c.e. article
Utilizing the Tempcap abutment with CAD/CAM

events
Academy of Osseointegration heads to Tampa

industry
Implant position in the esthetic zone
Stay on top of new techniques, products with *implants*

Thanks to rapidly advancing technology, the field of implant dentistry is always changing and evolving. Clinicians must be vigilant in their efforts to keep up with new techniques, new products and new technology that could affect treatment planning.

And that’s what makes the publication you are holding right now so valuable.

For this issue of *implants*, we’ve assembled a collection of articles from a variety of respected names and companies in dentistry. These expert clinicians are sharing their first-hand knowledge and expertise with you. In this issue, you can read about utilizing the Tempcap abutment with CAD/CAM, and you can also learn about the lateral antrostomy technique for maxillary sinus augmentation. We also have news on implant events and products.

But there’s more.

Every issue of *implants* magazine also contains a C.E. component. By reading the set of articles (beginning on Page 6) on “Utilizing the Tempcap abutment with CAD/CAM” by Dr. Kalman and “Lateral antrostomy technique for maxillary sinus augmentation” by Drs. Batal and Norris and then taking short online quizzes about these articles at [www.DTStudyClub.com](http://www.DTStudyClub.com), you will gain one ADA CERP-certified C.E. credit.

Keep in mind that because *implants* is a quarterly magazine, you can actually chisel at least four C.E. credits per year out of your already busy life without any more lost revenue and time away from your practice.

To learn more about how you can take advantage of this C.E. opportunity, visit [www.DTStudyClub.com](http://www.DTStudyClub.com). Annual subscribers to the magazine ($50) need only register at the Dental Tribune Study Club website to access these C.E. materials free of charge. Non-subscribers may take the C.E. quiz after registering on the DT Study Club website and paying a nominal fee.

I know that taking time away from your practice to pursue C.E. credits is costly in terms of lost revenue and time, and that is another reason *implants* is such a valuable publication.

I hope you enjoy this issue and that you get the most out of it.

Sincerely,

Torsten Oemus
Publisher
An affordable implant solution to grow your referral base

**INCLUSIVE**
TOOTH REPLACEMENT SOLUTION

Inclusive custom healing abutment at implant placement

Contoured soft tissue suicus after healing

Inclusive®
It's everything you and your referring dentist need for the perfect implant case.

$695* Includes everything you need to restore a missing tooth

Simple, Convenient, Affordable

Implant surgeons are increasingly looking for new and unique ways to be more restoratively driven and better support their referring dentists on the crown & bridge side of treatment. Glidewell’s new Inclusive Tooth Replacement Solution was designed to support this paradigm shift by providing everything that a restoratively driven surgeon needs to ensure success for his referring dentists. Reward your referring doctors with all lab costs for the final abutment & crown restoration pre-paid.

**NOW COMPATIBLE WITH MORE IMPLANT SYSTEMS — OPEN PLATFORM**

- Astra Tech
- OssecSpeed
- Biomet 3i Certain
- Nobel Biocare
- Branemark System
- Nobel Biocare® NobelActive®
- NobelReplace®
- Straumann® Bone Level
- Zimmer® Screw-Vent

In the event that your implant needs replacement, we include a backup inclusive Tapered Implant and final drill for your peace of mind.

*Price does not include shipping or applicable taxes. 
# Not a trademark of Glidewell Laboratories.

FOR MORE INFORMATION
888-786-2177
www.glidewelldental.com

GLIDEWELL LABORATORIES
Premium Products - Outstanding Value
**c.e. articles**

06  Utilizing the Tempcap abutment with CAD/CAM
    _Les Kalman, DDS_

12  Lateral antrostomy technique for maxillary sinus augmentation
    _Hussam Batal, DDS, DMD, and Olena Norris, DDS_

**events**

24  The Academy of Osseointegration heads to Tampa

**industry**

28  Implant position in the esthetic zone
    _Siarnak Abai, DDS, MMedSc_

**about the publisher**

33  submissions
34  imprint
Abutments as individual as your patients

Available for all major implant systems and in your choice of titanium, gold-shaded titanium and four shades of zirconia, ATLANTIS™ patient-specific CAD/CAM abutments help to eliminate the need for inventory management of stock components and simplify the restorative procedure.

ATLANTIS BioDesign Matrix™
The four features of the ATLANTIS BioDesign Matrix™ work together to support soft tissue management for ideal functional and esthetic results. This is the true value of ATLANTIS™ for you and your patients.

ATLANTIS YAD™
Designed from the final tooth shape.

Natural Shape™
Shape and emergence profile based on individual patient anatomy.

Soft-tissue Adap™
Optimal support for soft tissue sculpturing and adaptation to the finished crown.

Find out how ATLANTIS™ can bring simplicity and esthetics to your practice. Just take an implant-level impression, send it to your laboratory and ask for ATLANTIS today.

Custom Connect™
Strong and stable fit — customized connection for all major implant systems.

DENTSPLY IMPLANTS
800-531-3481 • www.dentsplyimplants.com
Utilizing the Tempcap abutment with CAD/CAM

Abstract

The E4D in-office CAD/CAM unit has been employed in an investigative laboratory study to design and mill an unconventional IPS e.max restoration that would be coupled with the Tempcap as a final implant-supported crown. The combination of the Tempcap, in-office CAD/CAM procedures and e.max allows the clinician to create an immediate final restorative product with ideal characteristics.

Introduction

The temporization of a dental implant following surgery, particularly in the anterior region, is a necessary procedure. The temporization allows for surgical healing, preservation of the gingival architecture and, most important, replacement of a tooth in the edentulous space for patient acceptance. Several techniques for the temporization exist, but the process has proved to be time-consuming and frustrating. The Tempcap abutment and the process for temporization were created to provide a simple yet effective approach. With the advent of CAD/CAM technology and e.max, the potential of the Tempcap to act as a final abutment seemed likely and suitable for investigation.
mize healing and osseointegration of the implant body to bone:
• Minimal forces, if any, should be exerted on the implant body, permitting proper healing and preventing a non-osseous union.\(^2\)
• The gingival architecture must be managed meticulously to prevent contamination, minimizing the risk of peri-implantitis and possible failure.\(^3\)
• There must be sufficient time for the process of osseointegration.\(^4\)
• Temporization and immediate restorations should not violate these factors.\(^5\)

The Tempcap (Research Driven, Ontario, Canada) is a healing cap and restorative platform combined (Fig. 1). It has an all-metal construction, and it contains two to three retentive pin projections (Fig. 2). Tempcap is available in different widths and heights to accommodate different implant sizes (Fig. 3) and is compatible with existing instrumentation (Figs. 4).

