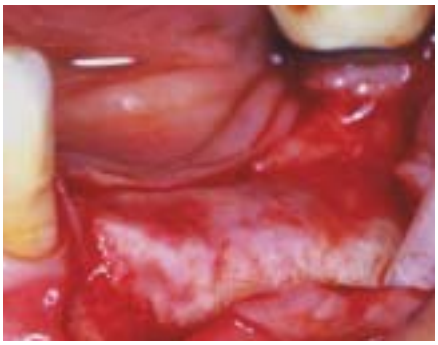


Figure 8 *Following GBR therapy with particulate material and a secured reinforced membrane, regeneration of an ideal ridge form is evident.*

membrane over the graft material, regardless of the type of graft material utilized. However, if a non-space maintaining defect is to be treated with particulate graft material, a titanium reinforced membrane must be utilized and secured over the graft material to maximize treatment outcomes. Tightly packing particular graft material and placing a secured, resorbable membrane in the hope that the graft material will maintain the space under the membrane ,is not predictable and often leads to a compromised final treatment result.

Graft material and membrane selection

When treating a space maintaining defect, a resorbable membrane is employed regardless of the graft material chosen.

However, the nature of the graft material utilized may play a significant role in membrane selection during the treatment of non-space maintaining defects. As previously mentioned, if autogenous or non-autogenous particulate grafting material is to be employed beneath the membrane, a titanium reinforced membrane must be utilized in the treatment of non-space maintaining defects. However, if an autogenous or non-autogenous block graft is to be placed beneath the membrane, and the graft may be contoured to mimic the desired post treatment bone morphology, either a secured resorbable or non-reinforced non-resorbable membrane may be employed.

While many authors have demonstrated predictable bone regeneration following placement of secured autogenous bone blocks without a covering membrane, Triplett and others have demonstrated, in separate publications, that significant resorption of the line angles of an autogenous bone block graft occurs when the block is placed without a covering membrane, as compared to an autogenous bone block graft beneath a secured covering membrane. Therefore, while the use of autogenous bone block grafts without secured covering membranes certainly fulfills the "second generation" definition of success in GBR therapy, such a therapeutic approach runs the significant risk of failing to fulfill the "third generation" prerequisites of GBR success.

The role of autogenous versus non-autogenous graft materials beneath secured, reinforced membranes

There is no doubt that, in the absence of covering membrane use, autogenous bone block grafts demonstrate a greater degree of predictability than non-autogenous bone block grafts, or particulate grafts. There is also no doubt that the use of autogenous particulate or bone block grafts beneath a secured, reinforced covering membrane hastens the regenerative process when compared to the use of non-autogenous grafts beneath a secured, covering membrane.

Nevertheless, the literature clearly demonstrates that, if a sufficient amount of time is allowed to pass, the final treatment results of GBR therapy utilizing autogenous or non-autogenous graft materials beneath secured, reinforced covering membranes are highly comparable. Coupled with the literature demonstrating similar functional success rates of implants placed in regenerated bone utilizing autogenous and non-autogenous materials beneath covering membranes, an argument can be made that the utilization of autogenous grafting materials beneath a secured, reinforced covering membrane, as part of an appropriately carried out Guided Bone Regenerative procedure, offers no advantage other than increased speed of the regenerative process.

Harvesting of autogenous bone for use in GBR therapy may range from a procedure as minimal as collection of "bone paste" at the time of osteotomy preparation, to utilization of burs or trephines to harvest bone blocks and cores adjacent to the area being treated, to the need to secure bone blocks or cores from a distant second surgical site. The clinician must decide, on a case by case basis, whether the potential for increased surgical trauma and postoperative morbidity in the collection of autogenous bone is justified in an effort to accelerate the regenerative process.

The following short surgical case reports demonstrate the thought processes which may be utilized in making these determinations:

Case Report I

A woman presents with a longitudinally fractured maxillary central incisor (Figure 1). Following tooth removal, the extensive nature of the alveolar defect is evident (Figures 2, 3). Because of the compromised nature of the buccal alveolar plate, the alveolar defect is not space maintaining at the midpoint of the buccal alveolar ridge. As a result, particulate material and a secured titanium reinforced membrane are utilized to

effect regeneration. Passive primary soft tissue closure is attained and maintained throughout the course of regeneration.

A six month re-entry demonstrates extensive regeneration of the alveolar bone, resulting in complete rebuilding of the buccal line angle of the alveolar ridge. Note that over packing of the defect beneath the secured titanium reinforced membrane has resulted in generation of alveolar bone in an area never before occupied by bone.

Case Report II

ITI implant placement in an ideal esthetic position has resulted in a significant "fenestration" of the apical area of the implant body. This is not a space maintained osseous defect. Treatment options include the following:

A. **Prior placement of the implant 25 – 30 degrees off angle:** While such an approach would have obviated the need for GBR therapy, it would have left the restorative dentist with a compromised and more difficult scenario for appropriate restoration (Figure 6).

B. **Placement of particulate material and a secured resorbable membrane to cover the exposed implant surface:** The use of a resorbable membrane would avoid a second stage membrane removal procedure. However, utilization of such materials would result in regeneration of a thin patina of bone over the buccal aspect of the implant "apex." Such a thin bony plate runs the risk of resorption under function, over time.

C. **Utilization of a secured reinforced membrane over a particulate graft:** This approach ensures regeneration of alveolar bone over the exposed implant surfaces of sufficient dimension to withstand functional forces over time. A reinforced membrane was secured with three fixation tacks, (Figure 7) over particulate grafting material. A seven month re-entry demonstrated regeneration of alveolar bone which precisely mimicked the contours established by the secured, reinforced membrane (Figure 8).

