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Welcome to implants

The goal of this quarterly magazine is twofold. First, it seeks to share practical dental knowledge that can be put to use in your day-to-day practice. Second, it is a vehicle to help you chip away at your continuing education (C.E.) requirements.

The amount of new information available in the dental field about new products, techniques and research data is astounding. Running a practice and seeing patients leaves little time for catching up on the latest clinical news and product information. Thus, we hope implants will not only be a welcome respite for those rare chunks of time you can devote to leisurely reading, but one that provides a practical return on your investment by providing information that you can actually put to immediate use.

In addition, we know that taking time away from the practice to pursue C.E. credits is costly in terms of lost revenue and time. As a quarterly magazine, implants is here to help you chisel at least four C.E. credits per year out of your already busy life without the lost revenue and time away from your practice. To that end, every edition of implants will include at least one hour of ADA CERP-certified C.E. credit where readers can answer questions about the materials at www.dtstudyclub.com to earn this credit. Annual subscribers to the magazine ($50) need only register at the Dental Tribune Study Club website to access these C.E. quizzes free of charge. In fact, even non-subscribers may take the C.E. quiz after registering on the DT Study Club website and paying a nominal fee.

If you are a practitioner with a penchant for words, it might also interest you to know that authors of the C.E.-accredited articles receive 15 percent of the fees collected from the non-subscribers who take the C.E. quiz online. The C.E. quiz for the articles in this edition will be available online on Nov. 9.

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The etiology of various types of failure modes in oral implantology

To date, the diagnostic realm of pre-operative examination in oral implantology has been frequently reviewed and researched. In this article we will discuss the possible etiology and diversity of potential implant failures associated with confining our pre-operative examination to two-dimensional radiographic images rather than cone-beam computed tomography (CBCT) three-dimensional based dental imaging technologies.

In recent years, CBCT dental imaging technologies have started to make big inroads into every discipline in our profession, expanding the horizons of clinical dental practice by adding a third dimension to craniofacial treatment planning. CBCT-based dental imaging captures a volume of data, and through a reconstruction process, it constructs images that do not contain distortion, magnification and/or overlap of anatomy.

In the same slices, different views are feasible with one exposure, taking the guesswork out of oral implantology.

Additionally, these imaging systems’ effective radiation doses, measured in Microsieverts are much lower in dose compared to a full mouth series of periapical radiographs (digital or even D speed film). According to dental practitioners who are placing implants, using this technology also makes them more proficient.

Essentially, CBCT dental imaging was a paradigm shift, especially for oral implantology where measurements are precise and provide practitioners clear insight into a patient’s anatomical relationships. CBCT-based dental imaging uses advanced technology to provide the most complete anatomical information on a patient’s oral and maxillofacial region, including the mouth, face, jaws, TMJ and other areas, leading to...
enhanced treatment planning and predictable treatment outcomes.

As far as other physical mechanisms contributing to implant failure modes, for the most part, the research and review papers concluded that the crown-to-root ratio guidelines associated with natural teeth should not be applied to a crown-to-implant restorations ratio. According to these papers, the crown-to-implant ratios of those implants that were considered successful at the time the reviews took place were similar to those implants that failed. Apparently, according to some of these papers, the guidelines that are used by some clinicians to determine the future prognosis of implant-supported restorations lack scientific validation as far as the possible grounds for implant fractures.

Furthermore, while the overall success rate of dental implants is high, accomplishing predictable reconstruction and esthetic results for single or multiple teeth replacements with dental implants is challenging. As dental implants become an increasingly viable treatment for replacing missing teeth, we may encounter more random maxillofacial anatomic and occlusal conditions.

The consequences

As far as oral implantology, like several institutions and authors have forecasted, with the rapidly aging population trend in the developed world and the resulting enormous unmet need for replacement of teeth, the growth in implant-based dental reconstruction products and services outstripped all other areas in dentistry. What’s more, in recent years implant dentistry and implant-based dental reconstructions have become part of the curriculum in the undergraduate and graduate programs of dental schools.

Yet, a large number of dental practitioners, including generalists and specialists, with different levels of proficiency who saw the opportunity to move into these sophisticated oral implantology arenas, continue to overlook the advantages of CBCT, and as a result we are observing a diversity of abnormal complications associated with these surgical procedures.

Dental practitioners can obtain only vague dimensions from traditional two-dimensional intraoral and extra-oral radiographic images due to magnification variations as a result of positioning and projection of anatomical structures, their properties and relationships. It is very difficult for traditional radiographs, such as periapical and panoramic images, to precisely replicate the anatomical structures captured on their receptors.

Traditional two-dimensional radiographic images essentially exhibit magnification, distortion, overlap of anatomical structures, restricted clarity and lack of accuracy in measurements, and therefore, the dimensions or determination of precise anatomical structures’ relationships are inaccurate. In addition to that, two-dimensional radiographic images do not allow for three-dimensional virtual rendering (3DVR).

A literature and Internet search revealed several published research and review papers on implant failures. One common failure associated with dental practitioners restricting their diagnostic field to two-
By utilizing only a two-dimensional panoramic radiograph that provides inaccurate dimensions, some practitioners play it safe and “stay away” from the mandibular nerve canal, compromising the prosthetic crown-to-implant ratios, resulting in bone loss and, ultimately, implant fractures. The follow-up procedures associated with the removal of the remaining piece of the fractured implant, grafting and placement of another implant are considered very invasive and, not to mention, the cost and the psychological affect it has on the patient.

A close-up look at the intraoral view of the failing implant-supported restoration reveals dehiscence and fenestration of the buccal cortical plate below crown #25.

A postoperative cross-sectional slices through the implant placed in the region of tooth #25 utilizing the i-CAT CBCT reveals the dental implant and its anatomic orientation in the buccal lingual perspective, demonstrating severe buccal bone dehiscence, exposing about a third of the implant buccal threads.

CBCT 3DVR revealing severe buccal bone dehiscence in the region of tooth #25.

dimensional radiographic images such as panoramic and/or periapical radiographs was perforation of the maxillary sinus (Figs. 1a–c). Every so often dental practitioners reveal that they perforated the sinus a few millimeters or so by error due to misinterpretation of the vertical dimension. Some cases remain asymptomatic and are put under close watch, like in this case, while others become symptomatic and the implants need to be removed.

According to some dental practitioners, they perforate the sinus by design, expecting to achieve “bi-cortical” anchorage in the maxillary sinus with the aim of increasing primary stability. However, according to a 15-year retrospective research paper published in 2000, implants that were anchored bi-cortically failed nearly four times more often than the mono-cortical ones. Furthermore, implant fractures accounted for more than 80 percent of the observed failures and were found to affect the bi-cortical group almost three times more often as compared to the mono-cortical ones.

