

# Implant Realities™



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### **ITI Mission Statement:**

To promote and disseminate knowledge on all aspects of implant dentistry and dental tissue regeneration through research, development, and education to the benefit of the patient.

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A free copy of *Implant Realities* is sent to each US section ITI member and fellow at the time of its publication. Additional copies are available at a cost of \$12.95 per copy. Contributing authors receive ten free copies of the issue of *Implant Realities* in which their article appears.

# Welcome to *Implant Realities*



**Paul A. Fugazzotto, DDS**  
*Editor in Chief,*  
*Implant Realities*

Dear Readers:

Welcome to the newly expanded *Implant Realities* (Vol. 1, 2006). *Implant Realities* is a semi-annual publication of the U.S. section of the International Team for Implantology (ITI). Each U.S. section ITI member and fellow receives a free copy of *Implant Realities* at the time of its publication, as a benefit of being part of this exciting organization.

You will note a number of changes in the format of *Implant Realities* including:

- The size of *Implant Realities* has been expanded to include more articles.
- Each issue of *Implant Realities* is now made up of specific sections which address key areas of interest to us all.
- *Implant Realities* is now published in a square bound format, allowing easier storage and reference to back issues.
- Submission and protocol forms are included in every issue.

The significant growth of *Implant Realities* is directly attributable to the increased volume of high quality submissions being received from an ever greater number of talented clinicians. All of us have interesting case reports, case series or clinical innovations in our practices, which would be of great interest and use to our members. I invite you to contribute to *Implant Realities* and join in the excitement. For more details regarding manuscript preparation and submission, please see page 42 of this issue.

If you are still somewhat unsure of the purpose of the ITI, I believe you will find Dr. Weber's editorial piece enlightening. Dedicated to education and research in the field of implant therapy, the ITI is a truly unique organization, which extends throughout the world.

Sincerely,

A handwritten signature in black ink, appearing to be 'Paul A. Fugazzotto'. The signature is fluid and stylized, with a long horizontal stroke at the end.

**Paul A. Fugazzotto, DDS**  
**Editor in Chief, *Implant Realities***

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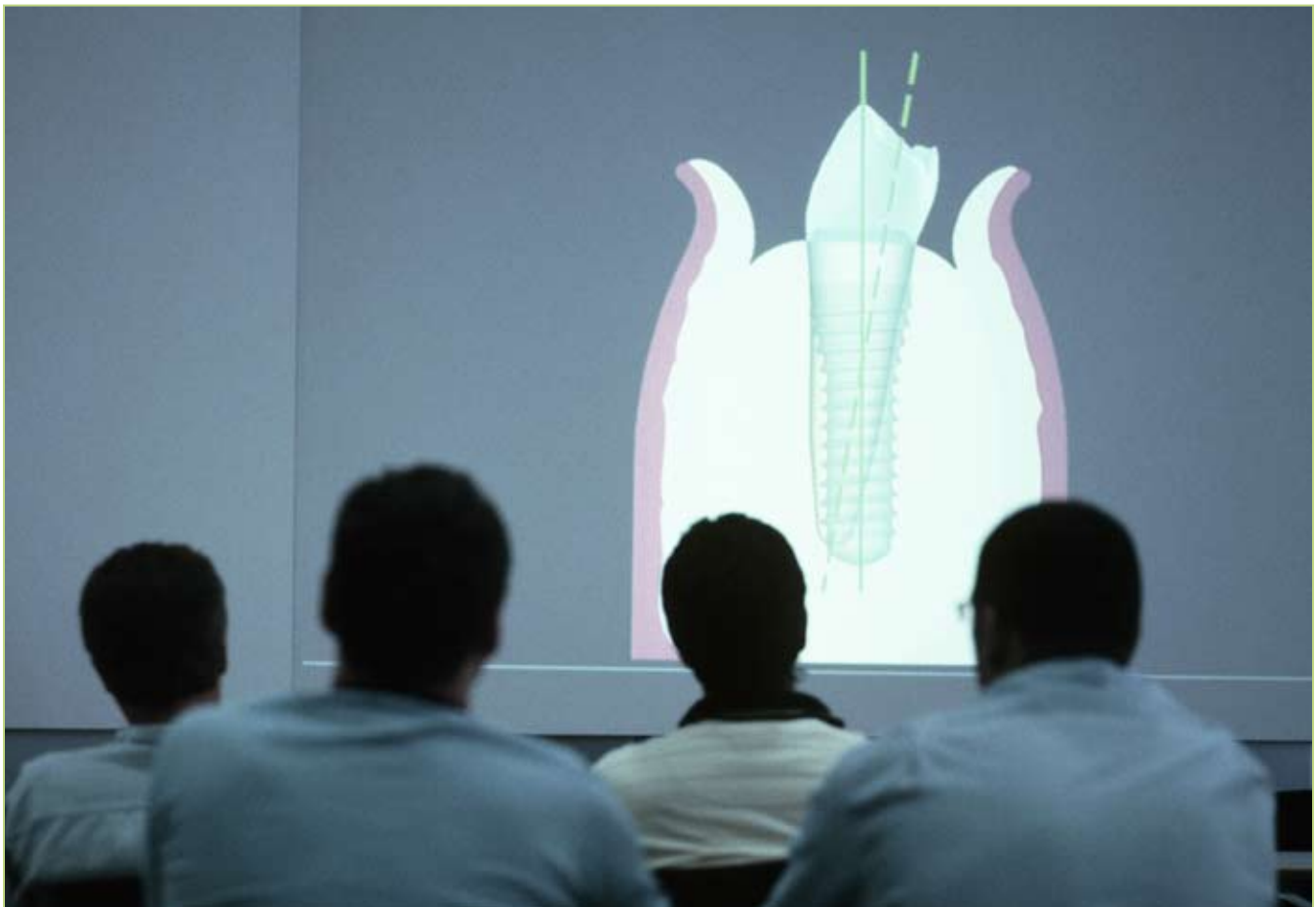
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## Hans-Peter Weber, DMD, Dr. Med. Dent.

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## Editorial: Hans-Peter Weber, DMD, Dr. Med. Dent.

This year marks the 30th anniversary of Professor Andre Schroeder's landmark publication, which documented for the first time the histological evidence of direct bone apposition to an implant surface in a non-decalcified section. As important as this finding was from a scientific and clinical point of view, it carries as much symbolic weight in that it represents the beginning of a great success story of a unique collaboration between academia, dental practice and industry. The anniversary was celebrated with the Andre Schroeder Symposium from May 4 – 6, 2006 in Berne, Switzerland.

The ITI was founded in 1980 as a result of the collaboration between Dr. Fritz Straumann and Prof. Andre Schroeder. Characterized by its ability to think outside the box, this group quickly became a leader and a trendsetter in the oral implant field. Whereas major parts of the implant world were at that time exposed to osseointegration according to Branemark (i.e. commercially pure titanium screws with a machined surface designed for a two stage surgical procedure), a different approach was followed by the Institute Straumann and the ITI. Titanium plasma sprayed (TSP) technology was used to create a rough, porous implant surface. The choice of a one stage surgical protocol led to a distinctly different implant design which quickly proved its biomechanically superior performance, especially in the partially edentulous indication.

Unfortunately, many people do not know what or who the ITI is. The ITI is a unique network of professionals in implant dentistry and related fields. It is a non-profit organization of academicians and clinicians active in research, development and education. At the core of ITI one finds scientific credibility, independence and responsibility toward the patient.

The promotion and financing of research projects in implant dentistry and related fields is the central activity of the ITI. Since its establishment in 1988 the ITI has supported 203 research projects with

a total of over 20.3 million US Dollars, making the ITI one of the largest non-governmental organizations to fund research grants in implant dentistry and related fields. Funding is not restricted to ITI Fellows and Members, but rather is open to everyone. What matters is the quality of a proposed research project, and its potential impact on progress in the field of oral implantology.

The second important mission of the ITI is innovation. Ideas and findings from research and clinical experience are the catalysts of both new developments and further development of existing products and techniques. Advances realized in just the past years were groundbreaking in the field of implant dentistry. Improved implant surface technology, the one stage surgical approach, early implant loading, immediately implant loading, simplified prosthodontic procedures, enhanced biomechanical stability, increased precision and greater long term efficacy can all be attributed to findings of ITI sponsored research and the Straumann® Dental Implant System.

Last but not least, the ITI supports and promotes education activities at all levels of undergraduate, postgraduate and continuing education for professionals in implant dentistry. Events include the ITI World Symposium, ITI National Congresses and ITI Education courses. Since 1988 the ITI World Symposium has been held every other year, alternating in Europe and North America. It has become one of the most important meetings in the field of implant dentistry worldwide. The recent North American ITI Congress in Miami proved to be an educationally most memorable event, as attested to by the participants.

Another ITI Education opportunity, the ITI Scholarship Program, has also proven a great success. It offers young clinicians a one-year scholarship opportunity in one of 16 Scholarship Centers worldwide: Nine in Europe, six in the USA, and one in Japan. Between 1998 and 2006, a total of 107 ITI Scholars have been supported with stipends of 30,000 US Dollars each.

Including the administrative contributions to each Scholarship Center, this amounts to a total of over 4 million US dollars paid by the ITI to date.

In summary, although still lacking understanding and recognition as a non-profit and a Straumann independent education and research entity, the ITI has already proven to be essential to many of us in academics and research. The ITI has given us access to substantial research funding that is investigator initiated, free of conflict of interest and void of corporate pressure to perform studies for the primary purpose of enhancing company profits. As the educational environment for company conducted medical and dental education faces dramatic changes in the not too distant future, I dare to predict that the importance and recognition of the ITI as an educational organization in implant dentistry will experience exciting growth in the U.S. I hope you join us on this exciting and fulfilling journey.



## Robert A. Jaffin, DMD

Dr. Robert Jaffin received his DMD from the University of Pennsylvania and his Certificate in Periodontics from Columbia University. He is a Diplomate of the American Board of Periodontology, a Fellow of the Academy of Osseointegration and a Section Chief of Periodontics at Hackensack University Medical Center. Dr. Jaffin is a Fellow of the ITI, as well as a lecturer and international author.

## Editorial: Robert A. Jaffin, DMD

It has been twenty two years since I was trained in a “new” implant technique developed by an orthopedist named Branemark. Initially, we placed implants in the fully edentulous mandible. We next ventured to the maxilla, and eventually to implant installation in partially edentulous spaces, single tooth positions and fresh extraction sockets. During this evolution the only type of implant I utilized was the machined titanium external hex prototype. My success rate of integration exceeded 95%. However, troubling sequelae became evident. Some of these sequelae included but were not limited to lesser success rates in type 4 bone, problems with screw loosening, broken implants, broken screws, bone loss and soft tissue recession.

As these complications began to creep into our practice, my partner Charles Berman coined the term “grief level.” After cases were in function for a year or two, patients presented with broken implants and/or loose implant fixed bridges. The clinical problem of loss of integration was complicated by the need to deal with referring dentists and patients who developed problems which required major “repair”. The era of the “grief level” had arrived. It wasn’t just the “grief”, but how much and how often it occurred.

In the fall of 1995, a patient with Von Willebrand’s disease presented in my office, requiring an extensive dental rehabilitation. Due to his bleeding disorder and the need to be transfused with fresh frozen plasma before any surgical procedure, it was decided that we would reduce the number of surgical exposures. After 10 years of utilizing two stage external hexed machined surface implants, I made the leap, at least in this case, to a single stage Morse taper TPS implant from a company called Straumann. I met with the Straumann rep to learn about the system. The case involved full mouth extractions and the placement of 12 implants, six in each arch. Treatment proceeded seamlessly. All implants integrated and the case was beautifully restored. I was happy, the prosthodontist was ecstatic, and the patient was beyond words.

As I became more knowledgeable about the Straumann system, I was hooked. I learned that extensive research and testing went into every component before it was sold. No longer would my patients be used to field test untried products. The result: A reduced “grief level”.

The Straumann implant system was great for the restorative dentist. I would return the patient to the dentist with the abutment in place and all components necessary for the impression taking and cast fabrication in a package. The restorative dentist no longer needed any screwdrivers or torque wrenches. He could treat the case like routine crown and bridge therapy. Since there was no external hex on the implant, full arch cases could be restored in segments without the fear of screw loosening. No longer were full arch frameworks which required multiple solderings necessary. These facts reduced the dentist’s “grief level” and made implant treatment economically viable.