Case Report III

A patient presented with a severely atrophic mandibular posterior ridge (Figure 9). Extensive bucco lingual ridge atrophy precluded ideal implant positioning. Following decortication, a reinforced membrane was secured with four fixation tacks. Particular grafting material was placed beneath the membrane, and the area was sutured. Passive primary soft tissue closure was maintained throughout the course of regeneration. A seven month re-entry demonstrated ideal regeneration of the atrophic alveolar ridge (Figure 10).

Implants may now be placed in the desired positions without fenestration or dehiscence of the implant bodies.

Conclusions

The prerequisites for maximization of Guided Bone Regenerative therapy have been well elucidated in the literature. Advantages and shortcomings of various materials are also well understood. It is incumbent upon all of us, as conscientious clinicians, to employ specific treatment modalities, and select regenerative materials, based only upon sound biologic principles and desired treatment outcomes.

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Utilizing the ITI Narrow Neck Implant in the Anterior Esthetic Zone

Will Martin, DMD, MS; Dean Morton, DDS, MS, FACP; Jim Ruskin, DMD, MD, FACS

Historically, dental implant body dimensions and restorative platforms have been limited. Treatment planning options for partially edentulous sites, particularly lateral incisors, were restricted by these implant dimensions. As a consequence, treatment choices other than dental implant-supported crowns were often employed, or modifications were made to existing restorative platforms allowing use in areas of reduced inter-dental space. In the mid-1990's, Straumann introduced the ITI Narrow Neck Implant (Figure 1).

The idea central to the development of the Narrow Neck Implant (NNI) was the creation of a more ideal option for restorative-driven restorations of small single tooth spaces in the anterior maxilla and mandible. The NNI design allows it to be utilized in areas of limited inter-dental space and ridge width (respectively greater than 5 mm). The implant also maintains biologically driven features including a machined collar compatible with development and maintenance of "biologic width," and an octa connection.

When planning for the use of the NNI implant in the esthetic zone, a "crown-down" philosophy will help ensure more predictable esthetic outcomes. This "crown-down" process involves:

1) Planning the position of the final restoration, and its relationship to the supporting hard and soft tissues

2) Development of ideal soft and hard tissue dimensions and positions, capable of supporting an appropriately positioned implant, and

3) Placement of an implant based on the proposed restoration through use of templates.

Preoperative planning commences with a diagnostic wax-up outlining the proposed gingival margin surrounding the restoration (Figure 2). This margin position is crucial in determining the vertical position of the implant shoulder. As a general rule the implant shoulder should be as shallow as possible but as deep as necessary to ensure maximum bone support and correct restoration emergence.

Sites where teeth are congenitally missing (e.g. lateral incisors) are often particularly deficient in hard tissue width (Figure 3). Onlay bone grafting provides a predictable method to regenerate adequate bone volume, capable of supporting an implant positioned ideally according to the planned restoration (Figure 4).

Subsequent to graft maturation, the NNI is placed according to a crown-down philosophy. This results in a degree of accuracy capable of simplifying restorative procedures and consequently allowing excellent esthetic results to be routinely achieved. A vacuform template (0.02 inch) made over a duplicate of the diagnostic wax-up, and trimmed at the gingival margin, enables the surgeon to position the implant shoulder to the desired depth with accuracy (Figure 5).

The reduced diameter of the NNI necessitated the elimination of the internal Morse-taper connection. The traditional abutment has been replaced with an external octa abutment type connection, thus making the implant a one-part design. The external octagonal connection allows the user to connect copings or framework blanks which can be modified intra or extra-orally. Restorative

Figure 1 *Narrow neck implant dimensions.*

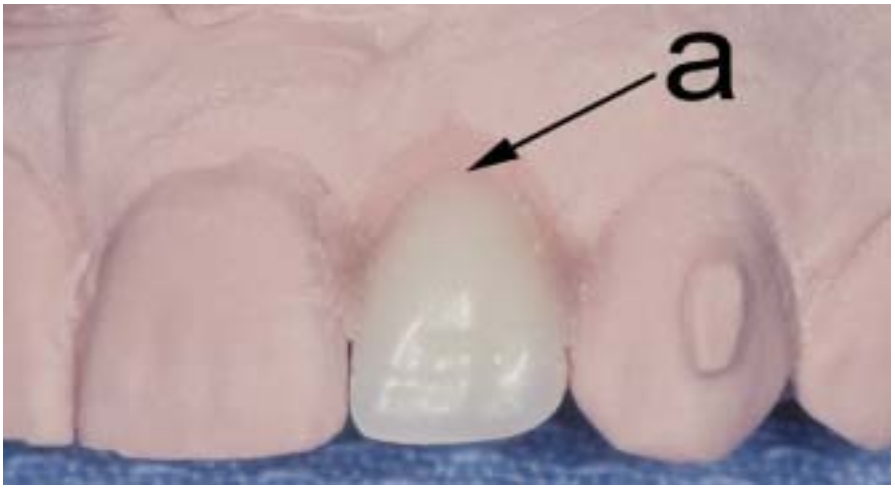


Figure 2 *Preoperative planning: the diagnostic wax-up.* ***a*** *= the proposed gingival margin.*