Another abnormal set of complications associated with dental practitioners restricting their diagnostic imaging to two-dimensional radiographic images is the displacement of implants into the maxillary sinus (Figs. 2a–c). Foreign bodies in the maxillary sinus include displaced teeth, roots, impression materials, dental instruments and more recently, dental implants. Not to mention that the procedure associated with the removal of foreign bodies from the maxillary sinuses is considered very invasive.

As demonstrated in this case, the CBCT-based dental imaging cross-sections revealed a concaved alveolar bone. It eliminated any surprises, allowing the dental practitioner to plan for bone grafting beforehand and discuss the treatment options, including the associated supplementary bone grafting costs with the patient. A two-dimensional panoramic image would have never revealed this phenomenon in advance. A different and unusual set of complications associated with dental practitioners restricting their diagnostic field to two-dimensional radiographic images is implant fractures (Fig. 4). Yet again, by utilizing only a two-dimensional panoramic radiograph, which provides inaccurate dimensions, some practitioners feel obligated to play it safe and stay away from the mandibular nerve canal by placing shorter implants. By doing so, they compromise the illustrated those from a preventive standpoint, that is, the use of CBCT based dental imaging prior placing dental implants.

A different set of tricky situations is associated with the anatomy of the anterior region of the maxillary alveolar bone (Figs. 3a, b). In this case, from what is observed visually clinically, one would expect the alveolar bone to be more than enough and shaped in a triangular form, representing the “triangle of bone” theory developed by Dr. Scott Ganz. This theory recognizes the shape of the existing bone volume and aids in determining whether it is a positive implant receptor site.

As demonstrated in this case, the CBCT-based dental imaging cross-sections revealed a concaved alveolar bone. It eliminated any surprises, allowing the dental practitioner to plan for bone grafting beforehand and discuss the treatment options, including the associated supplementary bone grafting costs with the patient. A two-dimensional panoramic image would have never revealed this phenomenon in advance. A different and unusual set of complications associated with dental practitioners restricting their diagnostic field to two-dimensional radiographic images is implant fractures (Fig. 4). Yet again, by utilizing only a two-dimensional panoramic radiograph, which provides inaccurate dimensions, some practitioners feel obligated to play it safe and stay away from the mandibular nerve canal by placing shorter implants. By doing so, they compromise the
prosthetic crown-to-implant ratio, at times causing bone loss, and ultimately, implant fractures.

In cases such as these, the follow-up procedures associated with the removal of the remaining piece or pieces of the fractured implant, grafting and placement of another implant are considered very invasive, not to mention the cost and the psychological affect it has on the patients. Moreover, compromising the prosthetic crown-to-root ratio represents a constant confrontational clash between implant surgeons and restoring dentists. More about this particular notion of prosthetic crown-to-root ratio will be discussed in the next section under the physical mechanisms contributing to implant failure modes.

Other serious complications associated with confining our pre-operative diagnostic radiographic examination to two-dimensional radiographic images include:

- dehiscence and fenestration of the buccal cortical plates (Figs. 5a–c);
- perforations of the mandibular lingual undercuts;
- violations of the nasopalatine nerve (in some cases causing permanent numbness of the premaxillary region);
- and violations of the inferior alveolar nerve canal, the least of which can cause potentially serious chronic pain, drooling and even permanent numbness of the lower lip (Fig. 6).

### Physical mechanisms contributing to implant failure modes

The etiology and physical mechanism of fractured dental implants incidents have been reviewed and studied at length in recent years. For the most part, the research and review papers concluded that the crown-to-root ratio guidelines associated with natural teeth should not be applied to a crown-to-implant restoration ratio. As far as the guiding principles of crown-to-root ratio for natural teeth vs. the crown-to-implant ratio, they have been frequently reviewed and researched at length in recent years.10, 13–20 In this section of the article we will discuss the possible etiology and diversity of potential physical mechanisms for implant failures.

Fractures can happen several years after implants are placed (Figs. 7a, b) or sooner. While in this particular case the treatment option was developed with an appreciation of the patient’s occlusal and mechanical circumstances and habits, following the implants fracture, a retrospective analysis of the site planned for the implants revealed extended inter-occlusal space on the articulated models and widespread occlusal wear of the opposing dentition (Figs. 7c, d). In this case, proceeding with careful assessment of all the available retrospective diagnostic information and upon further discussion with the patient, several diagnostic assumptions and one follow-up treatment option were established, which included replacement of the implant-supported crowns by a removable cast partial denture.

---

**Fig. 6.** A postoperative panoramic radiograph revealing two dental implants violating the cortical plate of the inferior alveolar nerve canal.

**Fig. 7a.** Implants #6 and 7 (Lifecore Biomedical, 3.3 x 15 mm) before the fracture. By default, based on physical principals, once an implant has integrated in the bone, the weakest point is the fulcrum where the internal screw engages the implant (a). Note the fracture level in implant #7 and fracture line in implant #6 (b).

**Fig. 7b.** Implants #6 and 7 after the fracture.

**Figs. 7c, d.** Retrospective analysis of the site planned for the implants #6 and 7 revealed an extended overbite requiring long crowns to meet aesthetic needs and, at the same time, the opposing occlusion presented extensive occlusal wear.
Considering the extremely invasive surgical procedure needed for the removal of fractured implants, a balanced decision was made against the risk of increasing damage. Thus, a choice was made to allow for primary closure of the soft tissue over the remaining implant bodies #6 and 7, that is, “put them to sleep,” followed by an insertion of an immediate acrylic removable partial denture and, subsequently, the fabrication of a removable cast partial denture.

This case attempts to provide an argument in favor of the consideration of physical mechanisms as potential contributors to implant fractures. While controversy continues to exist as to whether crown-to-root ratio can serve as an independent aid in predicting the prognosis of teeth, the same certainly applies to crown-to-implant ratio, unless multiple other clinical indices such as opposing occlusion, presence of parafunctional habits and material electrochemical problems, just to name a few, are considered.

Implant fractures are considered one potential problem with dental implants, especially delayed fracture of titanium dental implants due to chemical corrosion and metal fatigue. Following careful review of the referenced articles, which are very enlightening, we realized that to a great extent they support our theory that there are multiple factors involved in implant fractures.

These include: magnitude, location, frequency, direction and duration of compressive, tensile and shear stress; gender; implant location in the jaw; type of bone surrounding the implant; pivot/fulcrum point in relation to abutment connection; implant design; internal structure of the implant; length of time in the oral environment as it relates to metallurgical changes induced in titanium over time; gingival health; and crown-to-implant-ratio.

Considering the multiple factors involved in implant fractures, both physical and biological, we can only assume that it can happen especially if the forces of the opposing occlusion and or parafunctional habits are greater than the strength of the implant, especially over time. Therefore, it is imperative that the clinician be knowledgeable about the diversity of factors before recommending dental implants. Errors in diagnosing potential contributors to implant fractures are the most common reason that dental implants break.

Conclusion

While the quantitative relationship between successful outcomes in dental implants treatment and CBCT-based dental imaging is unknown and awaits discovery through large prospective clinical trials, there is enough clinical evidence to support the argument for the necessity of CBCT-based dental imaging systems.