The function of the Tempcap is:
• to allow for optimal gingival healing
• prevent contamination of the surgical field
• minimize forces and micro-vibrations on the implant
• facilitate the simple yet successful restoration of the implant (Fig. 5).

CAD/CAM stands for computer-aided design and computer-aided manufacturing. CAD enables the individual to digitally capture an image of a prepared tooth or structure and then design an indirect (out of the mouth) restoration by using software.\(^6\)

After the ideal restoration has been produced, the design is then fabricated out of a material by a milling machine. In-office E4D units (D4D Technologies) are currently available to allow for immediate chairside fabrication without the use of a commercial laboratory.

IPS e.max (Ivoclar Vivadent) is a relatively new metal-free dental material used in indirect restorations. It is an esthetic material composed of lithium disilicate and has ideal physical and esthetic properties, allowing it to be the first choice for CAD/CAM restorations. IPS e.max has strength second only to gold and has the ability of detailed CAM production.\(^7\)

**Methodology**

The Tempcap was selected and placed on an Ankylos (DENTSPLY) implant body (master cast with soft tissue) (Fig. 6). Digitization was achieved by using an E4D camera (Fig. 7), in which several images were captured to compile an accurate image (Figs. 8 and 9). CAD design was used with E4D software to determine and delineate margins (Fig. 10).
Tooth design was initiated incorporating several parameters:

- ideal esthetics and emergence profile (Fig. 11)
- adequate proximal contacts
- appropriate occlusal scheme
- material thickness requirements
- internal surface morphology to adapt to Tempcap
- design that can be milled via CAM technology

Numerous design iterations were required to achieve the desired design requirements (Figs. 12-14). IPS e.max was selected for milling (Fig. 15) and was executed by an E4D CAM unit (Fig. 16). Milling limitations, such as bur contact and prosthesis fracture, required CAD design modifications. Reiterations in CAD/CAM design were carried out until a successful restoration was achieved (Fig. 17).

The unfired IPS e.max crown was tried for fit and esthetics and then subsequently fired (Fig. 18), resulting in its color change. The crown was further stained, glazed and fired (Fig. 19), resulting in a highly esthetic final restoration (Fig. 20). The restoration’s internal aspect (Fig. 21) was assessed
for path of insertion, retention and fit.

The IPS e.max prosthetic crown was further assessed for fit, taking into account marginal fit, occlusion and proximal contacts (Fig. 22).

A secondary investigation utilized a more complex Tempcap to assess the limit of the CAD/CAM unit's capability. A stand-alone Ankylos (DENTSPLY) implant body was coupled with a Tempcap abutment with three retentive pin projections (Fig. 23). The abutment was digitized with the same methodology as described. An IPS e.max crown was executed and assessed (Figs. 24 and 25).

_discussion_

This study has determined that the Tempcap can be successfully and accurately digitized and milled by in-office CAD/CAM technology (D4D Technologies) to create an ideal prosthetic crown from IPS e.max within a laboratory setting. CAD software can be manipulated to generate forms beyond the scope of the unit.

Complex units, such as the three-pronged Tempcap may be successfully designed and milled. IPS e.max has the capability to be milled in com-
plex patterns, while still maintaining its structural integrity. However, further laboratory studies, quantitatively assessing stresses and strengths and utilizing a larger sample size, are required to validate the concept. Subsequent clinical investigations are required to assess the clinical significance and viability of the Tempcap with CAD/CAM technology. The potential to fabricate the Tempcap entirely from e.max should also be considered.

Conclusions

In-office CAD/CAM technology can be utilized and manipulated to generate digitized forms beyond the scope of the morphogenesis. CAM manufacturing has limiting factors that must be realized when producing modified prostheses. CAD modifications must account for these discrepancies. IPS e.max has the ability to be milled in extremely detailed designs.
The Tempcap can be optically scanned and digitized in order to design and create a CAD/CAM IPS e.max restoration using E4D technology. The utilization of the Tempcap as a successful provisional abutment has been documented; the utility of the abutment as a simple, efficient and cost-effective component seems promising. These advances simplify the procedure and reduce the cost, ultimately allowing a greater accessibility for both patients and clinicians.

Editorial disclaimer: Dr. Les Kalman is the co-owner of Research Driven and the inventor of the Tempcap.

References

Les Kalman, DDS, graduated from the University of Western Ontario with a doctor of dental surgery degree in 1999. He then completed a GPR at the London Health Sciences Centre. He has been involved in general dentistry within private practice since 2000. He has served as the chief of dentistry at the Strathroy-Middlesex General hospital. In 2011, he transitioned to full-time academics as an assistant professor at the Schulich School of Medicine and Dentistry. Kalman is also the coordinator of the Dental Outreach Community Services (DOCS) program, which provides free dentistry within the community.

Kalman has authored articles ranging from pediatric impression to immediate implant surgery in both Canadian and American journals. He has been a product evaluator for several companies, including GC America and Clinician’s Choice. Kalman is the co-owner of Research Driven Incorporated, a company that deals with intellectual property development. His most recent dental product invention has been featured on the W Network’s “Backyard Inventors” television series.

Kalman is a member of the American Society for Forensic Odontology, International Team for Implantology, Academy of Osseointegration, American Academy of Implant Dentistry and the International Congress of Oral Implantology, where he has been recognized with master distinction. He can be contacted at (519) 661-2111, ext. 86007, lkalman@uwo.ca or through www.researchdriven.ca.
Lateral antrostomy technique for maxillary sinus augmentation

Authors: Hussam Batal, DDS, DMD, and Olena Norris, DDS

Implant dentistry has become an integral treatment modality in dentistry and is to be considered a viable option in the restoration of partially edentulous maxillary arches. However, when presented with a deficient maxillary alveolar ridge, placement and/or longevity could be jeopardized without proper treatment. Maxillary sinus augmentation has shown to be a successful treatment option for restoration of anatomic deficiency in the posterior maxilla; this article will review the lateral antrostomy technique.