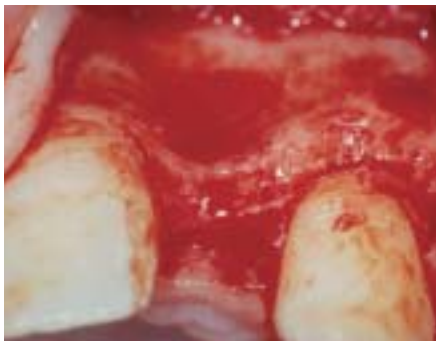


Figure 3 *A preoperative facial alveolar deficit is evident.*

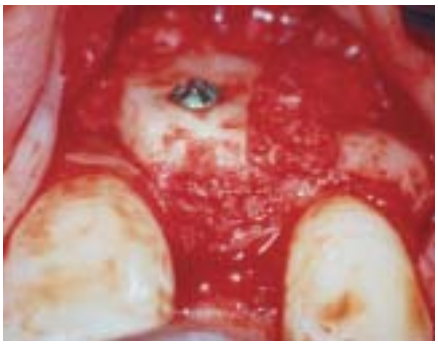


Figure 4 *An autogenous onlay graft has been secured.*

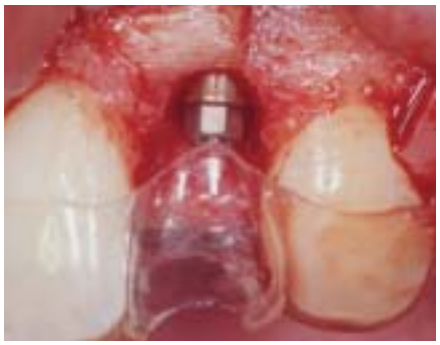
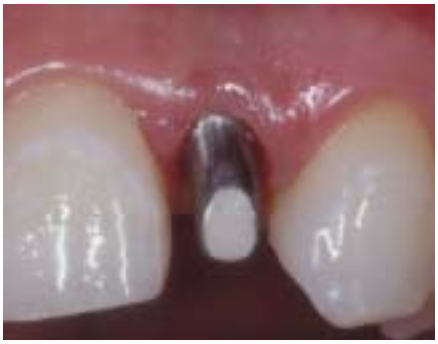
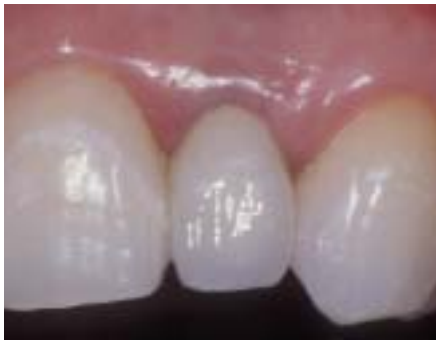


Figure 5 *An example of restorative driven surgery.*

Figure 6 *The MCC with titanium abutment and occlusal screw.*





Figures 7 & 8 *A titanium abutment and restoration in a 5 mm interdental space.*

Figure 9 *A customized metal ceramic blank.*

Figure 10 *The MCC and "PFM" abutment.*

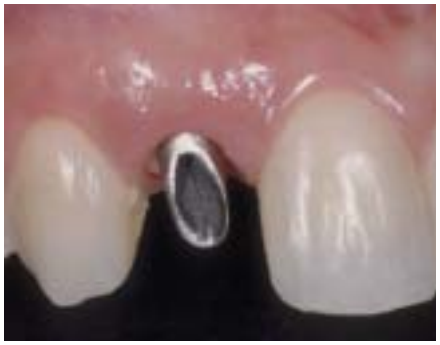


Figure 11 *The "PFM" abutment in place.*

options include:

1) Titanium copings - for cemented restorations

2) Oxidizable alloy framework blanks - for custom metal-ceramic copings for cement or screw-retained restorations

3) Non-oxidizable alloy copings - for custom metal copings for cement or screw-retained restorations.

Although possible, screw-retained restorations are rarely fabricated, due to the limited inter-dental space and the restricted area available for retaining screw access. Implant placement is therefore planned to place the long-axis of the implant through the incisal edge of the anticipated restoration, facilitating a cemented approach. The titanium coping can be utilized to support an interim restoration capable of shaping and contouring the soft tissues, allowing for development of ideal emergence profile. Once tissue maturation is complete, an implant level impression is made with an open or closed impression tray. The definitive restoration is then fabricated on a laboratory prepared or milled titanium coping (Figure 6). This approach (NNI and titanium coping) works well in limited inter-dental spaces (Figures 7 & 8).

In sites characterized by thin, friable tissues, or when soft tissue tinting will be unacceptable (e.g. a high smile line), the oxidizable alloy framework blank can be used to fabricate a custom metal-ceramic coping. Porcelain is stacked directly onto the oxidizable blank and shaped to support the tissue and establish a scalloped cement margin approximately 1 mm sub-gingival (Figure 9). The presence of sub-gingival ceramic results in more acceptable gingival coloration in patients with high esthetic concerns. A metal or all ceramic crown can then be fabricated to the ceramic shoulder (Figure 10).