This is necessary, especially due to the fact that the clinical management associated with some of these implant failures is difficult and at times it is considered very invasive; especially given the recent hype toward dental implants in our profession.

Based on a series of recent preliminary clinical research and review papers and case reports, the author strongly believes in a more selective approach that includes the use of CBCT-based dental imaging. It is a very reliable procedure from a precautionary standpoint, and by obtaining a CBCT-based dental imaging study prior to placing dental implants, many of the above mentioned complications that adversely affect our patients can be circumvented.

As far as the fact that the use of crown-to-implant ratio, in addition to other clinical indices, does not offer the best clinical predictors, and even though no definitive recommendations could be ascertained, dental implants are becoming increasingly popular and an increase in the number of failures, especially due to late fractures, is to be expected.

This report attempted to provide an argument in favor of consideration of physical mechanisms as potential predictors to implant fractures. It is essential for us to familiarize ourselves with the understanding and diagnostic competence of the multiple factors involved in implant fractures. Once observed, this predictor would certainly lead to better diagnosis and treatment planning.

In conclusion, and as alluded to earlier, oral implantology has become the fastest growing segment in dentistry. Therefore, the lessons learned from these troubled or compromised cases and the gaining of insight into these failure processes — including the accurate understanding of critical anatomical, restorative and mechanical information — might stimulate the clinicians’ implementation of preventive actions that may avoid the future failure outcomes with dental implants.

While researchers studying these CBCT-based dental imaging platforms’ methodologies agree that more outcomes assessment research has a long-term value, in the meantime we must work together to optimize our patient’s health.

To that effect, the recent introduction of numerous associated CBCT-based imaging systems and surgical guidance platforms are gradually taking our profession through key changes that have a major impact on the way we view and practice oral implantology.

This ultimately yields substantial public health benefits and translates into more predictable outcomes, the preservation of adjacent teeth, the protection of critical anatomical landmarks and improved esthetics and function, just to name a few.

A complete list of references is available from the publisher.
Since its introduction, sinus floor augmentation has generated great interest in the international scientific community and been subject to many changes in procedure. The first documented maxillary sinus augmentations using bone grafts date back to the work of Philip J. Boyne in the 1960s. An access osteotomy to elevate the sinus membrane can be performed by a vestibular or a crestal approach. The main advantage of the crestal approach is that it is less invasive than the vestibular one, which, while it gives the surgeon a view of the site, creates patient discomfort. A minimally invasive crestal surgical approach was proposed by Tatum in 1986 and subsequently refined by Summers in 1994.

The approach theoretically described by Summers can be successful if the residual bone height is at least 5.6 mm. Depending on whether the bone material resulting from the osteotomy or other graft materials are used, we get the OSFE technique (osteotome sinus floor elevation) or the BAOSFE technique (bone-added osteotome sinus floor elevation).

If the ridge is lower than 5.6 mm and cannot offer primary stability, an implant placement procedure is required that takes longer than the sinus lift procedure.

In the delayed approach, an osteotomy to the sinus floor is performed using a 5-mm trephine drill. Following that, the bone cylinder obtained by the trephine drill is pushed forward using a No. 5 osteotome with a concave tip. As a result, the Schneiderian membrane is lifted by the cylinder. Under no circumstances must the osteotome penetrate the sinus. As early as 1985, Muller et al. suggested avoiding such instruments if the force required was greater than 20 MPa, so as not to cause tissue damage from excessive compression.

In 2001, Fugazzotto developed a modification of this method for situations where a molar extraction was performed that included the interradicular septum and at least 50 percent of the postextractive alveoli in the cylinder to be elevated.

The crestal bone defect is then filled with bone substitute in the stages before healing. The delayed approach forces the patient to undergo at least two surgical procedures. The insertion of the implant, by contrast, may be performed concurrently with a crestal sinus lift if primary stability can be guaranteed.

Summers described this technique in 1995. Using an appropriate range of osteotomes (whose tip must never enter the sinus), he managed to lift the membrane by pushing the collected bone towards the apex to allow enough room for the fixture.

A modification of the Summers method is to use osteotomes of ascending length with crestal stops. They are alternatively concave and convex as their size increases (Malchiodi 2003). This approach ensures a...
reduction of the perforation risk and a better compaction of the bone because of the characteristic shape of these osteotomes. Summers inserted graft material by compacting it with his osteotomes inside the osteotomy site until the Schneiderian membrane was sufficiently detached. With this technique, the final quantity of material introduced is determined by how much the membrane can stretch (Winter et al. 2002), a characteristic that is not easily evaluated.

The shrinkage of about 1–2 mm that each sinus lift undergoes during the healing process must also be taken into account. Implant lengths must be related to the possible final dimension of the augmented ridge (Cosci and Luccoli 2000). The authors themselves raised the issue of greenstick fracture of the sinus floor, which often causes lacerations, and suggested the use of a special drill.

The piezoelectric bone surgery technique was introduced in 2000. Selective cutting can reduce the membrane perforation rate by 7 percent. This technology has allowed the development of a sequence of piezoelectric implant site preparation tools with instruments that provide access to the sinus membrane without trephine or traditional drills that present a high perforation risk.

Since 2003, various techniques have been designed with the aim of raising the membrane through an elastic balloon inflated by hydraulic pressure. Although several studies have shown high success rates, a possible complication is balloon rupture, which may lead to a possible simultaneous rupture of the membrane.

The purpose of this report is to assess the extent to which the sinus membrane can be augmented with special screw elevators, designed by the lead author, in the presence of at least 3 mm of space between the crown margin of the bone crest and the sinus floor, using hydrodynamic pressure (idrodissection) in combination with bone grafts.

**Materials and methods: demographic details**

Between May 2006 and March 2010, 29 patients (20 women and nine men) underwent surgery using a crestal sinus lift technique (Sinus Physiolift) and contextual placement of 32 implants. Of the patients, five smoked an average of eight to nine cigarettes per day. The average age at the time of surgery was 51 years (range: 20 to 72 years).

**Inclusion and exclusion criteria**

Patients were included in this study according to the following criteria:

- Partial edentulism under the maxillary sinus
- Minimum distance between the sinus floor and the crown margin of the bone crest of 3 mm (Fig. 1)
- Absence of sinus disease
- Absence of systemic disease and, in the case of diabetes, regular check-ups
- Patients willing to sign informed consent
- Primary stability of at least 20 Ncm
- Patients willing to undergo CT examinations

Exclusion criteria included:

- Parafuction, bruxism or clenching
- Heavy smokers (more than 10 cigarettes per day)
- Poor oral hygiene
- Patients undergoing chemotherapy or radiotherapy associated with taking biphosphonates
‘The main advantage of the crestal approach is that it is less invasive than the vestibular one, which, while it gives the surgeon a view of the site, creates patient discomfort.’