When developing any treatment plan, my first universal criterion is, would I perform this therapy on a family member? Given the option of one surgery and 12 weeks of healing versus two surgeries and 6 months of healing, followed by another 6 weeks for soft tissue maturation, the answer is obvious. Referring dentists and patients love the fact that both overall treatment time and the number of surgical visits are reduced when utilizing the “Straumann approach”. No more painful second stage surgeries. Soft tissue healing is immaculate. In posterior cases a final impression is taken when the abutment is placed. Once again, my “grief level” is diminished.

As time went on more and more advantages of the Straumann implant system became evident. This is the only system where the crown sits on the implant shoulder and not the abutment. There is no micro-gap between the abutment and the implant. These facts reduce stress and diminish the possibility of loosening of components, and of bacterial contamination. Once again, “grief levels” were reduced. Not only was my “grief” reduced but the number of implants placed was increasing.

The introduction of the SLA surface reduced integration time to six weeks. A further enhancement was the development of the “synOcta<sup>®</sup>”, which enabled the implant to be indexed. Now implants could be placed, an impression taken and an accurate provisional restoration fabricated on the bench. The provisional restoration could either be cemented or screw retained and quickly delivered. These facts reduced the “grief level” of the restorative dentist in these complex cases.

The Straumann implant system is also ideally suited for immediate loading. The thread pattern, the implant surface, the Morse taper and the fact that the crown sits on the implant shoulder are some of the factors offering great predictability and ease with immediate implant loading techniques.

As time went on, we ventured in immediate load cases from the full arches to segments to single teeth. When a patient is referred today, the first question asked by the dentist is, “Can we load the implant immediately?” Not only has my “grief level” diminished but the complexity of the cases has increased, with fewer headaches.

When reps from other companies visit my office, they always comment that Straumann is a wonderful implant in the posterior segments and good in type 4 bone. However, they question Straumann use in the “esthetic” zone. I find this “party line” mind-boggling. I show the reps case after case of beautiful esthetics with pink stippled tissue with papilla, on single or multiple implants restored by general dentists. Remember, this system has no micro-gap which contributes to bone loss around the implant. The resultant peri implant soft tissues are highly stable. Not only are the cases gorgeous, but the “grief level” for all concerned is significantly lower than it used to be.

After twenty plus years of placing implants, the last ten using Straumann, I know that integration is predictable. I also know that certain factors such as the implant surface make osseointegration more predictable. I know that some implants integrate faster than others. Bone loss can occur; but less bone loss occurs when there is no micro-gap. I know that some products are not researched or field tested adequately before they go to market place. I know that parts can loosen and/or break after they are in function; but this breakage occurs less frequently using a Morse taper system than with an external hex. I know that predictable esthetics can easily be achieved with no micro-gap.

As a result of these and other factors, I know that our “grief level” can be greatly reduced and our results enhanced. That is why I use the Straumann system in my clinical practice.



## Scott Lightfoot, DDS

Dr. Scott Lightfoot completed his dental training at The Ohio State University, College of Dentistry, where he also received his Certificate of Periodontology. He also holds a Masters Degree in Science and Arts. Dr. Lightfoot is a clinical instructor at Tufts University School of Dental Medicine and lectures locally and nationally. He is affiliated with the American Academy of Periodontology and the Academy of Osseointegration. He is a member of the ITI.

## Editorial: Scott Lightfoot, DDS

I trained in a program which afforded the opportunity to place almost every major implant on the market today, allowing me to evaluate the strengths and weaknesses of different implants systems. The Straumann dental implant was well represented, and was the main choice of our prosthodontics departments. Upon finishing my program I worked in the practice of a highly skilled prosthodontist. The prosthodontist I was working with preferred the Straumann® Dental Implant System for its superior restorative connection and its adaptability to different situations.

As a result of working with the prosthodontist, I developed a great deal of respect for the Straumann® Dental Implant System. When I decided to become a new associate in my primary established practice, the Straumann system was a natural choice. Straumann is my primary implant, even though other options are available to me. I believe that the Straumann dental implant provides several advantages for a new practitioner, or practitioner in a new practice setting.

One of the most important advantage of the Straumann® Dental Implant System is its high predictability. As we all know, it is very difficult to get a practitioner to change referral habits. Once a referral pattern has been changed, the new doctor needs to perform highly predictable procedures in order to retain and expand upon the new referral source. The Straumann system is a perfect choice for this task due to its high level of success. All components of the Straumann implant system are well researched and tested by the ITI prior to coming to market, unlike many other implant systems, where you are often performing "Beta testing" on patients in your practice.

A significant challenge for a new practitioner is to find doctors who currently are not utilizing dental implant therapy in their practices and to make these doctors comfortable with implant therapy. The Straumann® Dental Implant System, with its solid abutment restorative option, is truly easier than

standard crown and bridge and may be marketed to a "non implant" practitioner in this fashion. I routinely tell a new referral source, with confidence, that the Straumann solid abutment will be easier for them to restore than traditional crown and bridge technologies. Additionally, the parts and pieces of the past have been eliminated, and dreaded screw loosening has been done away with.

In more complex situations, the Straumann system's synOcta® connection, offers as many restorative options as any implant system on the market today. The flexibility afforded through the synOcta® system allows restoration of virtually any implant, should it be warranted. The adaptability of the Straumann system, from the easiest case to the hardest case, is essentially second to none.

An area in which the Straumann® Dental Implant System had, until recently, lacked an appropriate solution was provisionalization. However, with the advent of the new Meso abutment, Straumann implants may now be temporized at the initial placement of the dental implant or following healing of the dental implant in order to help ensure optimal final soft tissue form. The Meso abutment is the best designed temporary abutment on the market today as it affords the opportunity to control both submergence and emergence restorative profiles.

In summary, the Straumann® Dental Implant System is fully researched, highly predictable and offers multiple restorative options. Straumann provides a new practitioner with an excellent product to market to new referral sources.



### Barry D. Feldner, DDS, MS

Dr. Barry Feldner is a Diplomate of the American Board of Periodontology who currently resides in Kearney, Nebraska, and has a practice limited to periodontics and implants. He received his DDS degree from the University of Illinois, College of Dentistry, and his Certificate in Periodontics and a Masters degree from the University of Nebraska, College of Dentistry.

## Esthetic Root Coverage Using Coronally Advanced Flap Procedures Supplemented with Enamel Matrix Proteins

Marginal soft tissue recession is defined as the displacement of the soft tissue margin apical to the cemento-enamel junction with oral exposure of the root surfaces.<sup>1</sup> The resulting exposed roots are often the source of unpleasing esthetics and root sensitivity, and may create challenges for performance of effective oral hygiene, putting the patient at higher risk for caries and attachment loss. Marginal soft tissue recessions are often associated with tooth position, biotype, trauma, inflammatory periodontal disease, and occlusal forces.

Techniques for treating mucogingival problems began with free gingival grafts to increase the amount of keratinized gingiva, halt the progression of recession, and obtain some root coverage. In 1985, Langer and Langer introduced a technique that began the modern era of predictable root coverage.<sup>2</sup> Other techniques have been used for root coverage such as coronally advanced flaps (CAF), lateral sliding pedicle grafts, semilunar flaps, guided tissue regeneration, connective tissue grafts, and allografts. Rationales for

treatment include improved esthetics, or to treat cervical root defects, root caries, or root sensitivity.

The purpose of this article is to show five cases of root coverage using coronally advanced flaps (CAF's) supplemented with enamel matrix proteins (Emdogain<sup>®</sup> Straumann, Andover, MA)

### Case 1

A 32-year-old female's chief complaints were temperature sensitivity and esthetic dissatisfaction with teeth #'s 9 and 10 (Figure 1). Clinical evaluation revealed approximately 2 mm of exposed root and 3 mm of keratinized gingiva on both of these teeth. Because the patient had 3 mm of keratinized gingiva, the technique chosen was a coronally advanced flap. Following light root planing using an off angled chisel, an envelope flap design similarly to that described by Zucchelli & De Sanctis<sup>3</sup> was performed. An oblique horizontal incision of the papilla was made from the gingival margin on the facial of tooth #10 to the cemento-enamel

junction on the distal aspect of tooth #9 (Figure 2). The envelope flap was raised with a split-full-split approach in the coronal-apical direction using a Lucas 85 curette. An Orban knife was used to reflect and tunnel under the papillary areas mesial to tooth #9 and distal to tooth #10. Once the flap could rest without tension over the exposed roots, epithelium from the remaining intact papilla was removed between teeth #'s 9 and 10 with a 12D blade. The root surfaces were etched with 24% EDTA (Pref-Gel) for two minutes, then irrigated with sodium chloride. Emdogain<sup>®</sup> was placed on the root surfaces and the flap was sutured to its new position with 5.0 chromic gut. Following two minutes of light pressure the patient was instructed not to brush this area for six weeks, and to lightly debride the teeth with a cotton swab. Postoperative medications included Etodolac 400 mg tid for 3-5 days and Doxycycline 100 mg daily for 10 days. At one week (Figure 3) sutures were removed. Figures 4 and 5 show different views of the final results at 12 weeks.



Figure 1



Figure 2



Figure 3



Figure 4



Figure 5

**Case 2**

A 46-year-old female presented with 4 mm of exposed root and 2 mm of keratinized gingiva on tooth #11 (Figure 6). The same technique of root planing, incision design, flap reflection, etch, irrigation, Emdogain®, and a coronally advanced flap was used. Figure 7 shows the results at two weeks and Figure 8 demonstrates the results at 14 months postoperatively.

**Case 3**

A 51-year-old female presented with a 3-4 mm recession and cervical erosion on teeth #'s 6 and 7 (Figure 9). Using similar technique as described in the two previous cases results at 15 months post therapy can be seen in Figure 10.

**Case 4**

A 50-year-old female presented with a 4 mm root exposure and 3 mm keratinized gingiva on the prominent root of the upper left canine (Figure 11). Following root planing a beveled vertical incision was made on the mesial of #11 following a curved path (Figure 12) and

an oblique horizontal incision was made from the gingival margin on the buccal of #12 to the distal of #11. The root was etched, irrigated, and Emdogain placed prior to suturing (Figure 13). Postoperative results are shown at 10 months (Figure 14).



Figure 6



Figure 7



Figure 8



Figure 9



Figure 10



Figure 11



Figure 12



Figure 13



Figure 14

## Case 5

A 42 year old female stated her front two teeth made her feel and look old. Both #8 and 9 demonstrated 3 mm root exposure and 3 mm keratinized gingiva (Figure 15). Following root planing an oblique incision with a straight vertical component was made on the distal of #8, while a horizontal oblique incision was made in the papillary area distal to #9 (Figure 16). Split-full-split thickness envelope flaps were elevated leaving the papillary area between #8 and 9 intact. Epithelium was removed and the flaps were coronally advanced into final position (Figure 17).

Figure 18 shows the area 6 months post operative.

## Discussion

Enamel matrix proteins (EMP) are amelogenins found during enamel formation, as well as in the initial development of acellular cementum and the associated tooth attachment apparatus. EMP self-assemble to create a matrix that can mediate the formation of acellular cementum on the root of a developing tooth. Commercially available enamel matrix derivative is derived from developing teeth of porcine origin. The enamel matrix is recognized as self when encountered by the human body. These proteins have been shown to stimulate regeneration of the periodontal ligament, cementum, and bone. While this product has primarily been used to treat intrabony periodontal defects, there is general agreement among periodontal surgeons that soft tissue healing is improved with this substance as well.<sup>4</sup>

Regarding the presented techniques, the Lucas 85 curette is helpful for flap reflection and tunneling procedures. This curette is small enough to slip into the sulci of surrounding teeth without papilla reflection, while its angled shank allows negotiation around exostosis and curvature of the alveolus. Root planing with a Wedelstaedt or off angled chisel in a coronal-to-apical direction prepares the root nicely without causing the root ditching often seen with curettes.