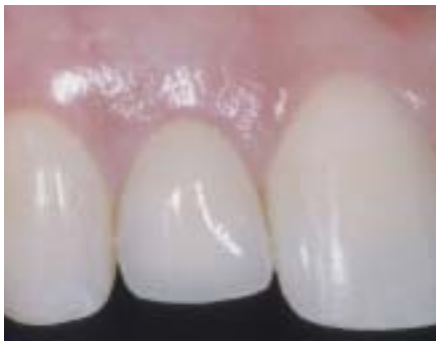
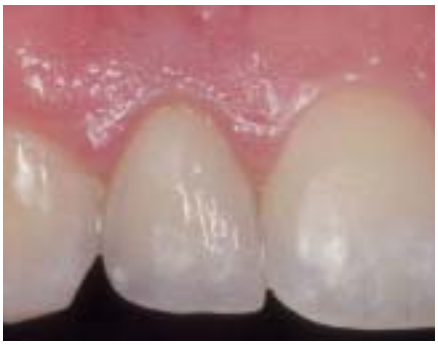
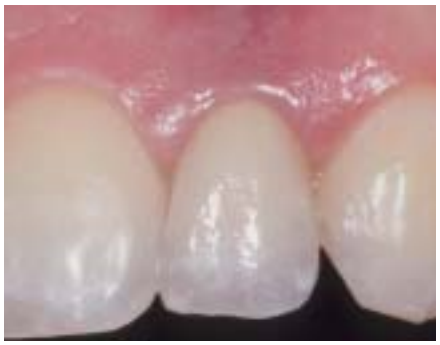


Figure 12 *The MCC in place.*





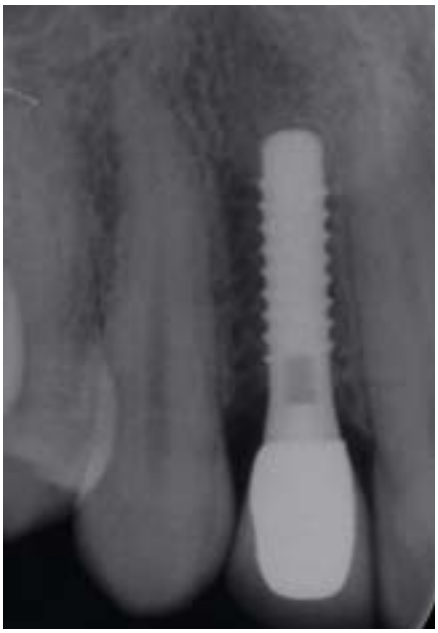
Figures 13 & 14 *Views of NNI implant restorations 7 & 10 at one-year follow-up.*

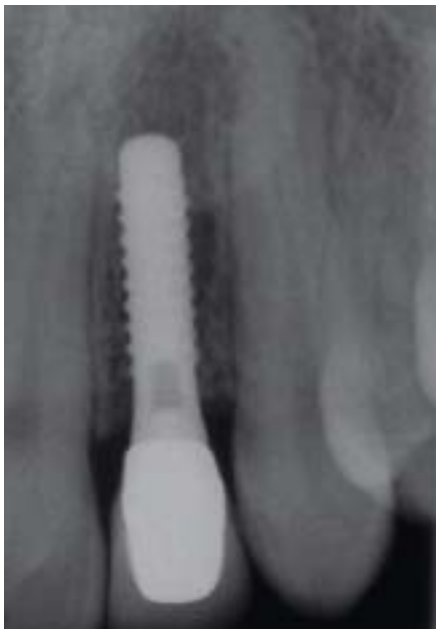
The final coping is now placed and torqued to 35 Ncm (Figure 11). Subsequent to sealing of the occlusal screw access, the metal or all ceramic crown is cemented and soft tissue esthetics confirmed (Figure 12).

In summary, the NNI implant is an ideal implant for restoration of limited inter-dental sites, especially in the case of esthetic lateral incisors. Contraindications naturally include areas of excessive occlusal load.

Thorough treatment planning, a restorative-driven approach and good communication between all TEAM members will make the implant experience predictable and routine (Figures 13 - 16).

The Center for Implant Dentistry would like to acknowledge: Dr. Farhad Boltchi, Eloy Henry, CDT, and Mitchell Jim, CDT, for their support in making these outcomes possible.





Figures 15 & 16 *Periapical radiographs at a one-year follow-up visit.*

Immediate Implant Placement: Managing the Thin Tissue Biotype

Stephen T. Chen, BDS, MDSc, FRACDS

The insertion of an implant immediately upon extraction of a tooth affords significant prosthetic and surgical advantages, including a shortening of the course of therapy and a lesser cost of the delivery of treatment (1). A number of experimental and clinical studies have demonstrated the predictability of this treatment modality in terms of bone-fill of the socket and implant survival rates (2 - 7).

However, inadequate attention has been directed to soft tissue healing and the stability of the peri-implant mucosa at immediate implant sites. Marginal soft tissue recession may detract from the esthetics of the final prosthetic result, especially when implants are placed in the esthetic zone and in individuals with a high lipline.

The likelihood of marginal tissue recession is increased in patients with a thin tissue biotype. The following case illustrates a treatment protocol for immediate implant placement at a site with a thin tissue biotype. The protocol includes the use of a subepithelial connective tissue graft to increase the thickness of the mucosa at the time of implant placement.

The patient presented as a healthy, non smoking 32 year-old male. The upper right central incisor had been endodontically treated and restored with a post-retained crown. The crown was loose and the marginal gingiva was inflamed and edematous (Figure 1). A periapical radiograph of the tooth confirmed that adequate bone was available apical to the root apex to anchor an implant. Proximal crestal bone levels were normal (Figure 2).

In order to restore gingival health prior to treatment, the loose crown was removed and a temporary partial denture was fitted. Figure 3 illustrates the clinical scenario prior to implant surgery, with soft tissue health re-established. The thin tissue biotype and highly scalloped gingival contours are evident.

Using periotomes, the gingival fibre attachment to the root was severed circumferentially. A full-thickness mucoperosteal flap was raised on the buccal aspect with mesial and distal releasing incisions. The flap was designed to avoid reflection of the proximal papillae. Following flap reflection, the root was carefully removed using a combination of periotomes and fine root forceps. The socket was debrided with curettes to remove all soft tissue tags. The walls of the socket were inspected and found to be intact, with no loss of bone height or fenestration defects.