History

Lateral antrostomy technique was first described by Tatum in 1976, first published by Boyne and James in 1980, and is commonly referred to as lateral antrostomy approach to the maxillary sinus floor. Currently, this method has become a common surgical technique, as it allows regeneration of bone in the posterior maxilla.

The primary procedural approach involves surgical access through the lateral wall of the zygomatic buttress of the maxilla followed by elevation of the sinus membrane and placement of bone-grafting material.

An alternative approach, advocated by Summers, is the crestal or “osteotome” technique. This procedure is less invasive, with reduced healing and overall treatment time; however, it is site specific and allows for only limited augmentation.

Anatomy

The maxillary sinus is a pyramidal-shaped cavity with four walls with the base facing the lateral nasal wall, the apex extending to the zygomatic buttress and the anterior extending to canine and premolar area. The average dimension of an adult sinus is 2.5-3.5 cm in width, 3.6-4.5 cm in height and 3.8-4.5 cm in depth; with an approximate volume of 12-15 cubic cm. Blood supply to the maxillary sinus is derived from the posterior superior alveolar, infraorbital, greater palatine arteries and terminal branches of the internal maxillary artery. The extent of pneumatization varies from person to person and increases with age.

The maxillary sinus is lined with the sinus membrane, also known as Schneiderian membrane, which, like the rest of the respiratory tract, consists of thin pseudo stratified ciliated columnar epithelium. The membrane is continuous with the nasal epithelium through the ostium of the middle meatus with a thickness of approximately 0.8 mm. Antral mucosa is thinner and less vascular than the respiratory mucosa. Nerve supply to the sinus is derived from the superior alveolar branch of the maxillary (V2) division of the trigeminal nerve.

This article qualifies for C.E. credit. To take the C.E. quiz, log on to www.dtstudyclub.com. Subscribers to the magazine can take this quiz for free and will be emailed an access code after the magazine’s release. If you do not receive the code, please write to support@dtstudyclub.com. Non-subscribers may take the quiz for $20. You can access the quiz by using the QR code below.
Proper function of the maxillary sinus depends on the balance of mucous production, transport via ciliated epithelium and adequate drainage through the ostium. There are local conditions that affect sinus function; they might be reversible or irreversible. Irreversible conditions include malignant or benign tumors of the naso-maxillary region; these are contraindications for sinus augmentation. Reversible conditions can be treated prior to sinus augmentation, one example being the narrowing of the osteomeatal complex that could compromise sinus drainage.

Additional reversible conditions include sinus disease, such as polyps or mucous retention cysts. Bacterial sinusitis with air fluid level should always be treated prior to sinus augmentation. The majority of these conditions are treated with medical or endoscopic sinus surgical procedures. Cone-beam computerized tomography (CBCT) scan prior to sinus augmentation is strongly recommended but not considered mandatory. A CT scan yields information regarding pathology in the sinus or chronic sinusitis and is used for precise location of the lateral approach to the maxillary sinus cavity. A common finding on CT scan, especially in smokers, is mucosal thickening; this condition is not considered contraindication to sinus augmentation.

Patient evaluation

Patients referred for posterior maxilla implant placement with concomitant sinus surgery should be assessed for possible general risk factors such as allergic rhinitis, history of chronic or recurrent sinusitis (multiple infections lasting more than four weeks or four episodes of acute sinusitis in the previous 12 months). Chronic use of nasal steroids or vasoconstrictors, chronic nasal obstruction or rhinorrhea, chronic hyposmia or hypogeusia are also to be assessed.

Previous treatment of head and neck neoplasms, radiotherapy to head and neck region and other co-morbidities, including immune-deficiencies, active bone disease (fibrous dysplasia, Paget’s disease, osteomyelitis), cystic fibrosis, asthma and chronic pulmonary disease should all be included in overall assessment. CT scans can aid in determination of sinus anatomy and pathology. A thorough intraoral exam should be performed to evaluate general dental pathology, inter-ridge space and alveolar ridge contour/width.

Technique

Lateral antrostomy technique is performed superior to the residual alveolar bone. Treatment initiates with the administration of a single preoperative dose of systemic antibiotic (Amoxicillin, clindamycin or levaquin) and Chlorhexidine 0.12 percent rinse. Local anesthesia is achieved by maxillary vestibular infiltration and middle/posterior superior alveolar nerve block (V2). Ideally, a mid-crestal or a slightly palatal incision performed, leaving at least 3 mm of attached tissue on the facial aspect of the incision,
with anterior and posterior vertical release. These vertical incisions should be at least 5 mm away from the planned osteotomy (Fig. 1). Full-thickness mucoperiosteal flap is then raised and the lateral aspect of the maxillary sinus is exposed.

The design of the antrostomy is based on the outline of the sinus on the CT scan, which also aids in determining the thickness of the lateral wall of the antrum, position of the antral floor from the crest of the ridge, relationships to the teeth (if present) and the presence of septa. Palatal transillumination can also aid in establishing the outline of the maxillary sinus (Fig. 2). Osteotomy can be performed using conventional rotary instruments at 800–50,000 rpm with irrigation for cooling. However, ultrasonic hand-pieces are preferred to conventional rotary instruments in order to decrease the risk of membrane perforation. Bone thinning is accomplished utilizing light pressure under copious cooling irrigation. Regardless of the instrumentation used to create the osteotomy, there are generally two techniques to create the lateral window: the “trap door” approach and the “access hole” approach (Figs. 3, 4).

Osteotomy should follow the outline of the sinus and should not be more than 3 mm away from the floor (Fig. 5); greater distances decrease the ability of hand-eye coordination and increase the chance of membrane perforation. The corners of the access window are usually round rather than at right or acute angles, as sharp corners increase the risk of membrane perforation when a trap-door approach is used.

The window should be large enough to allow access for instrumentation. If a trap-door approach is used, the height of the osteotomy should not exceed the width of the sinus, allowing for final horizontal positioning of the new floor. Upon thinning of the bone, a bluish hue of the membrane should be noted. Curettes are used to carefully elevate the sinus membrane and should always be maintained on the bony floor or sinus walls to avoid membrane perforation.