**Pre-surgical treatment**

All of the patients underwent two or more sessions of professional oral hygiene in the weeks prior to surgery.

For the proper execution of the surgical study, a cone beam or traditional CT with a barium X-ray mask (30 percent on the teeth and 10 percent on the base) was required.

Starting on the day preceding the surgery, antibiotic coverage with amoxicillin/clavulanic acid was administered every 12 hours for six days. Additionally, a 0.12 percent chlorhexidine rinse for two times a day was prescribed for a total of six days starting on the day before the surgical procedure.

**Surgical treatment**

All patients underwent conscious sedation and pain control therapy:
- Cortisone (4 mg Bentelan)
- Benzodiazepines (diazepam, 1 mg boluses to achieve the effect)
- NSAIDs (ketorolac tromethamine, 1 vial during surgery)
- Fargan (promethazine 1 mg used in consolidation only in patients already taking other medicines for the nervous system)
- Local anesthesia was performed in a plesic way in association with mepivacaine with a 1:100,000 adrenaline ratio (Septanest, 4 percent Septodont).

A bevelled intrasulcular crestal incision, extending from the mesial to the distal tooth, was performed. A full-thickness flap was elevated on the bone crest only. Following skeletonization of the ridge under the control of a surgical guide, the implant site was prepared with Piezosurgery 3 (Mectron Medical Technology, Carasco, Italy). The “bone implant” power was set following the protocols designed by Vercellotti, mainly with regard to the initial steps with an IM1 and an IM2P instrument up to 1 mm from the sinus floor (Figs. 2–4).

The baseline cortical sinus was eroded with an OT9 instrument to obtain an access hole of 2.4 mm in diameter (Fig. 5). The screw elevator was thus added by an implantology micromotor (20 Ncm, 20 rpm) in the prepared site as far as the cortical basal. However, the inside of the sinus did not have to be penetrated. The hollow screw was stable and ensured watertight integrity (Figs. 6, 7).

Once the screw elevators were inserted, the Physiolifter was connected, which joined the elevator with the syringe containing 3 ml of physiological saline solution (Figs. 8–10). It is worth mentioning that the syringe had been filled before its connection to the screw elevators to avoid the formation of air bubbles inside.

Then, pressing the Physiolifter, saline solution was injected into the sinus after checking for potential liquid loss due to incorrect insertion of the screw elevators. In this manner, the membrane was gradually separated.

The tube of the Physiolifter was later disconnected and the Valsalva maneuver was performed to drain the saline solution from the maxillary sinus. The same maneuver was also performed to verify the integrity of the membrane. If the patient feels water in the nose, the membrane is lacerated and the intervention has to be stopped.

After the screw elevator had been unscrewed and a preparation of the crestal portion of the implant tunnel with the IP 2-3 insert (Fig. 11), heterologous bone was compacted into the hole (Figs. 12, 13) according to Del Fabbro et al., who have demonstrated that this type of graft is associated with the highest implant success rates. Without activating the pedal, the graft material remaining in the implant site was pushed into the sinus using the OT9 instrument.

In the case of resistance of the graft material, a way to operate more smoothly was to intermittently activate the machine with the saline supply as low as possible. After freeing the channel implant, a conical implant (BIOMET 3i, Palm Beach Gardens, Fla., U.S.A.) of the appropriate diameter and length was inserted in a submerged healing procedure (Figs. 14, 15).

This technique, devised for single tooth gaps, can be used even if several teeth are missing and there is excessive pneumatization of the maxillary sinus. The
surgical procedure is identical for the second implant site where a second screw elevator is inserted. It must be ensured during this procedure that the first screw elevator is impenetrable by applying a special airtight seal so that the system is not pneumatized during the second lift.

Follow up and evaluation of the rise

All patients were recalled six months after surgery. An intraoral control X-ray was taken using a parallel-beam technique to check the amount of lifting and radiopacity (Figs. 16, 17). The WixWin visualization software (Gendex Dental Systems, Des Plaines, Ill., U.S.A.) was used for comparative measurement of the different X-rays. The measurement system was calibrated by referring to the linear distance between five implant coils (5 x 0.9 mm).

The vertical distance was measured at the implant axis, between the sinus floor and the highest point of the lifted area. This action was performed for each implant inserted, and an average was calculated for each patient in order to obtain one single value. Later, the difference between the values of the follow-up and the corresponding measurements on baseline X-rays was calculated.

Results

Between May 2006 and March 2010, 29 patients with an average age of 51 years received this special treatment. At baseline, the distance between the sinus floor and the crown margin of the bone crest was 4 ± 1 mm. The volume of saline added was 4 ± 1 ml. The radiographic controls showed that the graft material was distributed evenly around the implants, suggesting the integrity of the membrane.

At the time of surgery, radiographic controls showed an average height increase of 7.3 ± 1.5 mm. Six months after surgery, this figure had been reduced by about ± 0.5 mm on average. At reentry, two implants were not osseointegrated and were replaced after one month with implants of the same diameter and length, as the height increase was stable. All the other implants were osseointegrated.

Discussion

The maxillary sinus has always limited the placement of osseointegrated implants. A growing need was perceived to overcome this anatomic limit by offering a stable solution at reduced biological cost. In our implant age, patients cannot and should not accept removable restorations. These are easy enough to provide, but the patient cannot achieve full social reintegration.

There are many ways to perform a sinus lift. Some are now highly predictable and so easy to perform that they have become an everyday part of the oral surgeon’s armamentarium.

The vestibular approach to the sinus allows direct visual control, and it is therefore easier to achieve results. On the other hand, the postsurgical period is debilitating. Until recently, this was considered to be the only way to realize a major sinus lift as the crestal approach does not allow extensive extended lifting in most cases. This approach is certainly less disabling but, as already mentioned, it does not offer a view of the area where surgery is performed, which must therefore be explored by instruments, a feat that requires great sensitivity.

Traditional techniques cause a lot of patient discomfort because procedures fracturing the sinus floor and the raising and compaction of the graft material inevitably require the use of osteotomes, and a “hammer and chisel” are definitely not pleasant and are difficult for the surgeon to control.

We believe that the gold standard is a procedure where patient discomfort is minimal and where the possibility exists to achieve a large volume increase. Liquids are incompressible, and pressure is distributed through them in a uniform and progressive way, which is why they are so successful in sinus lifting.
way. This led us to consider the use of hydrodynamic pressure to obtain the desired result. The water balloon procedure was a good idea, but this method is not completely controllable because of the elastic resistance of the balloon, which does not allow safe elevation of the membrane.

To ensure that the system remains sealed, we designed special screw elevators that, through intimate contact between the coils and the basal cortex, allow us to use the pressure-tube syringe of the system efficiently.