Zuchelli & De Sanctis<sup>3</sup> showed beautiful results for CAF's using an envelope flap without vertical incisions. At a 5-year examination, 94% of the root surfaces initially exposed due to gingival recession were still covered with soft tissue, and 85% of the treated recession defects showed complete root coverage. Comparing one and five year data, they observed a  $1.38 \pm 0.09$  mm increase in keratinized tissue, while the mucogingival junction, displaced coronally during surgery, continued its apical shift toward its original (presurgical) position.<sup>5</sup> Two recent studies compared the results of CAF's with and without addition of enamel matrix proteins and found significantly more root coverage with the addition of the proteins.<sup>6,7</sup> A recent meta-analysis of multiple studies found the most predictable criteria for successful results using a CAF was  $> 1.2$ -mm tissue thickness measured 2 mm apical to the gingival margin.<sup>8</sup>

The results shown were achieved on the first five cases the author performed employing CAF procedures supplemented with enamel matrix proteins.

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Figure 15



Figure 16



Figure 17



Figure 18



### Paul A. Fugazzotto, DDS

Dr. Paul A. Fugazzotto received his DDS from New York University in 1979 and a certificate in advanced graduate studies in periodontology from Boston University in 1981. Since that time Dr. Fugazzotto has maintained a private practice limited to periodontics and implant therapy in Milton, Massachusetts. Dr. Fugazzotto is the Senior Editor of *Implant Realities*.

## Predictable Implant Placement at the Time of Mandibular Molar Extraction

Concepts, materials and techniques deployed when placing implants at the time of molar removal to eventually support crowns, has evolved significantly over time. Initially, an implant or multiple implants were placed in the root socket(s) at the time of tooth removal and restored following osseointegration. While such therapy afforded the opportunity to perform all surgical treatment in one appointment, the restorative dentist was often faced with a difficult challenge, and the treatment outcomes were frequently less than ideal (Figures 1 and 2).

As a result of these therapeutic shortcomings, guided bone regenerative therapy at the time of tooth removal, followed by implant placement at a second surgical visit, has long been advocated. The advantages to such a treatment approach include maintenance of all remaining bone at the time of tooth

removal, regeneration of lost alveolar bone in the area, and the ability to place an implant in an ideal prosthetic position in anticipation of subsequent restoration (Figures 3-5).

Modifications and combinations of existing surgical techniques now afford the opportunity to ideally position implants in molar sites at the time of tooth extraction, with concomitant bone regenerative therapy around the implant which has been placed, thus obviating the need for a second surgical session and significantly contracting the overall length of therapy. An article in a previous issue of *Implant Realities* discussed these therapies following removal of multi-rooted maxillary teeth. This paper will present a technique which facilitates ideal implant positioning at the time of mandibular molar removal.

### Intra Operative Site Assessment

While most multi-rooted mandibular teeth may be removed and replaced with an implant in one surgical session, it is important to assess the surgical site after tooth removal and defect debridement has been accomplished.

All mandibular, multi-rooted molars to be removed are hemisected (or trisected in the rare cases of three rooted mandibular molars), and the roots are carefully removed one at a time so as to preserve all remaining interradicular bone. Occasionally a tooth is encountered which has undergone significant endodontic and restorative therapy, which fractures repeatedly during the extraction process. Should this be the case, excessive trauma and/or the use of high speed instrumentation may be necessary to effect removal of tooth fragments. It is



**Figure 1** An implant has been placed with a mesial root socket of a mandibular first molar by a previous practitioner. The crown restoration recreated a "furcation" in the area, representing a hindrance to proper patient plaque control.



**Figure 2** Previous treatment by another practitioner has resulted in placement of two implants in the mesio buccal and disto buccal extraction sockets of a maxillary first molar. These implants cannot be restored in a maintainable manner.



**Figure 3** Tooth #19 is fractured and hopeless.



**Figure 4** Following tooth removal and placement of appropriate graft materials and a covering membrane, complete regeneration of the damaged alveolar bone is noted.



**Figure 5** An implant with a 4.8 mm wide body and a 6.5 mm wide restorative platform has been placed and restored with a single cemented crown.



**Figure 6** Tooth #30 is fractured and hopeless. During extraction, the tooth fractured in six places, necessitating significant trauma to the surrounding alveolar bone. A bone graft and covering membrane were placed.

then prudent to perform guided bone regeneration therapy with the appropriate graft materials and covering membrane rather than to place an implant in a site of significantly traumatized bone (Figures 6, 7). The site is re-entered following maturation of the regenerating hard tissues to place the planned implant in an ideal prosthetic position.

The presence of a periodontal and/or periapical inflammatory lesion around the tooth to be extracted is not a contraindication to immediate implant placement with concomitant regenerative therapy. However, the extent and morphology of alveolar bone destruction as a result of the aforementioned infection may preclude needed implant placement.

Figure 8 demonstrates a tooth which was to be hemisected and removed. Implant placement was anticipated during the same visit following defect debridement. However, after hemisection and removal of tooth #19, and debridement of the inflammatory lesion which was present, inadequate alveolar bone remained to effect ideal implant positioning. The two inflammatory lesions at the ends of the mesial and distal roots communicated through the interradicular septum,

undermining the septum and eliminating the bone necessary for attainment of primary implant stability in the proper position. As a result of these findings, guided bone regeneration was performed in the socket area at the time of tooth removal. Five and half months postoperatively, more than adequate bone is present for ideal implant placement (Figure 9).

### Implant Selection

Individual implant designs may aid or hinder the effort to place an implant in the area of the interradicular bone at the time of tooth removal.

Two implant designs are especially effective in facilitating such implant placement:

- A threaded implant with a 4.8 mm wide body and a 6.5 mm wide restorative platform: The implant flares from 4.8 mm to 6.5 mm in the area between the bone crest and the implant neck. This implant is utilized for immediate molar replacement when inadequate bucco lingual dimension of interradicular bone is present to secure the implant within its confines. The mesial and distal dimensions of the interradicular bone

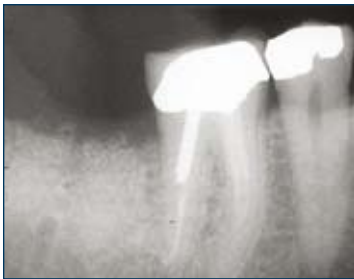
do not influence implant selection, as will be seen below (Figure 10).

- An implant which is 4.1 mm wide at its base and has a 6.5 mm wide restorative platform (Figure 11): The most apical portion of the implant is a 4.1 mm wide cylinder. The diameter does not begin to flare toward the 6.5 mm neck until the mid-point of the implant length is reached. This implant is utilized at the time of molar extraction if a narrower implant "apex" is required to anchor the implant in host bone. Such a situation is most often present when the dimension of the interradicular bone does not widen significantly enough in the apical areas of the root sockets to allow engagement of a 4.8 mm wide "implant apex".

### Technical Variations

Following tooth sectioning and delicate removal of each root independently, implant placement proceeds in one of the following manners:

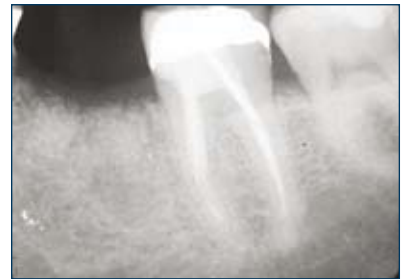
If the most crestal aspect of the interradicular bone is at least 3 mm wide mesio-distally distally: A 2.2 mm wide guide bur is drilled to the appropriate length. A guide pin is inserted and



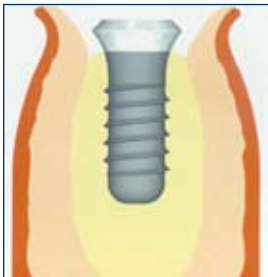
**Figure 7** Following maturation of regenerating hard tissues, more than adequate bone is present for ideal implant positioning.



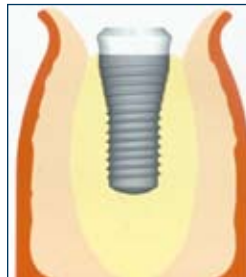
**Figure 8** Tooth #19 is fractured and hopeless. Following tooth extraction the periapical lesions around the mesial and distal roots communicated through the interradicular septum, undermining the interradicular bone. Appropriate graft materials and a covering membrane were utilized.



**Figure 9** Following alveolar bone regeneration, more than adequate bone is present for ideal implant positioning.



**Figure 10** A diagrammatic representation of an implant with a 4.8 mm wide body and a 6.5 mm wide restorative platform.



**Figure 11** A diagrammatic representation of a tapered implant with a 4.1 mm wide "apex" and a 6.5 mm wide restorative platform.



**Figure 12** Following removal of a mandibular first molar an osteotomy was performed in the interradicular bone, a guide has been placed, and a radiograph taken.

a radiograph is taken (Figure 12). If necessary, the initial osteotomy is extended apically. A tapered osteotome (Figure 13) is inserted into the osteotomy and moved mesial distal and buccal lingually to expand the osteotomy site. A 2.8 mm bur is used to prepare the osteotomy to depth. A 2.8 mm wide tapered osteotome is inserted in the osteotomy and once again utilized a mesio distal and bucco lingual directions to expand the osteotomy site. If the mesial and distal aspects of the interradicular bone are still intact at this point, a 3.5 mm bur is utilized to prepare the osteotomy to depth. A 3.5 mm wide osteotome is then inserted in the osteotomy and utilized in the manner already described. A decision is made as

to whether to insert a tapered implant with a 4.1 mm wide base and a 6.5 mm wide neck, or to utilize a 4.8 mm wide bur and prepare the osteotomy to depth, in anticipation of placement of an implant with a 4.8 mm wide body and a 6.5 mm wide platform. The chosen implant is then inserted to the osteotomy. Appropriate regenerative materials are placed, and the flaps are sutured. Following maturation of the regenerating hard tissues, the implant is ready for restoration (Figure 14).

If the interradicular bone does not demonstrate a mesial distal dimension of at least 3 mm, or if the mesial and/or distal aspects of the interradicular septum are lost during site preparation, the following modifications are employed:

Once the tooth has been hemisected and removed, and the depth and position of a guide pine are verified by a radiograph. Continued site preparation will result in loss of the mesial and/or distal aspect of the interradicular bone (Figures 15-18). Should this occur, it is imperative that final preparation of the osteotomy be accomplished in the appropriate position. The prime challenge to the clinician is the tendency of the bur to chatter and "walk out of" the osteotomy into one of the root sockets due to loss of mesial and/or distal retaining wall(s). Precise osteotomy preparation in such a situation is accomplished through the use of a modified drilling technique which is has been described for placement of implants into atrophic



**Figure 13** A view of a 2.2 mm wide tapered end osteotome.



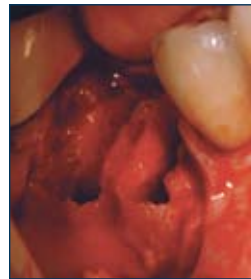
**Figure 14** Following manipulation of the interradicular bone, implant placement, and performance of concomitant regenerative therapy, the hard tissues are mature and the implant is ready for restoration.



**Figure 15** The mandibular second molar is fractured. Note the periapical lesions around this tooth.



**Figure 16** The first molar has been extracted and hemisected without damaging the interradicular bone.



**Figure 17** An initial osteotomy has been prepared the interradicular bone utilizing a 2.2 mm wide bur.



**Figure 18** A radiograph of a guide pin in the prepared osteotomy.



**Figure 19** A diagrammatic representation of the interradicular bone following hemisection and removal of the mandibular molar.



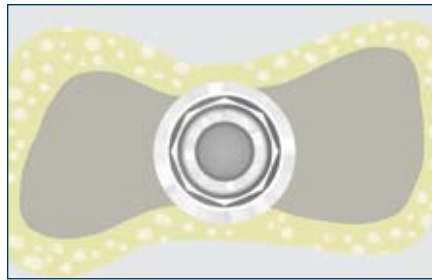
**Figure 20** The bur enters the osteotomy at an acute angle, so as to engage the lateral aspect of the base of the osteotomy site and provide a purchase point for continued osteotomy site preparation. The bur is straightened up during the osteotomy preparation.



**Figure 21** An implant is placed in an ideal position in the area of the interradicular bone.

ridges in a previous publication. The bur enters the interradicular bone at an angle, with the base of the bur engaging the lateral wall of the most apical extent of the osteotomy preparation. As the bur achieves a set point in the interradicular bone, it is straightened up and osteotomy preparation is continued (Figures 19-22). Osteotomy preparation continues in the same manner, with each subsequent bur requiring a less acute initial angle of entry. Upon completion of the osteotomy, the implant is placed in an ideal restorative position (Figures 23-24). Following completion of bone regeneration and osseointegration, the implant is ready to be restored with a single crown.