The sequence of membrane elevation is from the sinus floor, toward the posterior wall, then superior wall and finally to the anterior wall (Fig. 6a). The membrane should be elevated from the medial sinus wall to allow for optima graft placement (Fig. 6b); use of an iodophor gauze strip soaked in 2 percent Lidocaine with 1:100,000 epinephrine left in the space for five minutes minimizes bleeding and allows for better visualization before further dissection (Fig. 7).
The space created after sinus membrane elevation is grafted with optional materials (Fig. 8a). A collagen resorbable membrane is used to cover the window (Fig. 8b) and the mucoperiosteal flap is then repositioned and sutured. The presence of antral septa can create additional difficulty at the time of surgery; incidence of septa is approximately 30 percent and configuration is variable.

The use of CT scans prior to sinus graft surgery allows for additional information regarding the configuration of the septa and potential modification of the procedure depending on the location of the septa. Double window antrostomy approach is preferred in the presence of septa, with one window anterior to the septa and one posterior, elevating the sinus membrane from the lateral walls and above the septa (Fig. 9).

Post-operatively, patients are given a seven-day course of antibiotic (500 mg Amoxicillin three times per day, 500 mg Levaquin per day or 300 mg Clindamycin four times per day), Chlorhexidine 0.12 percent rinse (twice daily) and sinus precautions for a week, especially if sinus perforation was noted. Patients with history of chronic sinusitis could benefit from the use of nasal decongestants (Oxymetazoline 0.05 percent and sodium chloride 0.65 percent). The graft should be left to heal for a minimum of four to nine months, dependent on the type of grafting material used. In cases of simultaneous implants and sinus augmentation, the sinus membrane should be elevated prior to starting the implant osteotomy.

Prior to placement of the implant, the medial and anterior aspect of the sinus should be grafted (Fig. 10).

Success rate

Variables that affect success rate of implants in combination with sinus floor elevation include implant surface, type of bone graft, residual height of
bone, sinus membrane perforation and placement of collagen membrane over the lateral window.

**Implant surface**

The annual failure rate for machine surface implants is significantly higher ($p < 0.0001$) than for rough surface implants. Rough surface implants have 1.19 percent annual failure rate with three-year survival of 96.5 percent, as compared to machined surface implants with annual failure rate of 6.86 percent and three-year success rate of 81.4 percent. The healing phase failure rate for machined surface implants is 8.1 percent, compared to 1.1 percent for rough surface implants.

**Bone graft types**

Grafting material can be of human, animal, BMP or synthetic origin. Autogenous bone grafts (iliac crest, calvarial bone, chin, anterior ramus, alveolar ridge, tuberosity) remain the gold standard in bone-augmentation procedures; however, many allografts, xenografts and alloplastic materials have also been used successfully. Regardless of the type of bone graft, there is strong evidence that all grafting materials are effective, differing only in duration of healing time and amount of bone formation.

Studies suggest the best grafting protocol is coagulum with autogenous particulate bone, alone or with DBBM or DFDBA, with an estimated three-year survival rate 96.8-99.8 percent for rough surface implants. Studies have also shown that particulate bone grafts provide better outcomes, as compared to block grafts. Wallace et al reports an implant survival rate for iliac block grafts of 80.40 percent compared to a rate of 94.83 percent for particulate grafts. Testori et al has similar reports that use of particu-
late grafts alone increases implant survival to 92.5 percent as compared to 82.9 percent for autogenous block grafts alone.

It has been demonstrated that grafted sinuses may undergo re-expansion over time, in particular, during the initial two to three years after the procedure. The use of nonresorbable or slowly resorbable grafting materials should prevent this phenomenon. If particulated autogenous bone is used with xenografts or alloplastic materials, such as DBBM or HA, it should reduce the risk of bone resorption and sinus re-pneumatization.

Residual bone height

Sinus grafting and implant placement can be accomplished as a one-stage or two-stage procedure, with the decision often dictated by the amount and quality of the residual alveolar bone. This is attributable to the fact that it is difficult to achieve primary stability with a decrease in residual bone height (RBH). RBH can be measured on the periapical radiograph. In 1996, the Sinus Consensus Conference issued recommendations, dependent on the vertical dimension of the residual bone between the alveolar crest and the maxillary sinus floor. When RBH is greater than 10 mm (Class A), a classical implant procedure should be performed. When RBH is 7 mm to 9 mm (Class B), an osteotome technique should be applied in combination with immediate implant placement.

When the RBH is 4 mm to 6 mm (Class C), a lateral approach involving a grafting material with immediate or delayed implant placement is recommended. Finally, when RBH is 1 mm to 3 mm (Class D), a lateral approach involving bone-grafting material and delayed implant placement should be used.

Fig. 13a, Classification of sinus membrane perforation.

Fig. 13b, Class II (mesial) perforation of sinus membrane.

Fig. 14a, Repair of membrane perforation with collagen membrane.

Fig. 14b, Mixture of autogenous grafts, DBBM and PRGF.
general, immediate placement is not indicated when the residual height is less than 4 mm and in cases of poor bone quality. It has been demonstrated that immediate implant placement with less than 5 mm residual bone height noted significantly lower implant survival rates as compared to placement in more than 5 mm residual bone. The implant success rate is 96 percent when RBH is 5 mm or more and 85.7 percent when RBH is 4 mm or less.

Membrane over window
Positive effects of membrane are:
- prevents soft tissue ingrowth,
- contains particulate graft material,
- increases vital bone formation,
- increases implant survival rate
- and promotes positive outcome when used for perforation repairs.

Several studies have shown increased bone formation when membrane is placed over the lateral window.

Membrane perforation
Studies show no difference in success rates in cases with or without sinus membrane perforation. If repair is successful, membrane perforation does not appear to be associated with post-operative complication or reduced implant survival.

 Complications of lateral antrostomy

Complications may occur intraoperatively or postoperatively. Common intraoperative complications are perforation of the sinus membrane, bleeding and perforation of the buccal flap (very rarely). Bleeding from the lateral antrostomy is rare and usually temporary in nature. Branches of the posterior superior alveolar artery are present in lateral maxillary sinus wall and could be injured during preparation of the lateral window, especially in cases of extensive maxillary resorption.