**Conclusion**

In our clinical practice, we have not seen more complications in terms of membrane perforation compared to traditional methods, and the extent of augmentation is much greater than other crestal techniques. The most important benefit is the much less debilitating postoperative phase. Less time is spent in the surgery and the surgeon is less stressed during the procedure. Although the number of cases in this study was limited and the operator was an experienced surgeon, the results were very encouraging. (However, this technique does not replace the big sinus lift in case of residual bone height less than 3 mm.) The procedure should be learned carefully and slowly as the technique is operator-dependent. However, an extended follow-up is necessary to assess the stability of the result.

The authors would like to thank Mectron for collaborating and the production of the hollow screws. We also thank Giuseppe Vercellotti for his kind collaboration. A complete list of references is available from the publisher. This article first appeared in *implants*, Vol. 12, Issue 2/2011.

**_about the authors_**

Rosario Sentineri, DDS, MD, earned an advanced degree in medicine and surgery from the University of Genova in 1983. He specialized in odontostomatology and graduated with cum laude status in 1987. Sentineri is the founder and active member of the Piezosurgery Academy as well as a visiting professor at the University of Chieti, Italy. In addition, as the inventor of special Bone Expanders, Sentineri is an international referee of the Atrofic Ridge Expansion Technique. He also invented a crestal sinus augmentation technique using hydrodinamic pressure and special hollow screws.

Rosario Sentineri, DDS, MD  
Piazza De Ferrari 4/10 Genoa, Italy  
Tel. +390102474533  
E-mail: rosario.sentineri@gmail.com

Giorgio Dagnino, DDS, earned an advanced degree in odontostomatolgy and prostodontics from the University of Genova, Italy, and graduated with cum laude status and an academic medal in 2010. In 2010, Dagnino completed the annual post-graduated course in restorative dentistry (Dr. Adamo Monari). He is a former student of Rosario Sentineri, MD, DDS, and completed his post-graduated course in Atrofic Ridge Expansion in 2011.
The future of implant-supported restorations utilizing CAD/CAM technology

Author: Robert Humphries, DDS, MS

For over a decade, we have been fortunate in the area of restorative implant dentistry to be able to incorporate CAD/CAM-designed, precision-milled, custom patient-specific abutments in the treatment of our patients. However, this was not always the case.

Solutions of the past: Temporary and final abutments

Before 1999, we had limited abutment choices; mainly stock (straight or angulated) or custom cast abutments, with either choice presenting its own particular difficulties. Components designed for fabricating provisional restorations were even more difficult to work with.

Complications when using a final stock abutment could involve one or more of the following:

- If the implant fixture is not ideally placed, stock abutments rarely allow proper lines of draw, and therefore, there is no possibility for screw-retention of the prosthesis due to fixture angulation.
- They almost always need adjustments (interproximal and occlusal), and for cases where a zirconia stock abutment is utilized, micro-fractures are a definite possibility if the abutment is not properly handled during modification, which could then lead to abutment fracture.
- In cases where the cement line ends up millimeters sub-gingival and/or monoplane (circumferential), by design, cementation and the difficulty with removing cement could also be a problem.
- A larger quantity of alloy is necessary to properly support the overlying porcelain, greatly increasing the cost of the restoration, due to the smaller size of the stock abutment.

Custom cast abutments were the next step in improved abutment design and provided us the possibility of correcting fixture angulation problems and an abutment that represented, more anatomically, a crown preparation. However, problems that could occur with the use of these abutments are:

- They are costly.
- It is technically difficult to achieve an accurate fixture platform to abutment interface.
- Mis-casts are always a possibility.

Provisional abutments and restorations

Another factor in the process of providing our patients with dental implant restorations involves the fabrication of the provisional restorations. With most stock systems, the temporization process can be inefficient and, in most cases, very time consuming.

Stock components for implant provisionalization present the same problems as stock final abutments, including angulation, deep monoplane margins for cementation and non-ideal screw access openings. The provisional temporary "coping" also proves diffi-
cult to work with and, in many cases, quite unesthetic. In the end, these two types of abutments (stock and custom cast) have allowed us to serve our patients relatively well, but also present complicating factors that could affect everything from the fabrication of the abutment to the long-term soft-tissue health of the restoration.

_Enter the digital age: CAD/CAM patient-specific abutments_

Around 12 years ago, the first CAD/CAM designed, patient-specific abutments were introduced to dentistry: Atlantis™ abutments (Astra Tech Inc., Waltham, Mass.). These unique abutments have allowed dentists and laboratories to offer an abutment designed in a digital environment for the individual tooth/teeth being replaced, resulting in optimal function and esthetic results (Figs. 1, 2).

The key features of this abutment and the esthetic benefits that they help provide are defined by what is referred to as the Atlantis BioDesign Matrix™, which include:

- Atlantis VAD™ (Virtual Abutment Design) is the proprietary software used to design each patient-specific abutment based on the individual patient’s anatomy utilizing a 3-D cast scan and in an entirely virtual environment.
- Natural Shape™ refers to the ability to design the abutment such that it represents the shape of an “ideally prepared” tooth in all dimensions. This design allows for the proper occlusal clearance, as well as, retention and resistance forms.
- Soft-tissue Adapt™, which is the optimized support of the soft tissue forming the ideal emergence profile and soft tissue supported by the finished crown. The clinician and/or laboratory have the ability to develop the “ideal” emergence profile for each individual tooth in each specific site in the mouth.
- Teeth are not round. However, stock abutments only allow for a round or slightly flared abutment in an attempt to support the soft tissue.
- The Atlantis abutment provides the proper emergence profile to support the development of the soft-tissue contours in both one- and two-stage surgeries.
- Custom Connect™ describes the customized connection of an Atlantis Abutment to each particular implant interface. This means that each abutment interface and corresponding abutment screw is engineered and tested for each implant and optimally designed to incorporate the three key requirements of an interface design, including an insertion element, a tight “seal” or surface for seating and an anti-rotation feature.

_Development of soft tissue emergence profile using duplicate abutments and provisionals_

Whether using a one- or two-stage placement procedure, it is of paramount importance for the provisional restoration to guide the peri-implant soft tissues (gingival architecture) in developing the ideal emergence profile. Atlantis abutments make it possible for you to achieve this in a cost effective and time efficient manner.

At the time of implant placement, an index relation of the implant is made and transferred to the study model, allowing for placement of an analog. This altered model is then scanned into a 3-D virtual image so that the design of an Atlantis Abutment utilizing the Atlantis VAD software can begin (Fig. 3).

Atlantis abutments can be designed to the clinician’s and/or laboratory technician’s specifications, including such aspects as margin heights and depth, material used (titanium, gold-shaded titanium or zirconia), surface characteristics (smooth or textured for retention) and emergence width options (full anatomical dimensions, contour soft tissue, support soft tissue or no tissue displacement).

As a result, Atlantis abutments also allow for the correction of angulation discrepancies of the implant placed, and even provides the ability to create parallel abutments for multiple-unit restorations.