The described techniques are highly predictable, and help ensure ideal implant positioning at the time of mandibular molar extraction. Two hundred and seventy-one implants have been placed utilizing these techniques and subsequently restored. One hundred and ninety-eight of the implants are 4.8 mm wide screws with 6.5 mm wide restorative platforms, and 73 are tapered implants with a 4.1 mm wide base and a 6.5 mm wide restorative platform. Two implants have been lost during the initial stages of healing. No implants have been lost in function, yielding a cumulative success rate of 99%. The implants have been in function for up to five years with a mean time in function of 30.7 months.



**Figure 22** An implant is placed in the interradicular bone, and is secured by the remaining buccal and lingual aspects of the interradicular bone.



**Figure 23** An implant with a 4.8 mm wide body and a 6.5 mm wide restorative platform has been placed in the interradicular bone following appropriate preparation.



**Figure 24** Another view of the implant in the interradicular bone. Note that the mesial and distal aspects of the interradicular septum have been lost. The implant attained primary stability from the buccal and lingual aspects of the interradicular bone.



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Dr. Paul S. Rosen is a private practitioner in Yardley, Pennsylvania, and clinical associate professor of periodontics at the University of Maryland Dental School. An AAP member for more than 15 years, Rosen has served the Academy in numerous capacities including as chair of the Continuing Education Oversight Committee and reviewer for the editorial board of the *Journal of Periodontology*.

## Straumann® BoneCeramic as An Alternative Graft Material for GBR Use Around Immediately Placed Dental Implants

### Introduction

Dental implants have revolutionized management of partially and fully edentulous patients. Once offered as an option for treating only the completely edentulous patient who was unable to wear a full upper or lower removable denture, implant therapy has evolved into the treatment of choice to replace teeth which have been lost or are failing. This approach is supported by long-term studies demonstrating the high success rates for dental implants.<sup>1,2</sup>

Traditionally, implants have been placed into sites of native bone or augmented bone at least 6 to 12 months following tooth extraction, with an added waiting period of two to six months for before loading.<sup>3,4</sup> This prolonged period of treatment may be discouraging to patients who have been recommended to receive dental implants, and has led some clinicians to avoid such care. Immediate implant placement has been proposed as an alternative to the more traditional implant approach, to reduce treatment time to prosthetic completion and preserve bone at the site of the extraction can be achieved.<sup>5,6</sup> Studies demonstrate that immediate implant placement can be as successful as the more conventional delayed approach.<sup>7,8</sup>

One challenge of immediate implant placement is that the size of the extraction site often exceeds the dimensions of the implant that is to be placed. This fact has caused clinicians to select from a myriad of available materials and techniques to stabilize the initial blood clot, exclude epithelium and provide a scaffold for the distant osteogenesis necessary to achieve osseointegration. Various bone replacement grafts have been used either with or without a barrier membrane to promote regeneration of the alveolar ridge upon tooth extraction.<sup>9</sup> The grafting materials employed include autogenous bone, demineralized freeze-dried bone allograft, mineralized freeze-dried bone allograft, deproteinized bovine bone, alloplastic polymers and bioactive glass.<sup>10-16</sup> Clinicians have traditionally

embraced either autogenous grafts or allografts for guided bone regeneration (GBR) purposes due to their high levels of success. Morbidity from the procurement process and the volume of graft which can be harvested are concerns when utilizing autogenous bone. Bone allografts also present with questions about reduced efficacy of product related to tissue processing and/or risk of disease transmission.

Straumann® BoneCeramic (SBC) is a synthetic bone replacement graft, which is comprised of hydroxyapatite (HA) and beta-tricalcium phosphate (B-TCP) in a ratio of 60:40. HA constitutes the chief mineral component of bone. At physiological pH, HA is the least soluble of the naturally occurring calcium phosphate salts. This fact contributes to the relative resistance of HA to resorption, which is only bioresorbed during physiologic bone remodeling.<sup>17</sup> HA is often used in the reconstruction of bony defects and the augmentation of resorbed alveolar ridges due to its osteoconductive and space maintaining capabilities. The objective of HA use is to provide a scaffold for enhanced bone tissue repair and growth. Combining HA with autogenous bone decreases the amount of harvested bone needed for GBR procedures, thereby reducing patient morbidity. HA is well tolerated, as the majority of the human skeleton is composed of calcium phosphate. All forms of HA are biocompatible and do not cause a sustained foreign body response or toxic reaction.<sup>18</sup>

The beta-form of tri-calcium phosphate (B-TCP) is a porous calcium phosphate that is osteoconductive, providing a scaffold for potential bony in-growth. Tri-calcium phosphate is resorbable. Following initial osteoconduction, the host bone eventually replaces this alloplastic graft.<sup>19</sup> The problem with B-TCP graft material is that its replacement does not occur in a 1:1 ratio. Less bone volume is produced as compared with the volume of tri-calcium phosphate absorbed.<sup>20</sup> Combinations of B-TCP with adjunctive substances such as osteogenin and collagen have shown

reduction in volume, which suggest a 1:1 replacement of the alloplast by natural bone.<sup>19,21</sup>

The objective of combining insoluble HA and B-TCP is for the HA to maintain space (scaffolding function) while the B-TCP bioresorbs leading to the formation of a greater amount of host bone than if either of these two graft materials were used alone.

The following two case reports illustrate the successful use of this bone replacement graft material in a clinical private practice following placement of implants at the time of tooth extraction.

### Case 1

A 74 year-old Caucasian female was referred for replacement of her ailing maxillary left second premolar with a dental implant. The history of this tooth included endodontic treatment over ten years prior, and subsequent non-surgical and surgical retreatment within the past six months due to repeated periapical abscessing. Her medical history was unremarkable. A periapical radiograph of the area suggested an apical lesion and a short root (Figure 1). The patient's current symptoms of pain, probing to the apex on the facial aspect of the tooth and 2° mobility left this tooth with a hopeless prognosis.

The tooth was scheduled for extraction, simultaneous implant placement and guided bone regeneration (GBR). Following rinsing with a 0.12% chlorhexidine mouthrinse for 30 seconds immediately



Figure 1

prior to the procedure, a local anesthetic of one carpule of Articaine HCL 4% with 1:100,000 epinephrine (Septocaine, Septodont Inc, New Castle, Delaware) was given. Full-thickness flaps using sulcular incisions were elevated on the facial and palatal aspects of the tooth, extending from the mesial of the maxillary left first premolar to the distal of the left first molar. A vertical releasing incision was placed at the canine to facilitate access to the most apical extent of the lesion. Care was given to retain the papillae between these teeth. Upon reflection, any adherent granulation tissue was trimmed from the flaps. The area was debrided and a fenestration defect measuring approximately 3-4 mm was observed on the apical aspect of the first premolar (Figure 2). The tooth was extracted, with every effort being made to preserve labial bone. The defect was thoroughly debrided and rinsed with sterile saline. A 4.1 mm x 12 mm Straumann implant with a sand-blasted large particle acid-etched

(SLA) surface was placed according to the manufacturer's instructions (Figure 3). The direction of the implant paralleled the maxillary left canine in an effort to avoid the maxillary sinus. A closure screw was placed into the occlusal aspect of the implant. The residual defect received a graft of SBC (particle size 400 to 1000  $\mu$ m) mixed with Emdogain<sup>®</sup> (Figure 4). The graft was placed with light incremental pressure, filling the defect completely (Figure 10). A six-month bioabsorbable collagen barrier was placed over the area to effect graft containment and to delay the ingrowth of connective tissue into the area. The barrier was trimmed to overlap the defect by at least 3 mm, and extended from the fenestration over the occlusal aspect of the socket (Figure 5). The flaps were sutured with 5-0 expanded-polytetrafluoroethylene (e-PTFE) (Gore-Tex, W.L. Gore & Associates, Flagstaff, Arizona) using an interrupted technique. No effort was made to achieve primary closure where the premolar had been extracted, leaving the

membrane exposed (Figure 6). Additional Emdogain<sup>®</sup> was applied to the site and pressure was applied to the flaps.

The patient was prescribed amoxicillin 875 mg twice daily for ten days, and a mouth rinse of 0.12% chlorhexidine. Ibuprofen 600 mg was prescribed for both its analgesic and anti-inflammatory properties. The patient was seen every two weeks for the first month. At the first postoperative visit the sutures were removed. Post-operative visits included supra-gingival plaque removal with topical application of chlorhexidine 0.12% and selective stain removal. The patient was instructed to neither brush nor floss the surgical area for the first four weeks to provide for wound quiescence. Topical application by the patient of the chlorhexidine 0.12% was continued for four weeks. At this time the site had granulated over. The post-operative course progressed uneventfully. Exposure of the implant took place at 6 months.



Figure 2



Figure 3



Figure 4

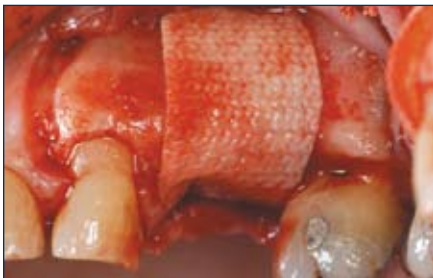


Figure 5

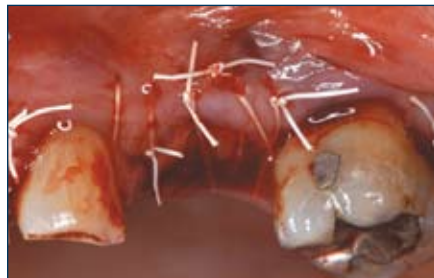


Figure 6



Figure 7



Figure 8

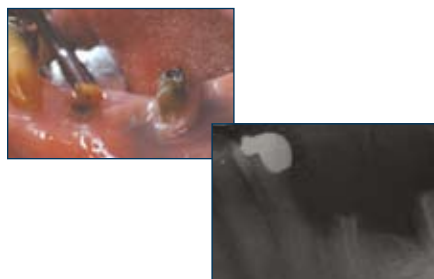


Figure 9



Figure 10

The success of the GBR procedure was assessed at the second-stage surgery when the flaps were reflected to place the healing cap. Complete bone fill of the defect had been accomplished (Figure 7) and the implant was stable upon torque application. A periapical radiograph exposed at the time of healing cap seating suggested good osseous fill. The flap was approximated to the healing cap and sutured with 4-0 gut sutures.

The final crown was fabricated on a synOcta<sup>®</sup> abutment utilizing standard protocols, and inserted 8 weeks following the removal of the sutures. The crown has been in function for over six months and a periapical radiograph of the implant demonstrates stability of the bone around the implant (Figure 8).

### Case 2

An 84 year-old Caucasian male presented with recurrent caries, which caused failure of the bridge constructed on his remaining mandibular left first and second molar resected roots (Figure 9). His medical history was non-contributory. Since the roots were deemed unrestorable even if crown lengthening were performed, two implants were planned to be placed at the time of teeth extractions.

The patient rinsed with a 0.12% chlorhexidine mouthrinse for thirty seconds immediately prior to the procedure. Local anesthesia consisted of one carpule of septocaine 4% with 1:100,000 epinephrine. Full-thickness flaps using sulcular incisions were elevated from the distal of the second premolar to the posterior edentulous region. A vertical releasing incision was placed at the second premolar to facilitate flap mobilization. The teeth were extracted, with care given to maintaining the integrity of the labial bone. Following debridement of any residual soft tissue from the extractions sockets, two Wide Neck SLA Straumann implants were placed, in such a manner as to ensure a minimum of three millimeters of native bone stabilized their apical most extent (Figure 10). The directions of the implants paralleled one another. At the first molar site a buccal dehiscence of approximately 3-4 mm was present and a labial gap of 1 mm extended along 50% of the implant. The residual defect on the anterior implant received a graft of Straumann<sup>®</sup> BoneCeramic (particle size 400 to 1000  $\mu\text{m}$ ) mixed with Emdogain<sup>®</sup> (Figure 11). The composite graft was placed with light incremental pressure, filling the defect completely. Closure screws were placed in both implants and a six-month bioabsorbable

poly lactide barrier was placed over the area to provide for graft containment and to delay the ingrowth of connective tissue from the flap into the defect (Figure 12). The flaps were sutured with 5-0 e-PTFE using an interrupted technique, and additional Emdogain<sup>®</sup> was applied to the area.