Excessive bleeding may occur with elevation of sinus membrane from the medial wall of the antrum, which is a location of the lateral nasal artery (branch of the sphenopalatine artery). The most common intraoperative complication is sinus membrane perforation. Membrane perforations may cause increased risk of short-term complications, such as acute or chronic sinus infections, bacterial invasion of the graft or loss of the graft material into the sinus. Sinus membrane perforation occurs in 11 percent to 56 percent of procedures during preparation of the lateral window, sinus membrane elevation or placement of the bone graft. Several factors affect the rate of perforation.

First factor is the thickness of the sinus membrane — rate of perforation of 41 percent reported with sinus membrane of less than 1.5 mm. Second factor is the width of the sinus (Fig. 11), i.e., the angle between the medial and the lateral walls. The narrower the angle, the higher the incidence of perforation — 0 percent incidence in angles greater than 60 degrees and 62 percent with angles less than 30 degrees. The angle is narrower in the anterior portion of the sinus and wider in the posterior aspect of the sinus.

Consequently, we recommend elevation of the floor, posterior wall, superior and anterior walls; such sequencing allows elevation from a wider portion to the narrower portion of the sinus. In addition, placing the window 3 mm above the floor and anterior wall will allow better coordination of eye-hand movement and decrease incidence of perforation. Third factor is the presence of septa; these cases are better approached utilizing a two-window approach with elevation of the membrane around the septum at the last stage (Fig. 12).

Perforation during placement of the graft is usually because of pressure against the membrane; this
can be avoided by packing the graft against the floor and anterior wall (Fig. 13). Utilizing ultrasonic drills also decreases the risk of membrane perforation, with incidence of perforation of 3–7 percent; as compared to 16–46 percent utilizing conventional drills.

**Membrane perforation types**

Membrane perforations are classified based on their location. Class I perforations typically occur along the apical wall of the prepared sinus window. Class II perforations occur along the lateral or crestal aspects of prepared sinus window, and they are subdivided as mesial, distal and crestal. Class III perforations occur at any location within the body of the prepared sinus window (Fig. 14).

Upon discovery of a perforation, ascertain its size and extend the osteotomy to gain better visualization and access to the sinus window. Intact membrane elevation should proceed in the area away from the site of the perforation and only after obtaining enough reflection of the membrane; the membrane in the area of the perforation should be reflected.

**Membrane perforation repair**

Membrane repair varies and is dependent on the size and location of the perforation. With Class I perforations, sinus membrane elevation proceeds along a normal course and apical to the displacement of the sinus membrane, resulting in it folding over itself and thus sealing the perforation. In cases of Class II perforations, extend the osteotomy mesially or distally to expose intact sinus membrane; if more than 3 mm of perforation is present or the membrane does not fold on itself, place a collagen membrane over the perforation area.

In cases of Class II perforations, when it is not possible to remove additional bone mesial to the prepared sinus window or in Class III cases of extensive sinus perforations, a membrane is shaped and inserted into the sinus window with its ends extruding out of the window. In general, during placement of the bone graft, the membrane will get displaced medially and inferiorly.

Extruding aspects of the membrane can be secured to the external aspect of the alveolar bone with fixation tacks to decrease displacement of the membrane. Curettes are used to mold the membrane to ensure adequate space for augmentation material. In addition to using a membrane, the use of consolidated particulate graft material decreases the incidence of migration of graft material into the sinus.

**Fig. 16** Graft infection: thickening of the sinus membrane, air pockets in the graft around implant.
Common post-operative complications are dehiscence of the incision line, migration of implant into the sinus (Fig. 15), loss of graft material, antral ostium obstruction, oral antral communication, graft infection (Fig. 16) and maxillary sinusitis. Postoperative infection has been reported in 2-5 percent of cases. Symptoms associated with post-op infection include erythema, tenderness, swelling, purulent discharge, nasal congestion and fistula.

Patients with a history of chronic sinus infection or sinus disease are at higher risk for post-operative graft infection or sinusitis. Untreated periapical pathology, extended surgical time and bacterial contamination of the graft may also contribute to infection. The two most common postoperative complications are graft infection or postoperative sinusitis; CT scans help to establish proper diagnosis (Fig. 17).

Antibiotics provide coverage for common sinus microorganisms, such as S. Pneumonia, H. Influenza and M. Catarrhalis. Appropriate antibiotic therapy is Augmentin in non-penicillin allergic patients and Levaquin in penicillin allergic patients. Treatment of postoperative infection includes antibiotic therapy and incision-drainage with cultures and removal of the graft, if infection does not respond to antibiotic therapy.

References

5) Chen et al. Implant placement immediately after the lateral approach to the trap door window procedure to create a maxillary sinus lift without bone grafting: a two-year retrospective evaluation of 47 implants in 33 patients. JOMS. 2007.

Hussam Batal is assistant professor in the department of oral and maxillofacial surgery at Boston University.

Olena Norris is senior resident in the department of oral and maxillofacial surgery at Boston University.
Dare to Compare on
Innovation, Quality, Service and Value

**Legacy™ 3 Implant**
All-in-1 Packaging includes implant, abutment, transfer, cover screw & healing collar
$200 vs $62.1 from Zimmer Dental

- Reality Check
  - Zimmer Customers
  - Save $421 with Legacy3

**SwishPlant™ Implant**
All-in-1 Packaging includes implant, straight abutment/transfer, cover screw & healing collar
$200 vs $705 from Straumann

- Reality Check
  - Straumann Customers
  - Save $505 with SwishPlant

**ReActive™ Implant**
All-in-1 Packaging includes implant, abutment, transfer & cover screw
$200 vs $694 from Nobel Biocare

- Reality Check
  - Nobel Customers
  - Save $494 with ReActive

---

**Implant Direct’s New Las Vegas Training Center**
Implant Direct offers an extensive list of educational opportunities at its Las Vegas Training Center with computers at each desk for Image Guided Surgical Training, models/mannequins for hands-on training and a four chair dental office for live surgical demonstrations.