Another unique aspect of Atlantis abutments is that they can be fabricated with an identical duplicate so that one abutment can be used with the provisional restoration (Fig. 4) while the second abutment is used with the final restoration.

It is with this initial abutment and provisional
’Atlantis abutments allow the ability to design a patient- and site-specific abutment for each individual tooth being restored, representing the shape of an “ideally” prepared tooth.’

crown that the ideal emergence profiles and gingival architecture are created (Fig. 5). The final restoration can then be fabricated using the second abutment (Fig. 6) by simply following these ideal tissue contours captured in the final impression. Results demonstrate a natural appearing and realistic restoration (Fig. 7). Radiograph indicates optimal bone maintenance around the implant (Fig. 8).

Conclusion

In conclusion, Atlantis abutments allow practitioners and dental technicians the ability to design a patient- and site-specific abutment for each individual tooth being restored, representing the shape of an “ideally” prepared tooth.

- Create an emergence profile that can help to sculpt the ideal gingival architecture.
- Eliminate deep cement lines by designing the margins of Atlantis abutments to sub-gingival specifications.
- Correct fixture angulation for single- and multiple-unit restorations.
- Reduce costs by decreasing the amount of alloy used with cast restorations.

By leveraging the continued advancements in digital technology, dental professionals can provide patients with the highest level of individual care and optimized function and esthetics for their implant-supported restorations with added simplicity, reliability and profitability.

Robert Humphries, DDS, MS, is a graduate of the University of Michigan where he earned his undergraduate dental degree in 1985 and completed his Master’s in the specialty of prosthodontics in 1988. Humphries has worked with the Atlantis patient-specific abutments for more than 10 years and has lectured on the advantages of this solution for various dental societies and study groups over the past several years. He has been actively involved in the American College of Prosthodontists and is currently the immediate past president of the Michigan Section of the American College of Prosthodontists. You may contact him at,

3801 Glenkerry Court
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Fig. 7. Final ceramic restoration (#8).
Fig. 8. Radiograph showing optimal bone maintenance around the implant.
Fig. 9. Atlantis BioDesign Matrix.
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Implant-prosthetic troubleshooting

When dental technicians and dentists break into a sweat!

Authors: Georg Bach, DDS, and Christian Müller, ZTM

Implant-prosthetic troubleshooting usually starts at an advanced stage of the implant-prosthetic treatment, i.e., when implants have already been inserted and the next step is the insertion of prostheses on the artificial abutment teeth. This point in time is extremely unfavorable for several reasons, one being that — owing to the already completed surgical phase — there is no opportunity for intervention and modification of the implant placement.

The other reason is that the patient feels he or she is on the verge of a successfully completed treatment and does not realise that difficulties may now arise, which in extreme cases could result in failure of the entire treatment. This development usually ends in mutual accusations and forensic disputes.

‘Incorruptible’: The dental master model

In a worst-case scenario, it will not become apparent that the inserted implants cannot be treated dentally, or only with extreme difficulty, owing to unfavourable placement in the jawbone until the dental master model has been created by the dental technician after casting or after the check-bite at the very latest.

Plaster is incorruptible!” This conclusion, attributed to Freiburg dental surgeon Prof Eschler, was deliberately kept trivial; however, it is simply and utterly true. The dental master model shows the realities concerning placement of the implant, its axis, also with regard to abutment teeth, and the transition to the gingiva.

Exemplary patient cases

Our report will demonstrate, based on a few exemplary patient cases, the solution possibilities, but also the limits of implant-prosthetic troubleshooting — especially in terms of achieving a sustainable result for patient, dentist and dental technician.

Unidentified jaw misalignment (Figs. 1–8)

The problem

Two years ago, a male patient (in his mid-70s) had received two implants in the maxilla, followed by treatment with telescopes and a partial prosthesis. The patient stated that “the work did not agree with him right from the start”.

Aside from functional problems, he disliked the fact that the maxillary front teeth were not visible even when he opened his mouth half-way. Just by looking at the maxillary prosthesis it was easy to no-
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**Unidentified jaw misalignment**

Figs. 5, 6. After interdisciplinary planning between dental technician and dentist, two additional distally located implants were inserted; the four artificial abutment teeth each received a telescopic crown. We used individual insertion keys to facilitate incorporation of the telescopes.

**Fig. 7.** Initial X-ray image (panoramic tomography) with two implants (treated with telescopes) in the maxilla.

**Fig. 8.** Condition after the increase of abutment teeth in the maxilla, each inserted distally of the previous implants.

**Our solution**

A wax-up marked the beginning of the actual treatment. It was modified until the patient was satisfied with the placement of his teeth and his subsequent appearance.

Based on the results of this treatment planning, we were able to determine which position and alignment would be required for two additional implants (distally of the existing ones).

This in turn resulted in the creation of a drilling template, which was used during the insertion of the two additional artificial abutment teeth. After osseointegration of these two implants in regions #14 and 24, the new partial prosthesis (now supported by four implants (two existing and two new ones) was produced and integrated step by step.

Aside from cases like the one mentioned above, which are usually the result of design errors and/or design flaws, there is additional, yet different implant-prosthetic troubleshooting — covering primarily implant fractures or failure of individual implants within an extensive supra-structure.

This considerably smaller part of implant-prosthetic problem areas, as compared with the group of design errors mentioned above, will be covered and evaluated in this article.

The purpose of this is to demonstrate solutions so that the patients affected receive a modified solution in order to preserve the existing and very expensive work.

---

**Loss of implant due to peri-implantitis**

(Figs. 9–18)

A bridge structure in the second quadrant had been in place without any problems in a 50-year-old female patient for 10 years. Therefore, she only came to recall and follow-up examinations sporadically. The problem-free period ended abruptly when swelling and bite pain occurred in the left half of the maxilla. A panoramic tomography revealed radiological indications of a profound osseous defect around the mesial implant, which had to be removed on the same day. The issue then was the entire supra-structure. The patient insisted that this structure be preserved owing to the financial cost of having a new structure created after re-implantation.

**Our solution**

A new implant was inserted after the soft tissue and bone had healed in the area where the lost implant had previously been in place. The bridge structure that had been temporarily affixed on the remaining implant was used as guidance for incorporation of a replacement implant and then removed for the actual implant procedure. After osseointegration of the artificial abutment tooth, we inserted a plastic abutment and made a casting of the integrated bridge structure with polyether casting material. This customised abutment was transformed into metal and the bridge structure finally cemented in place after a trial insertion.

---

**Implant fracture**

(Figs. 19, 20)

Diameter-reduced implants can often be implanted even in a reduced osseous bed and aid in
the avoidance of augmentations. However, when introduced into the market, diameter-reduced implants were frequently used for other indications as well; some authors even recommended using them as standard implants. Stress phenomena caused a considerable number of implant fractures, resulting in markedly restricted indications for diameter-reduced implants.