The socket was prepared to receive an implant. The preparation was directed slightly towards the palatal wall of the socket at the apical one third, with the coronal emergence centered at the incisal edge of the anticipated final crown. The palatal wall at the coronal one third of the socket was flared slightly with the profile drill to accommodate the implant collar.

A 10 mm ESTHETIC *PLUS* ITI implant was inserted to a depth which positioned the implant collar at the level of the buccal crestal bone. A coronal view of the implant demonstrated a 1 to 1.5 mm gap between the implant and the buccal bone (Figure 4). No bone grafts or barrier membranes were used.

A 3.5 mm beveled healing cap was

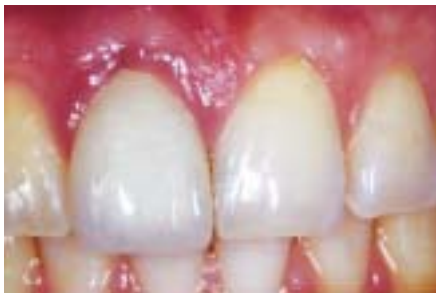


Figure 1 *The crown was loose and the marginal gingiva was inflamed and edematous.*

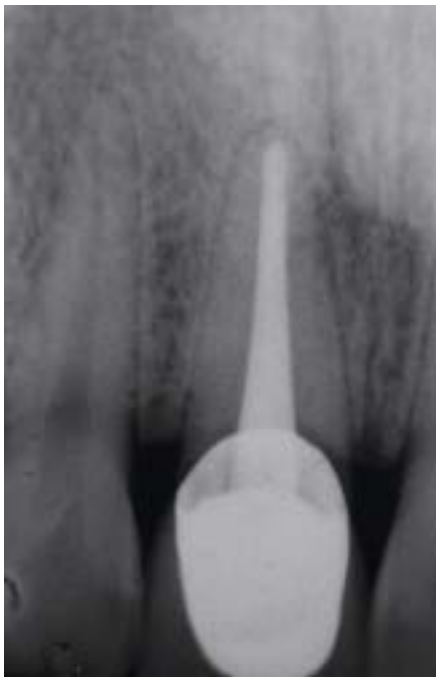


Figure 2 *Proximal crestal bone levels were normal.*

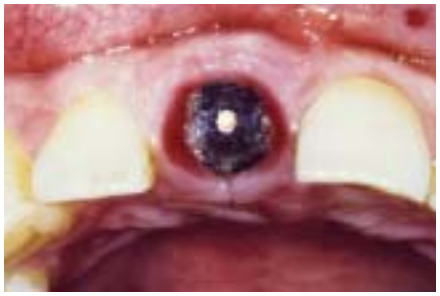


Figure 3 *The clinical scenario prior to implant surgery, with soft tissue health established.*

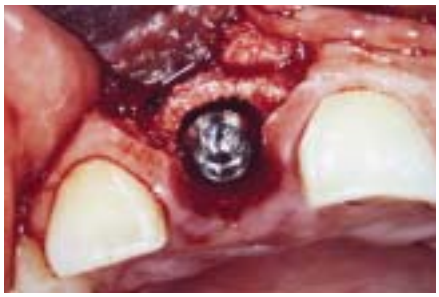


Figure 4 *A coronal view of the implant demonstrates a 1 to 1.5 mm gap between the implant and the buccal bone.*

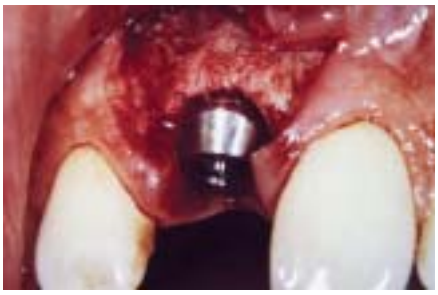


Figure 5 *A 3.5 mm beveled healing cap, with the bevel orientated towards the buccal, was placed.*

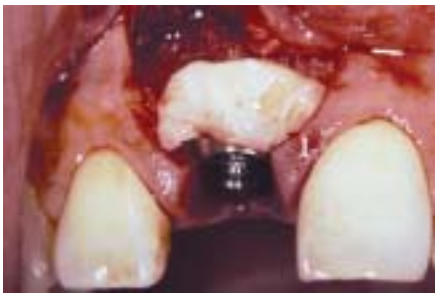


Figure 6 *A subepithelial connective tissue graft was obtained from the palate and placed on the buccal aspect of the healing cap.*

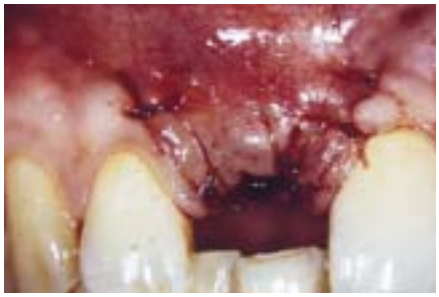
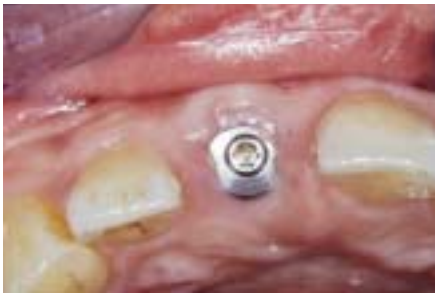
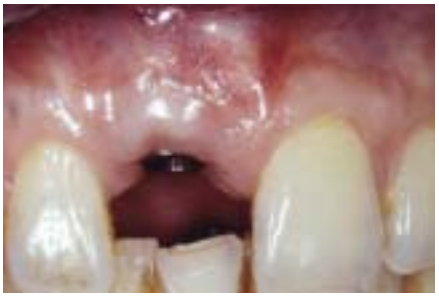