Five months following implant placement, abutments were connected. Full-thickness flaps were elevated to assess the outcome of the regenerative procedure. Complete bone-fill was noted where the anterior implant's bony defect had been present (Figure 13). Solid abutments were torqued to 35 Ncm2 and the flaps were sutured with 4-0 gut interrupted sutures. The final individual crowns were completed following soft-tissue healing and have been in function for six months (Figure 14).

### Discussion

These two cases demonstrate the efficacy of the Straumann<sup>®</sup> BoneCeramic alloplastic bone graft mixed with a biomimetic agent (Emdogain<sup>®</sup>) in achieving successful GBR outcomes around immediately placed implants. While the biphasic SBC alloplast alone with a membrane may have achieved this favorable result, it was mixed with a biomimetic agent to increase the biologic capability of this osteoconductive scaffold.<sup>22-24</sup>

The addition of Emdogain<sup>®</sup> to the graft material is a shift from the traditional paradigm that the biologic activity must be inherent to the graft itself. Alloplasts of demineralized freeze-dried bone (DFDBA) have traditionally been employed

in GBR therapy due to the belief that their intrinsic biologic activity will induce greater bone formation.<sup>25</sup> Studies have demonstrated these grafts vary greatly in their osteoinductivity capabilities. This variability is often related to donor factors and the manner by which the graft has been processed.<sup>26-29</sup> Additionally, demineralization reduces the graft's capacity to maintain space adequately, since post-processing DFDBA's consistency is more like that of a sponge, forcing the clinician to use a reinforced barrier that will maintain space. Many of the same biologic outcomes might be gained by using EMD. In vitro studies have suggested enamel matrix derivative may have an influence on the recruitment of osteoblasts and upregulate the expression of genes in those cells which are involved in bone formation.<sup>22-24</sup>

A major advantage of using a biologically active alloplastic scaffold instead of allografts or bovine xenografts is the elimination of concerns regarding the potential for disease transmission. Another benefit of a commercially engineered product is the ability to control the rate and amount of graft bioresorption. Modifying the ratio between the HA and B-TCP will influence the rate of graft material turn over. One caution in the use of this bi-phasic graft material is the fact that polymer barriers which biodegrade to acid products could cause premature loss of the B-TCP, leading to diminished regenerative outcomes. This concern was obviated in the second case reported upon, as the polymer barrier utilized maintains its barrier function for at least six months.<sup>30</sup>



Figure 11



Figure 13



Figure 12



Figure 14

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### Robert Vogel, DDS

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## Clinical Technique to Simplify Overdenture Success

The use of osseointegrated dental implants is rapidly becoming the standard of care for the fully edentulous patient to be restored to function with a mandibular removable full denture. Over two decades of university based clinical research and most recently ongoing studies at McGill University have established the multitude of benefits, both physically and emotionally, implant retained dentures provide our patients.

In the traditional non-splinted or individual implant overdenture the prosthesis is primarily tissue supported and implant retained. While the fabrication of this prosthesis must follow conventional full denture techniques including proper border adaptation, the final prosthesis should include a degree of mucocompression of the soft tissues in occlusal load to assure a level of support from the residual ridge.

The introduction of new overdenture components and techniques have addressed current issues in implant dentistry by simplifying and providing

more predictable long term outcomes with greater ease of use for the patient with decreased maintenance and cost. The LOCATOR® attachment is one such system that provides an ideal level of resiliency in use with non-splinted implants while allowing passive angulation correction on insertion and removal of the prosthesis. This results in minimal friction, wear and stress transfer to the underlying implants.

Options for connection of implant attachments into the final prosthesis are: Laboratory curing prior to delivery to the dentist or chairside cured "pick-up" intra-orally. Predictable results can be obtained with either technique when properly performed from impression making through delivery. The final goal is to ensure an intimate contact between the prosthesis and underlying tissues under function, so as not to transfer the full occlusal load to the individual implants in a non-splinted situation. Below is a chairside technique developed to increase predictability of this goal and simplify the process of delivering an Implant Retained/Tissue Supported Overdenture. This

technique has greatly reduced chairtime for the patient and adjustments for the clinician when curing attachments intra-orally.

### Step 1

Following integration of the dental implants the conventional healing caps are removed (Figure 1) and replaced with a tall **4.5 mm H x 5.5 mm W** cover screws (Figure 2) at the time of making the final border molded, custom tray denture impression. The impression made with the tall cover screws in place provides a channel in the final prosthesis (Figure 3) with adequate space to cure the LOCATOR® housing in the new denture at final delivery.

### Step 2

At delivery of the final prosthesis the LOCATOR® abutments are placed to 35Ncm (Figure 4), the housings and white block out spacers are placed on the abutments (Figure 5) and the denture is seated to ensure there is no contact with



Figure 1



Figure 2



Figure 3



Figure 4



Figure 5

the underlying attachment housings. Final denture adjustments are made to the borders and occlusion and the channels are lightly relieved if needed to avoid contact with the attachment and housing.

### Step 3

“Vent holes” are then placed in the depth of the channels (Figure 6) to allow escape of excess material during the curing of the housings in the denture. This will minimize material (acrylic) from flowing into undercuts, allow complete seating of the denture on the tissues without pressure from the curing material preventing full seating and provide visual access to inspect the housings under the denture prior to curing.

The housings are cured into the denture with the patient maintaining light bite pressure to provide slight mucocompression of the underlying tissue, to assure an intimate contact.

Upon complete set of the material the denture is removed (Figure 7) and any voids around the housings are filled in outside the mouth in a dry environment. The black processing components are then replaced with the final nylon retentive components (Figure 8), the denture is polished and patient instructed in use, care and hygiene of their new prosthesis and dental implants.



Figure 6



Figure 7



Figure 8



## Frederick Hains, DDS, FAGD

Dr. Frederick Hains is currently an Assistant Clinical Professor at Boston University Dental School and maintains a private practice in Braintree, MA. He is also a Fellow of The Academy of General Dentistry.

# Implant Primer: Part 1 – The Solid Abutment Restoration of a Failing Deciduous Molar Using the Simplified Straumann Abutment System

General dentists are presented with treatment planning challenges on a daily basis. Predictable implant therapy is often the most appropriate treatment in such situations. In the following case, a patient presents with a failing deciduous molar and a labially positioned second premolar. (Figures 1 and 2)

Treatment options are limited after removal of the deciduous molar due to the nonfunctioning second premolar. Replacement of the missing teeth is best effected through the placement of an implant supported crown in the resulting edentulous area. Proper implant placement will result in a straightforward course of treatment. The process of restoring this area with the Straumann® Dental Implant System will be presented.

The salient points to consider are the edentulous central location of the failing deciduous molar, the size of the resulting

edentulous space following the extraction and the super eruption of the opposing dentition. An implant can be placed centrally in the arch after removal of the #20 and the deciduous molar. The space left by extraction of the deciduous molar and #20 has left a space that is larger than the corresponding premolar and too small for a “normal” molar. The only reasonable option is to replace the missing deciduous molar with an implant supported deciduous porcelain fused to metal molar crown. The super eruption of the opposing dentition is addressed by selectively adjusting the maxillary teeth back to an appropriate occlusal plane. The intra-occlusal distance between the maxillary and mandibular arches will dictate the height of the ITI abutment to be used. The Straumann ITI Solid Abutment system provides three different height options. Color coded solid prefabricated abutments come in 4.0 mm, 5.5 mm, and 7.0 mm height, as do the

matching supporting components.

Appropriate implant placement is evident in Figures 3-5. Standard Straumann restorative components will be utilized for implant restoration. Use of these components is simple, straightforward and well within the skill level of all general dentists.

Straumann has assembled the necessary components to restore this implant and others similar to it in a packet. The packets are color coordinated and match the color of the prefabricated solid abutment which will be used to restore the case. In this instance a 4.0 mm implant abutment color code yellow was selected. The packet contains two impression caps, a positioning cylinder and a laboratory analog. All are yellow to match the 4.0 mm abutment. (Figures 6, 7)



Figure 1 Model of the case before treatment.



Figure 2 Left lateral view before treatment. Occlusal plane discrepancy.



Figure 3 Healing abutment lateral view.



Figure 4 Healing abutment occlusal view.



Figure 5 Lingual view.

## Abutment Insertion and Impression Taking

The healing abutment is removed from the implant and the prefabricated 4.0 mm solid abutment is placed and torqued into the implant to 35 Ncm. A white impression cap is snapped onto the head of the implant, over the abutment. The yellow positioning sleeve is placed and seated to the implant head. (Figure 8) This sleeve ensures the laboratory analog will be placed exactly as the abutment is situated in the mouth. Correct orientation is critical because of the abutment's unique shape. Positioning in the mouth must be reproduced in order to permit placement of the crown which will be fabricated. A final impression is now taken with an elastomeric material (Figure 9). An opposing model and bite registration accompany the impression. The analog found in the impression set

packet is also sent to the laboratory. The laboratory will fabricate a model with a tissue cuff to represent the patient's mouth. (Figure 10) Crown fabrication is carried out on these articulated models.

Information as to the desired shade is communicated to the laboratory, as well as your expectations for the final product. A picture of the shade guide positioned near the expected crown placement is a great aid for the laboratory technician, (Figure 11). Including pictures of a shade higher in value and a shade lower in value than the desired shade help the technician to calibrate the porcelain and better meet expectations. The prefabricated abutment will require a provisional restoration which is fabricated in the manner previously described by Dr. Scott Keith (Figure 12). The patient is able to function in this area until the final crown is completed.

On occasion, it is necessary to alter the solid abutment. Due to the accuracy and simplicity of the impression system, it is preferable to make corrections in the laboratory and request that the technician provide a modification coping to indicate the alterations to be made intra orally. Using the modification coping, alterations are made to the abutment which mimic those made by the technician, thus ensuring that the integrity of the impression is not lost.

The completed crown is returned and checked on the laboratory model (Figure 13). If the crown is acceptable, it is placed and evaluated in the patient's mouth. Delivery is performed in the customary manner for conventional crowns (Figures 14, 15).



Figure 6 This is the 4.0 mm abutment.



Figure 7 Packets containing the 4.0 mm abutment and the impression set.



Figure 8 The impression set.



Figure 9 Healing abutment.



Figure 10 Impression cap and positioning sleeve in place ready for impression.

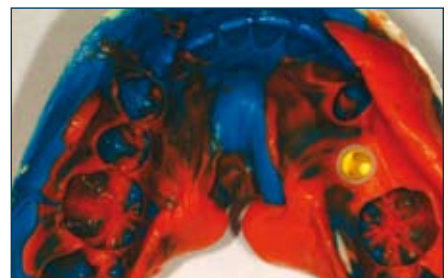


Figure 11 Final full arch impression.



Figures 12 and 13 Laboratory models with laboratory analogs.

## Summary

Implant restoration utilizing the Straumann solid abutment system is extremely simple and straightforward. Minimal armamentarium is required. Torque wrenches can often be borrowed from your implant specialist until you feel comfortable with the system and elect to invest in your own equipment. The solid abutment and the impression kit are the only additional components necessary to restore a single Straumann implant with an implant supported crown.

The cost and time to perform this service is reasonable and well within the average restorative dentists' comfort zone. A small premium added to the fee for a crown and coded as an implant supported crown (CDT coding D6059 for a PFM crown), in addition to the fee for the prefabricated abutment

(CDT coding D6056), will cover the material costs and provide for a profitable procedure. This technique is often easier to complete than standard crowns in difficult areas of the mouth, which would require tissue retraction and hemostasis when treating natural teeth.

Current treatment planning concepts dictate consideration of implants in the edentulous areas of a patient's mouth, or whenever the projected long term success following a heroic tooth saving procedure is less than optimal. In this example the implant option is the "standard of care".

Dentists unfamiliar with implant therapy should begin with simple cases and develop familiarity with the implant system. The knowledge and experience gained from restoration of simple implant cases afford the confidence to plan and execute more complex cases.



Figure 14 Shade selection.



Figure 15 Lateral view of provisional.



Figure 16 Provisional crown.



Figure 17 The completed implant supported crown.



Figure 18 The completed case.



Figure 19 A lingual view of the completed crown.



Figure 20 The crown and the 4.0 mm abutment. Placed on an implant facsimile.