- **Implant Dentistry 101: Three-Day Introductory Course**
  - March 21-23 | May 16-18 | June 13-15
  - 24 CE CREDITS

- **3D Implantology: Two-Day Advanced Course**
  - Featuring Anatomage Table surgical guides and STARTER software
  - April 19-20
  - 16 CE CREDITS

**View Dr. Niznick’s 2-Hour Lecture at Las Vegas Training Center & Earn 2 CE Credits FREE**
Dr. Gerald Niznick discusses how the latest implant design innovations are shaping the future of implantology.

---

**New**
Check out our easy to use mobile app!

**AO Annual Meeting**
Visit Us At Booth #201

**Compare for Yourself**
Introductory Offer: Make the switch & receive three FREE Implants!
Introducing CAD Milled Bars & Abutments

Select from a wide-range of bars and abutments for Implant Direct's popular industry-compatible implant interfaces below. Custom Direct bars are also available for Implant Direct and Nobel Biocare multi-unit, screw-receiving abutments as well as Implant Direct’s proprietary 1-piece Screw Direct® implant. Custom Direct abutments may be fabricated in titanium or one of five different zirconia shades for optimal function and esthetics.

Custom Direct™ bars made using the industry’s only robotic and full automation machining centers for unsurpassed precision and efficiency. Select bar design and order online at www.custom-direct.com

GPS® Titanium Bar
for 4-6 implants includes screws plus up to 4 male and female attachments - $995

Screw Direct®
Implant
$100 Discount on Custom Direct bars ordered for use with Implant Direct implants or abutments

Hybrid Titanium Bar
for 4-6 implants includes screws – $765

Custom Titanium Abutment
Lab designed - $100
Implant Direct designed - $130

Custom Zirconia Titanium Abutment
Lab designed - $120
Implant Direct designed - $150

Joining our full line of industry-compatible prosthetics

RePlant®
Internal Trilobal Connection Compatible with NobelReplace™

Legacy™
45° Conical Hex Connection Compatible with Zircon, BioHorizons®

InterActive™
18° Conical Hex Connection Compatible with NobelActive™ & NobelReplace CC

Swish™
Internal Octagonal Connection Compatible with Externet™ Ti base level

Our price
$45
$100
$100
$120
$120
$120
$120
$112
$100
$120
$100
$120

www.implantdirect.com | 888-649-6425
Academy of Osseointegration heads to Tampa

_The emphasis in the scientific program_ for the Academy of Osseointegration’s 28th annual meeting in Tampa, Fla., from March 7–9, will be on achieving quality and leveraging the advantage conferred by the interdisciplinary team approach.

The annual meeting program will focus on the future with the theme, “Moving Forward: Evidence, Experience, Excellence.” The opening symposium on Thursday, March 7, features some of the biggest names in implant dentistry.

Leading off will be researcher/clinician Lyndon F. Cooper, DDS, PhD, Chapel Hill, N.C., on the topic, “Translating Evidence Into Treatment Predictability: What Evidence Do We Have? What Do We Need?” Cooper is Stallings Distinguished Professor of the University of North Carolina Department of Prosthodontics and a member of the department of biochemistry and biophysics in the UNC School of Medicine. He is director of the Bone Biology and Implant Therapy Laboratory.

Cooper’s presentation will examine the current status of dental implant therapy and attempt to interrogate the levels of treatment predictability that exist for these different therapies. His current clinical interests focus on the development of cell-based tissue engineering for clinical bone formation and the immediate loading of dental implants.

Other opening symposium topics and speakers are:

- “Practical and Predictable Surgical Approaches in the Esthetic Zone: Multiple Challenges,” by Daniel Buser, DDS, DMD, of Bern, Switzerland. Buser will present surgical approaches in the esthetic zone, which offer successful outcomes with high predictability, that were developed at the University of Bern.
- “The Dental Implant: What Are the ‘Right’ Implants for Today’s Indications? Surfaces, Connections, and Flexibility,” by Clark M. Stanford, DDS, PhD, of Iowa City, Iowa. His presentation will show how the predictability of the process of tooth replacement with dental implants is becoming enhanced through the applications of new technologies expanding on our long-established protocols for implant therapy.
- “Implant Dentistry: The Interdisciplinary Advantage,” by Richard D. Roblee, DDS, MS, orthodontist from Fayetteville, Ark; Edward P. Allen, DDS, PhD, periodontist from Dallas; and Robert R. Winter, DDS, prosthodontist from Scottsdale, Ariz. Their presen-
Got Torque?

surgical led+

IA-400

implantmed

elcomed

W&H Impex Inc.
5490 Hawthorne Drive
Windsor, Ontario N8T 1J9
t: +1 519 944 6739
t: +1 800 265 6277
f: +1 519 974 6121
office.ca@wh.com

wh.com/na
The annual meeting will focus on utilizing an interdisciplinary approach to maximize comprehensive results in implant dentistry.

The program retains many popular features, beginning with the Corporate Forums on Thursday. This year’s participants are BioHorizons, BIOMET 3i, DENTSPLY Implants, Geistlich Biomaterials, Hiossen, Millennium Dental Technologies, MIS, Nobel Biocare, Osteogenics, Osteohealth, Straumann USA and Zimmer Dental.

Poster presentations will be introduced Thursday afternoon, just before the welcome reception held in the exhibit area. The popular, intimate round-table clinics and limited-attendance lectures with leading experts will be Friday morning. Oral abstract research presentations will also be presented Friday morning, and clinical innovations presentations will be Friday afternoon, preceding the president’s reception to be held at the Florida Aquarium.

The Allied Staff Program and the Laboratory Technician Program will be held Saturday. The “Lunch & Learn Sessions” return Saturday at noon.

Saturday’s Closing Symposium addresses the topic, “Where Are We Today and What Does the Future Hold?” Speakers will address esthetic parameters of tooth replacement, the role of team in implant dentistry, peri-implant tissue management and the evolving role of radiology in improving predictability.

More speakers and topics include:

• Urs C. Belser, DMD, of the University of Geneva, Geneva, Switzerland, “Contemporary Implant-Assisted Options for Patients with High Esthetic Demands: Where Are We Today and Where Will We Be Tomorrow?” Belser will discuss the rationale for an early placement/early loading concept for replacement of extracted teeth.

• David A. Garber, DMD, Henry Salama, DMD, and Maurice A. Salama, DMD, of Atlanta, on “What Was, What Is and What Will Be: The Evolving Role of Team in Implant Dentistry.” Their discussion will focus on a defined algorithm for the interdisciplinary team and will cover the diagnosis of deficiencies and the varied treatment options in detail.