Figure 7 *The flap was mobilized and was coronally advanced to cover the connective tissue graft, and to partially submerge the healing cap.*





Figures 8 & 9 *Following 8 weeks of healing, excellent soft tissue maturation and incorporation of the connective tissue graft into the buccal soft tissues are evident.*

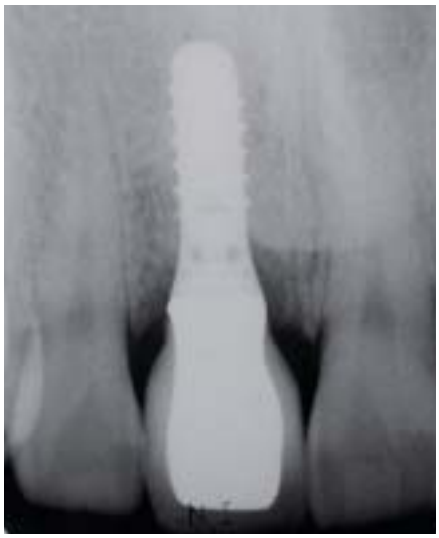


Figure 10 *A radiograph demonstrating ideal hard tissue contours.*

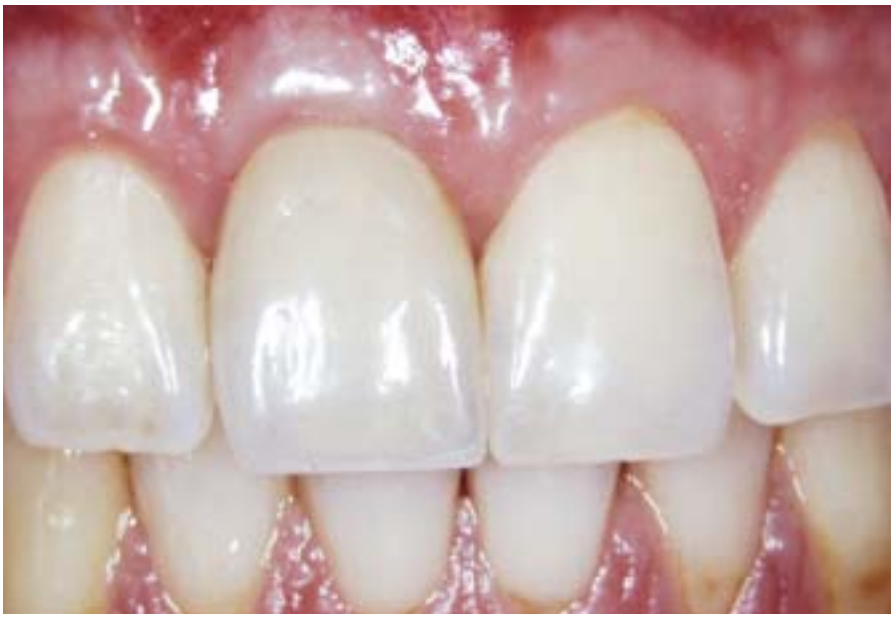


Figure 11 *A one year post-operative view.*

connected to the implant, with the bevel orientated towards the buccal (Figure 5). A subepithelial connective tissue graft was obtained from the palate and placed on the buccal aspect of the healing cap (Figure 6). The flap was mobilized by releasing the periosteum at its base, and was coronally advanced to cover the connective tissue graft and to partially submerge the healing cap (Figure 7). 5/0 chromic cat-gut suture was used. Following 8 weeks of healing, excellent soft tissue maturation and incorporation of the connective tissue graft subjacent into the buccal flap were evident (Figures 8 & 9). Slight marginal tissue recession had occurred, when compared to the situation immediately post-operatively (Figure 7 vs. Figure 9). However, the tissue

height remained coronal to that of the adjacent central incisor, a situation favorable to the attainment of an acceptable soft tissue esthetic result. The implant was subsequently restored, with ideal soft tissue contours and the expected radiographic appearance (Figure 10). A one-year post-operative examination confirmed that an excellent and stable soft tissue result had been achieved (Figure 11).

In conclusion, management of the soft tissue is a critical determinant of success of dental implants. At immediate implant sites where the mucosa is thin, adjunctive treatment in the form of a connective tissue graft may be of value in maintaining adequate tissue thickness, thereby reducing the likelihood of marginal tissue recession. This technique may be applied with equal efficacy to situations where buccal bone has been damaged and where guided bone regenerative procedures are required.