### Frank Higginbottom, DDS

Dr. Frank Higginbottom is a graduate of Baylor College of Dentistry. He has practiced general and restorative dentistry at Baylor University Medical Center in Dallas, Texas since 1973. Dr. Higginbottom has been a contributor to several textbooks, including *ITI Dental Implants, Planning, Placement, Restoration, and Maintenance*. He maintains a private practice in Dallas focusing on crown and bridge and implant prosthetics.

## Interim Restorations in Areas of Esthetic Concern

Anterior implant restorations offer patients the option of restoring missing tooth gaps in ways that appear as natural as their own dentition. Implants may be placed in mature sites or placed at the same time that a tooth is removed. Patients understandably do not want to be without a tooth during any healing period, and in many instances want a missing tooth to be replaced as soon as possible.

The dentist has several options to provide tooth replacement after an implant is placed. Options include a removable partial denture, a prosthetic tooth bonded to the adjacent teeth, a tooth borne fixed provisional restoration, or a restoration placed directly on the implant at the time of implant placement. For the purpose of this article all of these choices will be addressed, but the primary focus will be the different options for provisionalization when a direct connection to the implant is initiated.

### Interim removable partial denture

The removable partial denture (flipper) has been the typical first choice for interim tooth replacement for many years. This option seems simple enough. The dentist can direct the dental laboratory to fabricate the appliance which can be delivered by the surgeon at the time of implant placement, or shortly afterwards by the dentist. This option, while simple, can be abused. Patients will attempt to function with the removable appliance. Unless proper tooth support is provided, the appliance can apply unwanted pressure to the implant site or a graft placed in the surgical site. (Figures 1, 2, 3, 4, 5, and 6)

### Tooth borne bonded restoration

A natural tooth or resin pontic may be bonded to teeth adjacent to an implant site. This option is certainly more favorable than a removable option for the patient. The disadvantages of a removable partial denture can be avoided.

However, bonding to the natural teeth is not practical at the time of surgery. The patient will need to see the dentist when the field can be isolated and dried following surgery. Soft tissue changes will dictate the possible replacement of the bonded restoration to satisfy the patient's esthetic demands during the healing period. This option, however, does provide a good long term solution to avoid complications of a removable partial denture. This is particularly true when the adjacent teeth are not to be restored in the final treatment. (Figures 7, 8, 9, and 10)

### Fixed provisional restoration

If teeth adjacent to implant sites have existing crowns or are to receive crowns as a part of the final treatment, it may be advisable to place a fixed provisional restoration prior to implant surgery. This also provides a viable treatment planning option for proper implant positioning based on the projected final restoration position. (Figures 11, 12, 13, 14, 15, 16, and 17)



**Figure 1** Implants in #7 and #10 positions at 6 weeks healing.



**Figure 2** During the healing period removable temporary partial denture worn during the healing period.



**Figure 3** Removable temporary partial denture in place. The pontics can be relieved to avoid loading the implants at insertion. The pontics can be relined during the healing period as necessary for esthetics.



**Figures 4 and 5** NNI customized titanium abutments in place and torqued to 35 Ncm.



**Figure 6** Final restorations seated.

## Implant supported provisional restoration

Implants may be restored at the time of placement or at the time deemed appropriate for healing by the surgeon. Provisional restorations are utilized to

replace the missing dental unit. Besides filling the space of the missing tooth, the provisional provides missing function, and helps to maintain or guide the healing of the peri-implant soft tissues. The provisional restoration also serves as a blueprint for the technician to fabricate

a final restoration. Timing of the final restoration more and more often occurs much earlier. It is the author's opinion that, in the "Esthetic Zone," immediate restoration is always considered as a definitive choice. Regardless of the timing of restoration the dentist has



**Figure 7** 0.20" sheet resin coping for pontic fabrication.



**Figure 8** Temporary coping with resin seated in restorative space.



**Figure 9** Pontic is polymerized and polished, etched, and adjacent tooth surfaces etched and bond resin applied.



**Figure 10** Composite resin applied and the pontic positioned, cured and polished. Occlusion should be relieved so that there is no contact.



**Figure 11** Pre-treatment view of failing restorations. Patient will lose #8 and #9 and implants will be placed.



**Figure 12** Existing crowns sectioned off and countersink #8 and #9 to allow the surgeon to remove the remnants and place implants at the same time.



**Figure 13** Provisional fabricated and placed utilizing ovate pontics into the countersunk space of #8 and #9.



**Figure 14** Provisional at loading appointment 12 weeks following immediate placement.



**Figure 15** Provisional removed and healing abutments exposed.



**Figure 16** Healing abutments removed showing undeveloped peri-implant space.



**Figure 17** Final restorations after tissue conditioning and final impression.

three options for abutments to support a provisional restoration. The dentist may choose from a solid abutment cemented approach, the synOcta® titanium temporization coping, or the “new” synOcta® temporary meso-structure.

### **The Solid Abutment as a Provisionalization Option**

The simplest option to support an implant provisional restoration would be a cemented option on a solid abutment. For a definitive restoration the abutment

is placed and torqued to 35 Ncm and an impression taken for a final restoration. If the solid abutment is for an immediate restoration the abutment should be hand tightened only. (15-18 Ncm). (Figures 18, 19, 20, 21, 22, and 23)



**Figure 18** Pre-surgical view of orthodontically extruded #9. Goal was to over correct the gingival levels.



**Figure 19** Radiographic appearance prior to extraction. Radiographic template in place. Immediate placement and provisionalization planned.



**Figure 20** Solid abutment in place during the healing period. At final impression the appearance of the peri-implant space formed by the emergence profile provisional.



**Figure 21** Provisional fabricated on 5.5 mm solid abutment.



**Figure 22** Peri-implant space maintained by the emergence profile provisional restoration.



**Figure 23** Final restoration at 1 year.

## **synOcta® Titanium Provisionalization Coping**

At the time a provisional is attached to the implant a machined connection is the most biologically and physiologically satisfactory connection. The synOcta®

titanium screw retained temporary coping has been the standard for some time. This treatment option is performed at chair side or in the laboratory from an implant level impression. This approach provides a superior tissue response when compared to the cemented option, when the implant

is placed deeper in the esthetic zone. The titanium provisionalization coping is still the first choice for multi-unit immediate provisionalization treatments. (Figures 24, 25, 26, 27, and 28)



**Figure 24** synOcta® screw retained titanium provisionalization coping. The coping is shortened, sandblasted and opaqued.



**Figure 25** Laboratory or chairside fabricated screw-retained provisional restoration.



**Figure 26** Screw-retained provisional seated at time of final impression.



**Figure 27** Peri-implant space shaped by the screw retained provisional.



**Figure 28** Final restoration.

## synOcta® Meso-Temporary Abutment

A recent addition to the Straumann line of components is the synOcta® temporary meso abutment. This component provides the quality, stability, and fit of a machined titanium base with a preparable plastic top (PEEK, poly-ethyl-ester-ketone). The

abutment can be tightened up to 35 Ncm. The abutment provides an easily preparable option to deliver a custom fabricated provisional restoration, either cemented or screw retained. It may also be used as a customizable healing abutment in the instance that the implant is not loaded at the time of placement. (Figures 29-49)

## Conclusions

There are many options to provisionalize dental implants. These choices provide flexibility when fabricating a provisional restoration that not only restores function and appearance, but also assists in site development of the soft tissues.



**Figure 29** Pre-treatment radiograph of failing post and core tooth #6. Immediate placement and provisionalization is planned.



**Figure 30** Provisional at 6 weeks healing. Notice that the provisional was kept out of contact.



**Figure 31** The synOcta® temporary meso abutment. The abutment has a titanium seat and a preparable resin top.



**Figure 32** The synOcta® temporary abutment seated, note the tissue blanching as the abutment is seated. The shape of the sub-gingival portion needs to be customized for the patient.



**Figure 33** Abutment placed on analog holder handle.



**Figure 34** Chamfer diamond used to shape the sub-gingival portion of the abutment.



**Figure 35** The sub-gingival portion is flattened from the abutment connection point to the transition point or cementation point of the final restoration.



**Figure 36** The modified abutment placed, note less blanching of the soft tissues than with prior seating of the abutment. The abutment screw also is more easily seated.



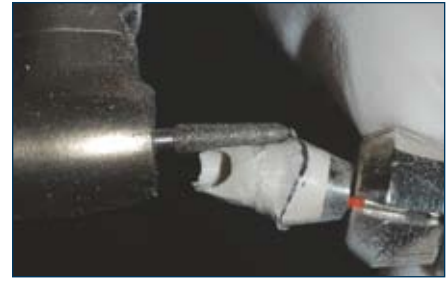
**Figure 37** The abutment is prepared to the free gingival margin similar to preparing a tooth.



**Figure 38** The prepared abutment is removed from the mouth and transferred to the laboratory.



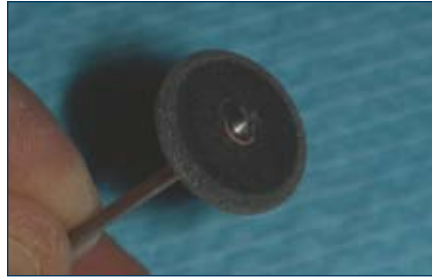
**Figure 39** A line is marked with a ultrafine Sharpie pin 2 mm apical to the prepared margin in the mouth.



**Figure 40** Course diamond instrument is used to move the margin apically 2 mm.



**Figure 41** Exacta rubber discs used for polishing and smoothing metal or resins.



**Figure 42** Exacta rubber wheel mounted on SHP mandrel.



**Figure 43** Rubber wheel smoothing and polishing the sub-gingival and supra-gingival modified surfaces of the abutment.



**Figure 44** Meso temporary abutment seated in mouth. Abutment may be tightened up to 35 Ncm.



**Figure 45** Clearance can be checked with sheet resin coping prior to filling with resin to fabricate the temporary.



**Figure 46** After temporary resin polymerizes the temporary is removed from the mouth. The abutment is also removed and placed on the analog holder and resin added to extend the margin to the prepared finish line.



**Figure 47** Completed and polished provisional restoration.



**Figure 48** Temporary restoration seated in mouth.



**Figure 49** The appearance of the peri-implant tissues conditioned by the temporary restoration during the healing period.



### Jason R. Gillespie, BS, DDS, MS

Dr. Jason R. Gillespie maintains a full-time private practice limited to Prosthodontics in San Antonio, Texas. Dr. Gillespie is a graduate of Baylor College of Dentistry and earned his certificate in Prosthodontics as well as a Masters in Oral Biology from Baylor College of Dentistry, where he currently holds a position as an Adjunct Assistant Professor for the Department of Restorative Sciences.

## The Cantilever: A Viable Restorative Option

Restoring adjacent implants in the anterior region can be a true restorative challenge. Problems encountered include a lack of adequate space, lack of adequate tissue contour and inadequate bone. Many times these problems are related to one another. In areas of limited space, positioning implants with adequate space between restorative platforms can be difficult. This can result in the loss and leveling of crestal bone between implant bodies, which often leads to a soft tissue

deficiency (Figure 1). Guidelines have been suggested to improve the esthetic outcomes of adjacent implants.

To minimize the possible loss of bone between implants Tarnow et al have discussed the effects of inter-implant spacing of implants and its possible role in crestal bone height. Immediate placement of implants has been suggested to reduce the incidence and degree of ridge resorption, which could minimize

the loss of soft tissue support. Some implant designs have attempted to improve the crestal bone height in hopes of maintaining a more ideal position of the papillary tissue. Another possible technique to avoid this potential loss of bone is to have only one implant placed, and use a cantilevered prosthesis.

The two following cases demonstrate the usefulness of the cantilevered restoration in the esthetic zone. Although not an



**Figure 1** Note lack of papilla between the central and lateral.



**Figure 2** Falling teeth 26 and 27 show lack of bone support



**Figure 3** Preop cast measurement of 11.5 mm.



**Figure 4** Implant in site #27, note tissue height #26.



**Figure 5** Solid abutment torqued to 35 Ncm.



**Figure 6** Impression components in proper position.



**Figure 7** Provisional coping ready for vacuum-formed template.



**Figure 8** Provisional coping picked up using bisacrylica resin.



**Figure 9** Soft tissue prevents resin from having ideal contour.

ideal treatment for all situations, it can be a useful alternative should the need arrive.