The case presented here reflects the typical progress of this early phase. A purely implant-supported (two abutments) extension bridge was incorporated into the fourth quadrant. A diameter-reduced implant was used in spite of an oro-vestibular bone dimension that would have been sufficient for supporting a standard implant. The result was that the distal implant fractured after eight years.

**Our solution**

In one surgical session, we removed both the implant fragment remaining in the bone by way of an osteotomy and placed a further distal implant. After its osseointegration, we incorporated a completely new bridge using the existing mesial implant. The results achieved here can help us learn from design errors and select a different approach for future cases, so that we can also treat patients who have had failure of a comprehensive prosthetic restoration. Our last case will illustrate this situation.

**The unsuccessful conventional treatment versus the successful, well-planned implantological procedure (Figs. 21–34)**

Finally, we would like to present an unusual case: an unsuccessful conventional treatment that was replaced with implantological treatment carried out in close collaboration between the dentist and dental technician.

The patient had experienced considerable complications during prosthetic treatment (the goal being a telescopic partial prosthesis supported by teeth #43 and 33, while preserving the front teeth #42 to 32, which had been caries-free and without fillings until then, and replacement of teeth #47 to 44 and 34 to 37).

First, tooth #33 fractured and had to be extracted, in spite of the fact that preparation and casting had
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4. Self-tapping groove for increased initial stability
5. Tapered body for soft bone expansion

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**Implant fracture**

Fig. 19. The distal (diameter-reduced) implant of a bridge supported entirely by fractured implants.

Fig. 20. An additional implant was inserted distally after removal of the fragment that had remained in the bone. After integration of the implant, a new bridge supported entirely by implants was created, while incorporating the former implant.

**The unsuccessful conventional solution**

Figs. 21–25. Owing to the loss of prospective abutment teeth #43 and 33 during the prosthetic treatment phase, the remaining front teeth #42, 41, 31 and 32 received telescopic crowns.

Fig. 26. The partial prosthesis showed insufficient mounting. Already been done. Treatment was replanned after this event, and teeth #42, 41, 31 and 32 were also prepared (the goal being telescopic crowns). Shortly before implementation, tooth #43 also had to be extracted. The patient was unable to give the exact reasons for this. This left her with four teeth — #42, 41, 31 and 32 — which all had telescopic crowns.

Anchoring of the partial prosthesis was poor; the patient was able to loosen it with minimal tongue-applied pressure. The pronounced tendency of the prosthesis saddles to cave in also resulted in complications in the form of multiple recurrent pressure sores.

The patient was referred to us at this point. The reason for this according to her dentist was that implants, which the patient had inquired about, could be inserted neither in the extended front-tooth area nor in the side-tooth area owing to the narrow and atrophied alveolar ridge.

**Our solution**

It was true that the alveolar ridge on both sides, starting with the cuspid region and extending to the area where the molars had been previously, was fairly pointed, and the course of the osseous limbus alveolaris displayed a pronounced sagging distally of the previous pre-molar zone.

The patient thus showed considerable osseous deficits in both the oro-vestibular and horizontal dimension. In order to assess the basic possibilities of oral implants, we decided to perform 3-D imaging, which proved extremely helpful in this complex patient case.

After illustration of the osseous situation, there were indications that implantation would be possible without carrying out augmentation procedures. We then prepared a virtual implant plan, the results of which led us to prepare a drilling template. The remaining front teeth proved very helpful as a place
The unsuccessful conventional solution
Figs. 27–29. With the aid of 3-D imaging and planning, four implants were inserted in regions #46, 43, 33 and 36 without any augmentative treatment.

Fig. 30. After osseointegration of the artificial abutment teeth, two side-tooth bridges entirely supported by implants and four individual crowns were integrated with the remaining mandibular teeth.

Figs. 31–33. Three-dimensional diagnosis and planning (see dental pins) of the third and fourth quadrant.

Fig. 34. Orthopantomogram after incorporation of four implants, three of which were diameter-reduced Roxolid (Straumann) implants.

for securely anchoring the template. By opting for a shortened row of teeth with one implant each in the region of the former six-year molars and an additional artificial abutment in each of the former cuspid areas, we were able to keep the dimensions of the template relatively small.

The insertion of four implants in the regions of teeth #46, 43, 33 and 36 and their osseointegration were followed by treatment with the supra-structures, which consisted of two bridges in regions #46 to 43 and 33 to 36, entirely supported by implants, and four individual crowns on the front teeth. The restorations were temporarily affixed for six months and then cemented in place.

This article first appeared in implants, Vol. 12, Issue 2/2011.
The maintenance of crestal bone around dental implants

Author_Mohammed A. Alshehri, BDS

The longevity of dental implants is highly dependent on integration between implant components and oral tissues, including hard and soft tissues. Studies have shown that submerged titanium implants had 0.9 to 1.6 mm marginal bone loss from the first thread by the end of the first year in function, while only 0.05 to 0.13 mm bone loss occurred after the first year.\textsuperscript{1-3}

The first report in the literature to quantify early crestal bone loss was a 15-year retrospective study that evaluated implants placed in edentulous jaws.\textsuperscript{1} In this study, Adell et al. reported an average of 1.2 mm marginal bone loss from the first thread during healing and the first year after loading. In contrast with the bone loss during the first year, there was an average of only 0.1 mm bone lost annually thereafter.

Based on the findings on submerged implants, Albrektsson et al. and Smith and Zarb proposed criteria for implant success, including a vertical bone loss of less than 0.2 mm annually following the implant’s first year of function.\textsuperscript{4, 5}

Non-submerged implants have also demonstrated early crestal bone loss, with greater bone loss...
Clinical Case

Treatment of a Severe Vertical Intrabony Periodontal Defect with CKDI Regenerative Products

CK Dental (www.ckdental.net) produces a full array of periodontal regenerative products including high quality bone allografts and GTR membranes such as pericardium. This case report documents dramatic gains in bone growth and reduction in probing depths following use of CK Dental products for treatment of a severe vertical intrabony periodontal defect.

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After (9 months) - Note mesial tooth bone fill

A blend of 70% mineralized cortical cancellous and 30% demineralized cortical cancellous bone (225-1000 microns) was used. This combination is the optimal mix for regrowing bone in the mandible. The opposite is the case for the maxillae. Due to the softer bone, a greater concentration of osteoinductive bone (demineralized) is used. Pericardium membrane was used for GTR. These products were manufactured by Grand Biologics for CK Dental.

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in the maxilla than in the mandible, ranging from 0.6 to 1.1 mm, at the first year of function.6–8

_Surgical trauma_

Heat generated at the time of drilling, elevation of the periosteal flap and excessive pressure at the crestal region during implant placement may contribute to implant bone loss during the healing period.