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Literature Review

Philip R. Melnick, DMD; Paulo M. Camargo, DDS, MS

Peri-implant Tissues at Submerged and Non-Submerged Titanium Implants Abrahamsson I, Berglundh T, Moon IS, Lindhe J. ***Journal of Clinical Periodontology 1999; 26:600-607***

Crestal Bone Changes Around Titanium Implants. A Histometric Evaluation of Unloaded Non-Submerged and Submerged Implants in the Canine Mandible.
Hermann JS, Buser D, Schenk RK, Cochran DL. ***Journal of Periodontology 2000; 71:1412-1424***

Influence of the Size of the Microgap on Crestal Bone Changes Around Titanium Implants. A Histometric Evaluation of Unloaded Non-Submerged Implants in the Canine mandible.
Hermann JS, Schoolfield JD, Schenk RK, Buser D, Cochran DL. ***Journal of Periodontology 2001; 72:1372-1383***

Role of the Microgap Between Implant and Abutment: A Retrospective Histologic Evaluation in Monkeys
Piatelli A, Vrespa G, Petrone G, Iezzi G, Annibali S, Scarano A. ***Journal of Periodontology 2003; 74:346-352***

Peri-implant Tissues at Submerged and Non-Submerged Titanium Implants Abrahamsson I, Berglundh T, Moon IS, Lindhe J. *Journal of Clinical Periodontology 1999; 26:600-607*

It has been speculated that peri-implant tissue healing responds differently to initially submerged vs. non-submerged implants. This study intended to investigate the peri-implant tissues following placement of two-piece implants two distinct protocols: single staged, non-submerged and two-staged, initially submerged.

Six dogs received six mandibular implants, three following a submerged protocol and three in a non-submerged manner. All implants were placed with the fixture margin at the bone crest level. Abutments were connected at the time of implant placement in the non-submerged group and at three months following implant placement in the submerged group. After nine months the animals were sacrificed and the implants were subjected to histometric and radiographic analysis.

The results revealed substantial similarities between the two groups in a number of important parameters: height of mucosa, "biologic width", percent bone to implant contact, and bone density.

These findings suggest that peri-implant tissue response is independent of the one or two-stage placement protocol. Both surgical techniques result in equally successful peri-implant tissue stability.

Crestal Bone Changes Around Titanium Implants. A Histometric Evaluation of Unloaded Non-Submerged and Submerged Implants in the Canine Mandible. Hermann JS, Buser D, Schenk RK, Cochran DL. *Journal of Periodontology 2000; 71:1412-1424*

The purpose of this study was to examine histometrically crestal bone changes around non unloaded non-submerged and submerged 1- and 2-piece titanium implants.

Fifty-nine implants were placed in edentulous mandibular areas of five foxhounds. Implants were divided into six groups: (A) one-piece, non-submerged with the rough-smooth interface located at the alveolar crest; (B) one-piece, non-submerged with the rough-smooth interface located 1 mm apical to the alveolar crest; (C) two-piece, non-submerged with the abutment being connected at the tie of implant insertion and the fixture-abutment connection (microgap) located at the bone crest level; (D) two-piece, submerged with microgap located at the bone crest level; (E) two-piece, submerged with the microgap located 1 mm coronal to the bone crest level; and (F) two-piece, submerged, with the microgap located 1 mm apical to the bone crest level. On submerged implants, abutments were connected three months after implant placement. Animals were sacrificed at six months after implant placement and undecalcified specimens were analyzed by histometry.

The results showed that for one-piece implants (groups A and B) bone crest levels were located close (0.20 mm) to the rough-smooth interface. On group C, the bone level was 1.68 mm apical to the microgap and 0.39 mm apical to the rough-smooth interface. On group D, the bone level was 1.57 mm apical to the microgap and 0.21 mm apical to the rough-smooth interface. On group E, the bone level was 2.64 mm apical to the microgap and 0.06

mm apical to the rough-smooth interface. On group F, the bone level was 1.25 mm apical to the microgap and 0.89 mm apical to the rough-smooth interface.

It was concluded that on one-piece, non-submerged implant systems, the rough-smooth interface determines the coronal bone level around the fixture. In two-piece implants systems used in a non-submerged or submerged fashion, the location of the microgap determines the coronal bone level around the fixture when it (the microgap) is located at or apical to the bone crest; when the microgap is located coronal to the bone crest (group E), the rough-smooth interface determines the coronal bone level around the fixture.

Influence of the Size of the Microgap on Crestal Bone Changes Around Titanium Implants. A Histometric Evaluation of Unloaded Non-Submerged Implants in the Canine mandible.

Hermann JS, Schoolfield JD, Schenk RK, Buser D, Cochran DL. ***Journal of Periodontology 2001; 72:1372-1383***

Dental implants may be placed in one- or two-piece configurations, utilizing either a submerged or non-submerged approach. Subsequent bone changes around implants have been linked to the surface texture (smooth vs. rough) around one-piece implants and the microgap between abutment and implant around two-piece implants. Suggested causes for bone resorption have been movement between components and the size of the microgap. This histometric study attempted to evaluate bone changes around two-piece implants with three different microgap configurations and mobile vs. immobile implant components.

Sixty titanium implants were placed in edentulous mandibular areas of five foxhounds. Implants were divided into six groups (A, B, C, D, E, F, G); abutments were attached to the fixtures at the time of implant placement with microgaps (mg) of <10 μm, 50 μm, and 100 μm. The implant/abutment interface was positioned approximately 1 mm coronal to the bone crest in all groups. Groups A (mg<10 μm), B (mg=50 μm) and C (mg=100 μm) had their implants and abutments laser welded together to prevent movement. Groups D (mg <10 μm), E (mg =50 μm) and F (mg=100 μm) were held together by abutment screws. At three months the dogs were sacrificed, and the peri-implant bone changes were analyzed histometrically.

Results revealed that the laser-welded group showed bone levels approximately 1.06 mm from the microgap. The non-welded group demonstrated a distance of approximately 1.72 mm between the microgap and the bone. The difference between non-welded and laser-welded groups was statistically significant.

It was concluded that the size of the microgap did not significantly influence the amount of bone change. However, under non-loaded conditions, two-piece, non-submerged implants show bone changes to be more affected by movement between components than by the size of the microgap. However, even the smallest microgap resulted in significant bone loss.