### Case 1

A 68 year-old female patient with recent history of root-end resections and restorations involving teeth #26 and 27 presented with a buccal hard and soft tissue dehiscence involving the treated teeth (Figure 2). All treatment options

were discussed with the patient and she agreed that both teeth needed to be extracted. However, only one implant was treatment planned for site #27. The concern was the amount of space between #25 and 28, which totaled less than 12 mm (Figure 3). The mandibular lateral incisor would be a cantilevered restoration. The implant was placed and allowed to heal (Figure 4). A 5.5 mm solid abutment was placed and torqued to 35 Ncm without event (Figure 5). An

impression was made and a provisional restoration was fabricated (Figures 6-11). A final restoration was fabricated utilizing an ovate pontic for tooth #26 (Figures 12-13). The restoration was cemented using a resin-reinforced glass ionomer cement. A radiograph was taken to check baseline bone levels and ensure all excess cement has been removed (Figures 14-15). The cantilevered restoration allowed for an improved esthetic result in a limited space situation.



**Figure 10** Flowable composite resin is added to improve contour.



**Figure 11** Provisional restoration is finished and cemented using IRM.



**Figure 12** Final restoration on working cast.



**Figure 13** Note ovate pontic design of #26.



**Figure 14** Final restoration cemented, note tissue height under pontic #26.



**Figure 15** Final radiograph of mesially cantilevered prosthesis.

### Case 2

A 52 year-old female presented with an implant placed in site #6 (Figure 16). There was a severe bone deficit in the area of tooth #7. Implant placement in this site was abandoned due to the

esthetic demands of the patient. The implant position was deep due to a lack of bone relative the surrounding soft tissue. Soft tissue grafts had been completed on two occasions prior to final restorative

procedures. A healing abutment was removed and a synOcta<sup>®</sup> impression was made (Figure 17). A 7 mm solid abutment was placed (Figure 18) to allow for the fabrication of tissue shaping provisional



**Figure 16** Patient presents with implant and provisionals.



**Figure 17** synOcta<sup>®</sup> final impression following tooth preparation.



**Figure 18** A 7 mm solid abutment was hand-tightened for provisionalization.

restorations (Figure 19). A meso-abutment was utilized to allow control of cement lines (Figures 20-23). The abutment was torqued to 35 Ncm without event and a final restoration was cemented (Figures 24-26). A final radiograph was taken for a baseline bone level and to ensure

proper cement removal (Figure 27). The cantilevered restorations allowed for the preservation of the soft tissue in the area of #7, by not disturbing the hard tissue support of the area.

*Special thanks to the surgical expertise of Dr. Eduardo Lorenzana (San Antonio, Texas) and Dr. Farhad Boltchi (Arlington, Texas) and the laboratory support of Jeff Singler, CDT (Dallas, Texas).*



**Figure 19** Newly fabricated provisionals can shape tissue.



**Figure 20** Working cast helps with abutment selection.



**Figure 21** Meso-abutment selected to raise cement line.



**Figure 22** Meso-abutment prepared to allow access to cement lines and note buccal orientation groove.



**Figure 23** Final cantilevered restoration with ovate pontic on meso-abutment.



**Figure 24** Meso abutment is seated and torqued to 35 Ncm.



**Figure 25** Access hole is blocked with cotton prior to cementation.



**Figure 26** Final restoration is cemented with IRM.



**Figure 27** Final radiograph demonstrates severity of bone loss in the area of #7.



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### Bobby Butler, DDS

Dr. Bobby Butler received his undergraduate dental degree from the University of Oklahoma in 1987 and a Certificate in Periodontics from the University of Florida in 1993. He is a Diplomate of the American Board of Periodontology and is on the faculty at the University of Washington School of Dentistry. He is a member of many professional organizations and lectures on a variety of dental topics. He maintains a private periodontal practice in Seattle, WA. His practice emphasis is on aesthetic microsurgical techniques, regenerative therapy and dental implant aesthetics.

## Esthetic Implant Treatment Planning and Therapy Concerns in the Severely Compromised Periodontal Patient

The severely involved chronic periodontitis patient is difficult to address from a cosmetic standpoint. In today's climate it is not enough to arrest periodontal diseases. How do we treat the esthetic deficiencies? The discussion must also include when to retain periodontally compromised teeth and when implants should be considered.<sup>6</sup> In the esthetic zone, the retention of teeth may be more predictable with regard to soft tissue esthetics than implant use.<sup>1,2</sup> This is especially true if we consider adjacent implants.

This patient presented with generalized, chronic periodontitis which was moderate on #3 and severe on #s 4, 8, and 9. The patient had a history of juvenile periodontitis that was diagnosed but untreated many years before. The patient's chief complaint was the protrusive nature of her front teeth and the black space between the teeth. She wanted to improve the cosmetic appearance of her front teeth (Figure 1), and reported that the space had been increasing. She was referred for

the possibility of saving the incisors with periodontal therapy or to replace them with dental implants. The patient presented with advanced horizontal bone loss interproximally between #s 8 and 9 (Figures 2 and 3). Heavy subgingival calculus was present and interproximal probing depths were 8-9 mm. The patient had a Class II malocclusion with a deep overbite.

The patient was advised of the need for periodontal and orthodontic treatment if her esthetic and health concerns were to be corrected. She was advised that, without orthodontic therapy, a satisfactory esthetic result would not be possible. There were 3 treatment options discussed. All involved comprehensive orthodontics. They would include non-surgical periodontal therapy, and orthodontics including extrusion of #s 8 and 9. The possibility was given of keeping the central incisors and then splinting them with crowns.<sup>7</sup> The other two options involved a fixed partial denture or 2 adjacent implants. Tooth extrusion for site development was done and reassessed

as therapy progressed.<sup>5</sup> The patient was given the option of retaining the incisors and not doing implants after they were extruded. The pocket depths around the teeth had decreased to 5 mm on the mesial surfaces. Tooth mobility was between 1 and 2 on a Millers scale. They could have been splinted with crowns. Both options provided an acceptable esthetic result. The most predictable long-term plan was to place implants, which addressed the functional demands of the patient. The patient's goals were to "have a nice smile" and "strong front teeth".

Treatment options are difficult to assess in patients with severe osseous destruction, especially at the midline. Extrusion for site development is not a guarantee that adjacent implants can effectively achieve an esthetic result. Keeping even one tooth will often make the esthetic outcome more predictable.<sup>4</sup> Figures 4 and 5 show another juvenile periodontitis case where we did extrude the teeth and preserve both incisors. In this case mobility and pocket depths decreased dramatically. In the case



Figure 1



Figure 2

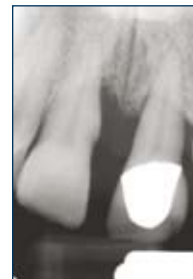


Figure 3

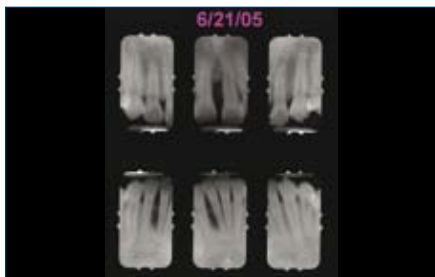


Figure 4



Figure 5

where we placed implants, extrusion and retention of the teeth with splinted crowns may have been a good esthetic choice, but was less predictable from a long-term functional standpoint. The other consideration is the sequencing of implant placement. Should they be placed simultaneously or sequentially? Kan has published on the predictability of sequential placement.<sup>3</sup> We had elected to treat this patient in such a manner before this published paper. Our rationale was the preservation of the soft tissue papillary form. In cases where the

osseous support is limited this approach can prevent some of the papillary and gingival resorption that could occur. In the presented case the patient went through 2 years of orthodontic treatment before the first implant was placed. The incisors were extruded 5-6 mm (Figures 6, 7). The left central incisor was extracted and immediate placement was completed with a Straumann TE implant (Figures 8, 9, 10). After 3 months, the implant was provisionalized (Figure 11). Special attention was paid to keep the emergence profile of the implant

provisional restoration flat on the facial aspect to avoid even excessive recession. The right central incisor was extruded further at this point to decrease the mesial infrabony defect which was present (Figure 12). The right central incisor implant was placed immediately (Figure 13). Both implants were 10 mm 3.3 x 4.8 TE implants. A substantial facial concavity and large incisive canal were present. The TE implants were ideal in dealing with these anatomical limitations. In both sites customized healing abutments were made to preserve the peri-implant soft tissue form (Figure 14).



Figure 6



Figure 7



Figure 8



Figure 9



Figure 10



Figure 11



Figure 12



Figure 13



Figure 14

Orthodontic Extrusion did develop a much more favorable osseous profile for the implants, as well as a better crown to root-ratio (Figure 15). It did not develop the osseous crest to where it was before the patient had juvenile periodontitis. With adjacent implants the osseous levels are never ideal. There is also always some papillary resorption (Figures 16, 17). With proper emergence profiles and with appropriate treatment sequencing, soft tissue recession can be controlled. In this case, some facial rebound did occur on the left incisor (Figure 18) within the two years after restorative treatment. If the implant had been placed more facially, or the crown had a greater cervical convexity, this would not have occurred.

The final result demonstrates stable excellent and osseous crest levels around the implants (Figure 19). The papillary levels are cosmetic and the patient is happy with the results. Retaining the teeth may have resulted in slightly better papillary levels, but not in a stronger functional result. There may be several treatment strategies that are acceptable in any patient. We must weigh many factors including our patient's desires. In this case the prognosis of the implants is excellent, and the patient's esthetic concerns have been addressed.

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Figure 15



Figure 16



Figure 17



Figure 18



Figure 19



### Ira N. Dickerman, CDT

Mr. Ira N. Dickerman received his AAS in dental laboratory technology from Middlesex Community College in 1977. Ira has lectured to countless implant study groups over the years and has participated in the training of many restorative dentists in implant reconstruction. From single teeth to full arch milled bar reconstructions, he has treatment planned the restoration of 1000's of implant units and reconstructions.

## Temporization of the Straumann® Dental Implant System

The Straumann® Dental Implant System lends itself to temporization through a variety of prosthetic modalities. These can range from the simplistic and straightforward solid abutment system to the more sophisticated synOcta® technique. It is interesting to note that there is a dramatic contrast between the restorative techniques of the North American vs. European dental communities. In North America the solid abutment technique is still the prosthetic abutment of choice in the highest percentage of Straumann dental implant restorations. In contrast, the European Community embraces the synOcta® more often.

Perceived as less difficult, the solid abutment requires selection and placement prior to final impressing. At this point we are presented with two choices for covering the solid abutment during the laboratory phase. We can simply use the original plastic protection cap cemented on the solid abutment to prevent the patient from irritation to their tongue/lips etc. This is cemented with

temporary cement, and needs to be checked so that it is not in occlusion. The second solid abutment provisionalization option is fabrication of a functional temporary utilizing the plastic temporary cap. This is designed for both Regular Neck 4.8 mm and Wide Neck 6.5 mm implants and is engaging for single units and non-engaging for multi unit applications. The doctor fabricates these temporaries directly in the patients' mouth. If time allows he (or she) has the additional option of working on a poured cast. These caps are fabricated from plastic compatible for joining with methyl methacrylate based resins. Composite resin type materials (Luxatemp, etc.) may be utilized on the copings but mechanical retention is required. They will not bond to the component.

synOcta® presents us with a very different set of options. The synOcta® modality is designed to delay abutment selection until prosthesis fabrication. This allows the restorative doctor to maintain a minimum inventory of components. After the synOcta® implant level impression is taken, temporization options are as follows.

Do nothing. In non-esthetic situations the patient is maintained with the healing caps in his (her) implants. They leave the appointment the way they arrived. In esthetic situations where tissue control is imperative, the new RN synOcta® Peek Meso Abutment is employed. This abutment has a titanium implant interface and a Peek (plastic) superior portion designed for easy customization chairside. Diamonds or carbides are employed to adjust the margin position. This is a significant asset, especially in esthetic areas where there are scalloped tissues. The emergence profile angle may also be adjusted, allowing the restorative practitioner ultimate control. The abutment engages the octa in the RN 4.8 mm implant. (It is not available for the 6.5 mm WN implant.) A cemented restoration is fabricated to fit the prepared Meso Abutment. The temporary is fabricated with conventional techniques. (Direct Build Up, Compression, or Pre-form Ion Crowns), and cemented with temporary cement.