• Joseph Y.K. Kan, DDS, MS, of Loma Linda, Calif., on “Peri-Implant Tissues in the Esthetic Zone: What Do We Really Know and What Can We Realistically Achieve?” Focusing on current implant treatment philosophies and methodologies, Kan will cover diagnosis and treatment planning, surgical, prosthetic management of soft and hard tissue for optimal anterior implant esthetics.

• William C. Scarfe, DDS, BDS, MS, of Louisville, Ky., on “The Evolving Role of Radiology in Improving Treatment Predictability in Implant Therapy.” Scarfe’s presentation will provide a closer look at how CBCT imaging will provide the 3-D framework for implant therapy totally within the digital domain, thereby improving treatment predictability.

Friday morning’s program features the highly successful parallel surgical and restorative tracks, annual meeting organizers said. Speakers will include Drs. Craig Misch, Sarasota, Fla.; Robert Marx, Miami; Paul Fugazzotto, Milton, Mass.; Eduardo Lorenzana, San Antonio, Texas; Dennis Shanelec, Santa Barbara, Calif.; Hideaki Katsuyama, Yokohama, Japan; Thomas Wilson, Dallas; Brody Hildebrand, Dallas; Ronald Jung, Zurich, Switzerland; Hans-Peter Weber, Boston; Stephen Parel, Dallas; German Gallucci, Boston; Mario Roccuzzo, Torino, Italy; and J. Robert Kelly, Farmington, Conn.

The program was created by the 2013 Annual Meeting Committee, chaired by Dr. Dean Morton, Louisville, Ky._

(Source: Academy of Osseointegration)

‘Moving Forward: Evidence, Experience, Excellence.’
educate  |  inspire  |  connect

AACD 2013
Seattle

Featuring: Betsy Bakeman, DDS, Newton Fahil, Jr., DDS, David Garber, DMD, John Kois, DMD, Jacinthe Paquette, DDS, Maurice Salama, DMD, Cherilyn Sheets, DDS, Frank Spear, DDS, and more!

*Educators subject to change

www.AACDconference.com

April 24 - 27, 2013
29th Annual AACD Scientific Session

American Academy of Cosmetic Dentistry
Implant position in the esthetic zone

Since the advent of modern root form osseointegrated implant dentistry in 1952, clinicians have strived for improvements in implant positioning in the esthetic zone to achieve predictable restorative and esthetic results. Years of clinical experience in congruence with controlled clinical studies have helped establish parameters as a guide for these results. Establishing a treatment plan and clinical protocol prior to implant placement is paramount.

Treatment planning traditionally begins with comprehensive medical and dental evaluations, articulated diagnostic casts, radiographs, cone-beam computed tomography (CBCT) scans and a diagnostic wax-up. Patient demands must be taken into consideration prior to surgery, and pre-surgical mockups may be necessary to convey the information to the patient.

The advancement of CBCT technology has led dentistry into a new realm of dimensional accuracy. In combination with the use of a surgical or guided stent, proper 3-D positioning of an implant has led to more accurate clinical results. The importance of the implant position can be manifested in the four dimensionally sensitive positioning criteria: mesiodistal, labiolingual and apico-coronal location, as well as implant angulation.1 The ultimate goal is not only to avoid sensitive structures but to respect the established biological principles to achieve esthetic results.

Mesiodistal criteria

Correct implant position in a mesiodistal orientation allows the clinician to avoid damaging adjacent critical structures. A minimum distance of 1.5 mm between implant and existing dentition prevents damage to the adjacent teeth and provides proper osseointegration and gingival contours2-4 (Fig. 1a). Distances of less than 3 mm between two adjacent
Implants leads to increased bone loss and can reduce the height of the inter-implant bone crest. A distance of more than 3 mm between two adjacent implants preserves the bone, giving a better chance of proper interproximal papillary height (Fig. 1b).

**Labiolingual criteria**

An implant placed too far labially can cause bone dehiscence and gingival recession while an implant placed too far lingually can cause prosthetic difficulties. A thickness of 1.8 mm of labial bone is critical in maintaining an implant soft-tissue profile (Fig. 2). Labially oriented implants compromise the subgingival emergence profile development, creating long crowns and misalignment of the collar with respect to the adjacent teeth.

**Apico-coronal criteria**

Peri-implant crestal bone stability plays a critical role in the presence of interdental papilla. Implants placed too shallow may reveal the metal collar of the implant through the gingiva. Countersinking implants below the level of the crestal bone may give prosthetic advantages but can lead to crestal bone loss. The ideal solution would be the placement of an implant equicrestal or subcrestal to the ridge. However, the existing microgap at the implant abutment junction leads to bone resorption because of peri-implant inflammation. It is suggested that an implant collar be located 2 mm apical to the CEJ of an adjacent tooth if no gingival recession is present (Fig. 3).

**Implant angulation**

Implant angulation is particularly important in treatment planning for screw-retained restorations. Implants angled too far labially compromise the placement of the restorative screw while implants angled too far lingually can result in unhygienic and esthetic prosthetic design. For every millimeter of lingual inclination, the implant should be placed an additional millimeter apically to create an optimal emergence profile. In general, implant angulation should mimic angulation of adjacent teeth (Fig. 4). Furthermore, maxillary anterior regions require a subtle palatal angulation to increase labial soft-tissue bulk.

**Inclusive Tooth Replacement Solution**

The Inclusive® Tooth Replacement Solution was developed by Glidewell Laboratories as a complete, prosthetically driven method of restoring missing dentition. The solution is comprised of treatment planning, implant placement, patient-specific temporization and the definitive restoration (Figs. 5a–5f).

To read the article in its entirety, see www.inclusivemagazine.com

**References**


‘The ultimate goal is not only to avoid sensitive structures but to respect the established biological principles to achieve esthetic results.’
Zimmer® Puros™ Allograft

Nurturing ideal bone growth for proven remodeling with structural integrity.*

Visit www.zimmerdental.com to learn more about Puros Allograft.
Pacific Dental Conference

Save these dates!

March 7–9, 2013  Vancouver, BC Canada

Inspiring speakers
Fantastic networking
Unforgettable location!