Role of the Microgap Between Implant and Abutment: A Retrospective Histologic Evaluation in Monkeys

Piatelli A, Vrespa G, Petrone G, Iezzi G, Annibali S, Scarano A. ***Journal of Periodontology 2003; 74:346-352***

This was a retrospective histologic study in monkeys which compared the bone response to two-piece implants with the microgap placed at different levels relative to bone crest.

A total of forty implants divided into three groups were placed 1 - 2 mm coronal to the bone crest (15 implants), at the bone crest (12 implants) and 1 - 1.5 mm apical to the crest (13 implants). The implants were loaded early, immediately, and inserted immediately post-extraction. The distance between the bone crest and the fixture/abutment interface (microgap) was the outcome evaluated in the study.

The results showed that there was a 0.13 mm coronal bone level migration in the group where the microgap was initially located 1 - 2 mm coronal to the bone crest. On implants initially placed at the bone crest, a 2.10 mm vertical bone resorption was observed. On implants initially placed 1 - 1.5 mm apical to the bone crest, a 3.60 mm bone resorption was noticed.

The results suggest that as the microgap was moved coronally away from the bone crest there was less bone resorption. Early, immediate loading of immediate placement did not effect bone remodeling.

Conclusions

The stability of peri-implant tissues is essential in achieving and maintaining implant esthetics. It has been speculated that the position of the gingival tissue is dictated by the location of the underlying bone crest. If bone resorption occurs following implant placement, vertical bony defects and increased pocket depth may develop in areas which present with a thick periodontium or, alternatively, gingival recession may take place in areas where the periodontium is thin. Therefore, during implant placement, the selection of a surgical technique and type of implant that minimizes factors related to bone resorption will aid the clinician in achieving a predictable and stable position of the gingival margin. The articles reviewed above suggest that a one-piece, non-submerged implant placed with the microgap coronal to the bone crest would minimize post-implant insertion bone resorption and consequently maximize peri-implant tissue stability and esthetics.

Upcoming Events

2003 Courses

Comprehensive Restorative Techniques
June 7; Newport Beach, CA
Presented by Dr. Robert Vogel, Mr. Michael Hahn

Planning and Restoring Implant Patients with Advanced and Complex Needs
June 13 - 14; Austin, TX • November 14 - 15; Princeton, NJ
Presented by Drs. Jim Ruskin, Dean Morton, Will Martin

Clinical Realities of Ridge Augmentation, Sinus Augmentation, PRP
June 18 • October 8 • November 19 • December 10; Milton, MA
Presented by Dr. Paul Fugazzotto

Clinical Realities of Immediate Loading
June 19 • October 9 • November 20 • December 11; Milton, MA
Presented by Dr. Paul Fugazzotto, Dr. Richard Baker, Mr. Ira Dickerman

Achieving Anterior Esthetics
June 20; Newport Beach, CA
Presented by Dr. Gary Solnit

Immediate Placement and Advanced Surgical Techniques
June 27 - 28 • August 15 - 16 • November 14 - 15; Newport Beach, CA
Presented by Dr. Jay Beagle

Edentulous Ridge Expansion and Localized Management of the Sinus Floor (2 day course)
July 5 - 6 • October 17 - 18
Presented by Dr. Ronald B. Odrich, Dr. Alan A. Winter, Dr. Alan S. Pollack
Barbara G. Dasaro, Administrator 212/838-0940 or www.parkavepe-rio.com/services/surgical_lect.htm

Simplifying Esthetic and Implant Dentistry
July 11; Pittsburgh, PA
Presented by Drs. Jim Ruskin, Dean Morton, and Will Martin

Esthetic Restorations: Hands-on Workshop
July 18 • July 19; Newport Beach, CA
Presented by Dr. Frank Higginbottom

Comprehensive Implant Prosthetics and Predictable Anterior Esthetics
July 18; Chicago, IL • December 5, December 6; Newport Beach, CA
Presented by Dr. Robert Vogel

Creating a Vision: Techniques to Simplify and Enhance Esthetic Implant Dentistry
July 25; Pittsford, NY
Presented by Dr. Larry Grillo

Communicating the Benefits of Implants to Denture Patients
August 1; Pikeville, KY
Presented by Beth Peshman, RDH

Straumann Education Week
August 4 - 9; Newport Beach, CA
Presented by Drs. Jim Ruskin, Dean Morton, Will Martin, Scott Keith

Strategies for Success with the ITI® DENTAL IMPLANT SYSTEM
August 15 - 16; Mackinac Island, MI
Presented by Dr. Scott Keith

Restorative Simplicity with the synOcta® System: Workshop for Dental Labs
September 6; Newport Beach, CA
Presented by Mr. Terry Charters

Achieving Anterior Esthetics
September 13; Newport Beach, CA
Presented by Dr. Scott Keith

Simplified Restorative Procedures
September 20; Newport Beach, CA
Presented by Dr. Mark Miller

Team Approach to Implant Dentistry
October 17; Phoenix, AZ
Presented by Dr. Robert Vogel, Beth Peshman

Esthetic Restorations: A Restorative Workshop for Surgeons
October 2; Newport Beach, CA
Presented by Dr. Scott Keith

Implant Issues for Dental Hygienists
October 8; Buffalo, NY
Presented by Beth Peshman, RDH

Sustained Practice Growth in a Changing Environment: A Proven Approach
November 7; Milton, MA
Presented by Drs. Paul A. Fugazzotto and Neal H. Fleisher
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