When the choice of temporization is



Figure 1



Figure 2



Figure 3



Figure 4



Figure 5



Figure 6

screw retained, aluminum components are utilized, which are available as RN, WN, Engaging or Non-Engaging. This is done with the most control in the laboratory setting. Full arch temporaries can be made

this way. We can utilize denture teeth for a temporary hybrid prosthesis or tooth colored plastic/composite materials for porcelain fused to metal treatment plans. The Straumann® Dental Implant System

affords us a complete range of temporary restorative options: the choice is yours.



Figure 7



Figure 8



Figure 9



Figure 10



Figure 11

## Preservation of Alveolar Ridge Dimensions Following Tooth Extraction: Evidence from Controlled Clinical Trials

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

Lekovic V, Kenney EB, Weinlaender M, Han T, Klokkevold P, Nedic M, Orsini M. **A bone regenerative approach to alveolar ridge maintenance following tooth extraction. Report of 10 cases.** *J Periodontol* 1997; 68:563-570.

Lekovic V, Camargo PM, Klokkevold PR, Weinlaender M, Kenney EB, Dimitrijevic B, Nedic M. **Preservation of alveolar bone in extraction sockets using bioabsorbable membranes.** *J Periodontol* 1998; 69:1044-1049.

Iasella JM, Greenwell H, Miller RL, Hill M, Drisko C, Bohra AA, Scheetz JP. **Ridge preservation with freeze-dried bone allograft and a collagen membrane compared to extraction alone for implant site development: a clinical and histologic study in humans.** *J Periodontol* 2003; 74:990-999.

Zubillaga G, Von Hagen S, Simon BI, Deasy MJ. **Changes in alveolar ridge height and width following post-extraction ridge augmentation using a fixed bioabsorbable membrane and demineralized freeze-dried bone osteoinductive graft.** *J Periodontol* 2003; 74:965-975.

Lekovic V, Kenney EB, Weinlaender M, Han T, Klokkevold P, Nedic M, Orsini M. **A bone regenerative approach to alveolar ridge maintenance following tooth extraction. Report of 10 cases.** *J Periodontol* 1997; 68:563-570.

The purpose of this study was to quantify bone changes in the alveolar ridge following treatment of extraction sockets with a surgical technique based on the principles of guided bone regeneration (GBR). Ten patients who required extraction of at least two anterior teeth participated in the study. Using a split mouth design, experimental sites were treated with an expanded polytetrafluorethylene (e-PTFE) membrane for GBR while control sites did not receive any membrane. Flaps were advanced as to achieve primary wound closure on experimental and control sites. Bone measurements (vertical resorption of the buccal plate, horizontal ridge resorption, and internal socket fill) were taken using a titanium pin placed on the external surface of the buccal bony wall as a fixed reference point. Measurements were taken at the time of the extraction and at 6-month re-entry surgeries. Results showed that 70% of the membranes remained submerged during the 6-month experimental period while 30% became exposed to the oral environment. In cases where membranes did not become exposed, experimental sites presented with 23% less vertical resorption of the buccal plate (6-month measurements were  $2.29 \pm 0.29$  mm on experimental sites and  $1.46 \pm 0.26$

mm on control sites), 34% less horizontal ridge resorption (6-month measurements were  $5.57 \pm 0.57$  mm on experimental sites and  $2.57 \pm 0.53$  mm on control sites), and 25% more internal socket fill (6-month measurements were  $1.29 \pm 0.50$  mm on experimental sites and  $3.14 \pm 0.67$  mm on control sites) than control sites. These differences were statistically significant. Bone changes observed in experimental sites where membranes were exposed in the course of healing did not reveal significant differences from control sites. It was concluded that the use of e-PTFE membranes for GBR is effective in preserving alveolar ridge dimensions following tooth extraction. Membrane exposure in the course of healing negatively impacts GBR results.

Lekovic V, Camargo PM, Klokkevold PR, Weinlaender M, Kenney EB, Dimitrijevic B, Nedic M. **Preservation of alveolar bone in extraction sockets using bioabsorbable membranes.** *J Periodontol* 1998; 69:1044-1049.

The purpose of this study was to evaluate the clinical effectiveness of a bioabsorbable membrane made of glycolide and lactide polymers in preserving alveolar ridge dimensions following tooth extraction based on the principles of guided bone regeneration (GBR). This study used a similar protocol to the one reported above. Sixteen patients requiring two extractions of anterior teeth or bicuspid participated in this split-mouth design study. Following elevation of buccal flaps, teeth were extracted and experimental sites were treated

with a membrane made of glycolide and lactide. Control sites did not receive any membrane. Flaps were advanced to achieve primary wound closure on experimental and control sites. Titanium pins placed on the external surface of buccal bony walls were used as fixed reference points for the following measurements: vertical resorption of the buccal plate, horizontal ridge resorption, and internal socket fill. Measurements were taken at the time of the extraction and at 6-month re-entry surgeries. Results showed that none of the experimental sites presented with membrane exposure in the course of healing. Experimental sites presented with 33% less vertical resorption of the buccal plate (6-month measurements were  $2.81 \pm 0.19$  mm on experimental sites and  $1.81 \pm 0.19$  mm on control sites), 43% less horizontal ridge resorption (6-month measurements were  $6.06 \pm 0.17$  mm on experimental sites and  $2.94 \pm 0.19$  mm on control sites), and 25% more internal socket fill (6-month measurements were  $1.06 \pm 0.17$  mm on experimental sites and  $3.00 \pm 0.18$  mm on control sites) than control sites. These differences were statistically significant. This study suggests that treatment of extraction sockets with membranes made of glycolide and lactide polymers is valuable in preserving alveolar bone in extraction sockets and preventing alveolar ridge defects.

Iasella JM, Greenwell H, Miller RL, Hill M, Drisko C, Bohra AA, Scheetz JP. **Ridge preservation with freeze-dried bone allograft and a collagen membrane compared to extraction alone for implant site development: a clinical**

and histologic study in humans. *J Periodontol* 2003; 74:990-999.

This study was conducted to assess the effectiveness of a treatment consisting of a combination of a bone allograft and an absorbable membrane in preserving ridge dimensions following tooth extraction. Twenty-four subjects requiring extraction of one anterior tooth or bicuspid participated in this parallel design clinical trial. Following elevation of a buccal full thickness flap and extraction of the teeth, experimental sockets were filled with a tetracycline hydrated freeze-dried bone allograft and covered with a collagen membrane. Control sites did not receive either the bone allograft or the membrane. Flaps were sutured at their original position with no attempt being made to achieve primary closure of the flap. The vertical dimension of the ridge was measured using an acrylic stent as reference while the horizontal dimension of ridge was taken with a digital caliper. Measurements were taken at baseline and at six months post-operatively during re-entry surgeries. Experimental sites presented with 1.4 mm (16%) less horizontal resorption of the alveolar ridge and with 2.2 mm more alveolar ridge height than control sites. These differences were statistically significant. The results of this study suggest that a combination of a bone allograft and a collagen membrane improve alveolar ridge height and width dimensions following tooth extraction compared to extraction alone.

Zubillaga G, Von Hagen S, Simon BI, Deasy MJ. **Changes in alveolar ridge height and width following post-extraction ridge augmentation using a fixed bioabsorbable membrane and demineralized freeze-dried bone osteoinductive graft.** *J Periodontol* 2003; 74:965-975.

The purpose of this study was to determine the dimensional changes and the effect of membrane stabilization (vs. non-stabilization) on post-extraction bone grafting. Eleven extraction sites were treated with demineralized freeze-dried bone (DFDBA) and covered with bioabsorbable membranes. Five membranes were stabilized with bioabsorbable tacks. Complete full thickness flap closure was achieved. The sites were classified as "grafted" or "augmented." Grafted sites were so defined if the sockets were found to be intact with grafting to the height of the existing walls (<1 mm increase in GBR height). Augmented sites were those without intact walls, requiring supplemental grafting to achieve a width of  $\geq 6$  mm (>1 mm increase in GBR height). In some cases, this meant an increase in height as well as width. Five cases showed membrane exposure during the healing period. Measurements

of alveolar height and width were taken at pre-determined points immediately after extraction, guided bone regeneration (GBR), and four months post-operatively. After four months healing, mucoperiosteal flaps were reflected. Measurements of width and height were taken at the mesial, center, and distal at distances of 3 mm and 5 mm from the alveolar crest. Ridge height measurements were taken from a fixed point (stent). Net gain or loss was expressed in terms of both distance in millimeters and percentage. The combined width measurements at 3 mm of the grafted sites showed a net loss of 1.8 mm or -17.72% of original ridge width. For augmented sites, the results were a net loss of 0.54 mm or 7.7% of ridge width. At 5 mm, the grafted sites showed a net loss of 1.6 mm or 15.91% of ridge width. The augmented sites demonstrated a net gain of 0.2 mm or 2.56%. Combined height measurements for the grafted sites showed a net loss of 0.9 mm or 7.7%, whereas the augmented sites demonstrated a net gain of 0.1 mm, however 2.7 mm or 96.29% of the grafted bone intended to increase alveolar height was lost. Sites with tacked membranes, when compared to the non-tacked, showed less loss of augmented bone width but more loss of bone height. Membrane exposure did not seem to effect outcome. The authors of this study concluded that treating extraction sockets with DFDBA grafts and bioabsorbable membranes failed to preserve or augment alveolar ridge height or width after a 4-month healing period. Virtually all of the augmented graft was lost and there was additional loss into the 3 mm zone. They hypothesized that the gelatin carrier in the bone graft material might be responsible for the disappointing results.

### Discussion

Alveolar bone resorption is a common consequence of tooth extraction and it poses a clinical problem in two different ways: it creates an esthetic problem for the fabrication of conventional or implant-supported prostheses and it can make the placement of dental implants difficult or sometimes impossible. Therefore, preservation of alveolar bone dimensions following tooth extraction is desirable.

The controlled clinical trials described above provide solid evidence supporting the concept that techniques aimed at alveolar ridge preservation following tooth extraction are effective in doing so as compared to untreated controls. The first two abstracted studies by Lekovic and co-workers showed that a surgical technique utilizing non-absorbable or absorbable membranes for guided bone regeneration (GBR) in a submerged fashion (combined with flap advancement) resulted in not only statistically but also clinically significant

bone preservation results. For instance, 6-month horizontal ridge measurements were 5.57 mm in sockets treated with e-PTFE membranes and 6.06 mm in sockets treated with a membrane made of glycolide and lactide polymers while the horizontal ridge measurements for their respective controls were 2.57 mm and 2.94 mm. If it is taken into consideration that the average standard implant diameter is approximately 4 mm, treatment of extraction sockets with GBR may determine whether a straight forward implant therapy that does not require further bone augmentation is possible or not.

The study by Iasella and co-workers showed that a combination of a bone allograft and a collagen membrane for GBR used in a non-submerged fashion is also effective in preventing resorption of the alveolar ridge. Given the study design where control sites did receive neither the membrane nor the bone allograft, it is not possible to determine the role played by either of the two treatment components in the results observed. The benefits observed in experimental sites of the study by Iasella and co-workers are of similar magnitude to the ones observed in the experimental sites of the two studies conducted by Lekovic and co-workers. While comparisons between studies should be interpreted with caution, they are suggestive of the fact that the combination of a bone allograft to the GBR procedure may not improve the outcome of GBR alone.

Zubillaga and co-workers also showed that a combination of a bone allograft and a collagen membrane for GBR used in a submerged fashion is also effective in the maintenance of alveolar ridge dimensions following tooth extraction. The re-entry measurements observed by Zubillaga and co-workers were of similar magnitude to the ones recorded in the experimental sites of the other three studies herein described. The study by Zubillaga and co-workers did not involve controls and the authors concluded that the alveolar ridge would always lose dimensions following tooth extraction despite utilization of preservation procedures. However, data from control sites of the first three studies described above show that the loss in alveolar ridge dimensions in the absence of preservation procedures is significantly greater.

In summary, these four studies provide evidence to recommend alveolar ridge maintenance procedures following tooth extraction. The benefits observed appear to be similar for the various materials and surgical techniques utilized. However, more studies directly comparing various materials and surgical techniques are necessary to determine the optimal treatment modality.

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