- Three days of varied and contemporary continuing education sessions are offered
- Over 130 speakers and 150 open sessions and hands-on courses to choose from, as well as the Live Dentistry Stage in the Exhibit Hall
- Over 300 exhibiting companies in the spacious PDC Exhibit Hall
- Excellent Spring skiing and snowboarding on local mountains or drive the scenic Sea to Sky Highway to Whistler/Blackcomb

Registration opens October 15th, 2012 at...

www.pdconf.com
submissions formatting requirements

Please note that all the textual elements of your submission:

- complete article
- figure captions
- literature list
- contact info (e-mail addy please)
- author bio

must be combined into one Microsoft Word document. Please do not submit multiple files for each of these items. In addition, images (tables, charts, photographs, etc.) must not be embedded in the text document.

All images must be submitted separately, and details about how to do this appear below.

If you are interested in submitting a C.E. article, please contact us for additional instructions before you make your submission.

_text length

Article lengths can vary greatly — from a mere 1,500 to 5,500 words — depending on the subject matter. Our approach is that if you need more or less words to do the topic justice, then please make the article as long or as short as necessary.

We can run an extra long article in multiple parts, but this is usually discussing a subject matter where each part can stand alone because it contains so much information. In addition, we do run multi-part series on various topics. In short, we do not want to limit you in terms of article length, so please use the word count above as a general guideline and if you have specific questions, please do not hesitate to contact us.

_text formatting

Please use single spacing and do not put extra space between paragraphs. We also ask that you forego any special formatting beyond the use of italics and boldface, and make sure that all text is left justified.

If you would like to emphasize certain words within the text, please only use italics (do not use underlining or a larger font size). Boldface should be reserved for article headlines, headers and subheads please.

Please do not "center" text on the page, add special tab stops or use underlines in your text as all of this must be removed manually before layout. If you require a special layout, please let the word processing program you are using help you to do this formatting automatically rather than doing it manually.

If you need to make a list or add footnotes or endnotes, please let the word processing program do it for you automatically.

There are menus in every program that will help you apply all sorts of special formatting.

_image requirements

Please number images consecutively by using a new number for each image. If it is imperative that certain images are grouped together, then use lowercase letters to designate the images in a group (i.e., Fig. 2a, Fig. 2b, Fig. 2c).

Insert figure references in your article wherever they are appropriate, whether that is in the middle or end of a sentence, but before the period rather than after. Our preference is to have figure references noted in the appropriate place within the text as it helps the readers to orient themselves when moving through the article. In addition, please note:

- We require images in TIF or JPEG format
- These images must be no smaller than 4 x 4 inches in size at 300 DPI
- Images should be 1 MB in size each

If you have an image that is greater than 1 MB, please do not bother "sizing it down" to meet our requirements, but send us the largest file size available. The larger the starting image is in terms of bytes, the more leeway the designer has in terms of resizing the image to fill up more space should there be room available.

Also, please remember that you should not embed the images into the body of the text document you submit. Images must be submitted separately from the textual submission.

You may submit images through a zipped file via e-mail, unzipped individual files via e-mail or post a CD containing your images directly to us (please contact us for the mailing address as this will depend upon where you will be mailing them from).

Please do not forget to send us a head shot photo of yourself that also fits the image requirements noted above so that it can be printed along with your article.

_abstracts

An abstract of your article is not required. However, if you choose to provide us with one, we will print it in a separate box.

_contact info

At the end of every article is a contact info box with contact information along with a head shot of the author.

Please note at the end of your article the exact information you would like to appear in this box and format it according to the previously mentioned standards.

A short bio (50 words or less) may precede the contact info if you provide us with the necessary text.

_questions? comments?

Please do not hesitate to contact us for our International C.E. Magazine Author Kit or if you have other questions/comments about the article submission process:

Group Editor Robin Goodman
r.goodman@dental-tribune.com

Implants Managing Editor Sierra Rendon
s.rendon@dental-tribune.com

Managing Editor Fred Michmershuizen
f.michmershuizen@dental-tribune.com
Copyright Regulations

The international C.E. magazine of implants, published by Tribune America, is printed quarterly. The magazine's articles and illustrations are protected by copyright. Reprints of any kind, including digital mediums, without the prior consent of the publisher are inadmissible and liable to prosecution. This also applies to duplicate copies, translations, microfilms and storage and processing in electronic systems. Reproductions, including excerpts, may only be made with the permission of the publisher.

All submissions to the editorial department are understood to be the original work of the author, meaning that he or she is the sole copyright holder and no other individual(s) or publisher(s) holds the copyright to the material. The editorial department reserves the right to review all editorial submissions for factual errors and to make amendments if necessary.

Tribune America does not accept the submission of unsolicited books and manuscripts in printed or electronic form and such items will be disposed of unread should they be received.

Tribune America strives to maintain the utmost accuracy in its clinical articles. If you find a factual error or content that requires clarification, please contact Group Editor Robin Goodman at r.goodman@dental-tribune.com. Opinions expressed by authors are their own and may not reflect those of Tribune America and its employees.

Tribune America cannot assume responsibility for the validity of product claims or for typographical errors. The publisher also does not assume responsibility for product names or statements made by advertisers.

The responsibility for advertisements and other specially labeled items shall not be borne by the editorial department. Likewise, no responsibility shall be assumed for information published about associations, companies and commercial markets. All cases of consequential liability arising from inaccurate or faulty representation are excluded. General terms and conditions apply, and the legal venue is New York, N.Y.
New, from the inventors of Piezosurgery®
C1
A Conical Connection Implant

Platform Switching
Promotes vital soft tissue growth and reduces bone resorption

Micro Rings
Improve the bone to implant contact at the crestal zone by increasing surface area

Dual Thread Design
Increases bone to implant contact, reinforces osseointegration and enhances primary stability

Surface Treatment
Creates an osseconductive morphology and achieves superb osseointegration results

Visit us: CMW Meeting Booth #4634 and the AO Annual Meeting Booth #526
Priced at $249.00, each C1 implant is packaged with a single use final drill, cover screw, and PEEK abutment. To learn more about MIS, visit our website: www.misimplants.com or call: 866-797-1333 (toll-free)

MIS USA
Make it Simple