_Heat generation and excessive pressure_

Eriksson and Albrektsson reported that the critical temperature for implant site preparation was 47 degrees Celsius for one minute or 40 degrees Celsius for seven minutes.9 Matthews and Hirsch demonstrated that temperature elevation was influenced more by the force applied than drill speed.10 When both drill speed and applied force were increased, no significant increase in temperature was observed owing to efficient cutting.10,11

Sharawy et al. compared the heat generated by the drills of four different implant systems run at speeds of 1,225, 1,667 and 2,500 rpm.12 All of the drill systems were able to prepare an 8 mm site without the temperature rising by more than 4 degrees Celsius (to 41 degrees Celsius).

For all drill systems, the 1,225 rpm drill speed required a 30 to 40 percent longer drilling time when compared with 2,500 rpm and a 20 to 40 percent reduction in the time required for bone temperature to normalise. With greater depth of preparation and insufficient time between drill changes, a detrimental temperature rise to 47 degrees Celsius or greater may be reached. The authors recommend that surgeons interrupt the drilling cycle every five to ten seconds to allow irrigant time to cool the osteotomy.

_Periosteal flap_

The periosteal elevation has been suggested as one of the possible contributing factors to crestal implant bone loss. Wilderman et al. reported that the mean horizontal bone loss after osseous surgery with periosteal elevation is approximately 0.8 mm, and the reparative potential is highly dependent upon the amount of cancellous bone (not cortical bone) underneath the cortical bone.13

The bone loss at stage II implant surgery in successfully osseointegrated implants is generally vertical and noted only around the implant characterised by saucerisation, not the surrounding bone even though during surgery all the bone was exposed. Therefore, this hypothesis is not generally supported.

_Occlusal overload_

Research has indicated that occlusal overload often resulted in marginal bone loss or de-osseointegration of successfully osseointegrated implants.1,3,14–20 The crestal bone around dental implants could be a fulcrum for lever action when a bending

---

Table 1: Comparison between implant and tooth.

<table>
<thead>
<tr>
<th></th>
<th>Tooth</th>
<th>Implant</th>
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<tbody>
<tr>
<td><strong>Connection</strong></td>
<td>Periodontal ligament (PDL)</td>
<td>Osseointegration (Brånemark et al. 1977), functional ankylosis (Schroeder et al. 1976)</td>
</tr>
<tr>
<td><strong>Proprioception</strong></td>
<td>Periodontal mechnaoreceptors</td>
<td>Osseoperception</td>
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<tr>
<td><strong>Tactile sensitivity</strong> (Mericske-Stern et al. 1995)</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td><strong>Axial mobility</strong></td>
<td>25–100 µm</td>
<td>3–5 µm</td>
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<td>(Sekine et al. 1986, Schulte 1995)</td>
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<tr>
<td><strong>Movement phases</strong></td>
<td>Two phases</td>
<td>One phase</td>
</tr>
<tr>
<td>(Sekine et al. 1986)</td>
<td>Primary: Non-linear and complex</td>
<td>Linear and elastic</td>
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<tr>
<td></td>
<td>Secondary: Linear and elastic</td>
<td></td>
</tr>
<tr>
<td><strong>Movement patterns</strong></td>
<td>Primary: Immediate movement</td>
<td>Gradual movement</td>
</tr>
<tr>
<td>(Schulte 1995)</td>
<td>Secondary: Gradual movement</td>
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<tr>
<td><strong>Fulcrum to lateral force</strong></td>
<td>Apical third of root (Parfitt 1960)</td>
<td>Crestal bone (Sekine et al. 1986)</td>
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<td><strong>Load-bearing characteristics</strong></td>
<td>Shock absorbing function</td>
<td>Stress concentration at crestal bone (Sekine et al. 1986)</td>
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<td>Stress distribution</td>
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</tr>
<tr>
<td><strong>Signs of overloading</strong></td>
<td>PDL thickening, mobility, wear facets, fremitus, pain</td>
<td>Screw loosening or fracture, abutment or prosthesis fracture, bone loss, implant fracture (Zarb and Schmitt 1990)</td>
</tr>
</tbody>
</table>
Factors associated with increased bending overload in dental implants:
- Prostheses supported by one or two implants in the posterior region (Rangert et al. 1995)
- Straight alignment of implants
- Significant deviation of the implant axis from the line of action
- High crown/implant ratio
- Excessive cantilever length (>15 mm in the mandible, Shackleton et al. 1994; >10–12 mm in the maxilla, Rangert et al. 1989; Taylor 1991)
- Discrepancy in dimensions between the occlusal table and implant head
- Para-functional habits, heavy bite force and excessive premature contacts (>180 μm in monkey studies, Miyata et al. 2000; >100 μm in human studies, Falk et al. 1990)
- Steep cusp inclination
- Poor bone density/quality
- Inadequate number of implants

The cortical bone is known to be least resistant to shear force, which is significantly increased by bending overload. The greatest bone loss was seen on the tension side. According to Von Recum, when two materials of different moduli of elasticity are placed together with no intervening material and one is loaded, a stress contour increase is observed where the two materials first come into contact. Photoelastic and 3-D finite element analysis studies demonstrated V- or U-shaped stress patterns with greater magnitude near the point of the first contact between implant and the photoelastic block, which is similar to the early crestal bone loss phenomenon.

Misch claimed that the stresses at the crestal bone may cause microfracture or overload, resulting in early crestal bone loss during the first year of function, and the change in bone strength from loading and mineralisation after one year alters the stress-strain relationship and reduces the risk of microfracture during the following years.

Wiskott and Belser described a lack of osseointegration attributed to increased pressure on the osseous bed during implant placement, establishment of a physiological biological width, stress shielding and lack of adequate biomechanical integration between the load-bearing implant surface and the surrounding bone. They focused on the significance of the relationship between stress and bone homeostasis. Based on a study by Frost, five types of strain levels interrelated with different load levels in the bone were described:

1) Disuse, bone resorption
2) Physiological load, bone homeostasis
3) Mild overload, bone mass increase
4) Pathological overload, irreversible bone damage
5) Fracture

‘There has been no evidence that peri-implantitis induces crestal bone loss during healing and, in the first year of function, at a faster rate than following years.’

---

### Table II. Studies regarding the biologic width around natural teeth or dental implants.

<table>
<thead>
<tr>
<th></th>
<th>Natural Teeth</th>
<th>Non-submerged</th>
<th>Submerged</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulcus depth (SD)</td>
<td>0.69 mm</td>
<td>0.97 mm</td>
<td>0.16 mm</td>
</tr>
<tr>
<td>Junctional epithelim (JE)</td>
<td>1.34 mm</td>
<td>1.14 mm</td>
<td>1.88 mm</td>
</tr>
<tr>
<td>Connective tissue (CT) attachment</td>
<td>1.07 mm</td>
<td>0.77 mm</td>
<td>1.05 mm</td>
</tr>
<tr>
<td>Biologic width</td>
<td>2.04 mm</td>
<td>1.91 mm</td>
<td>3.08 mm</td>
</tr>
<tr>
<td>(JE + CT)</td>
<td>(JE + CT)</td>
<td>(SD + JE + CT)</td>
<td>(SD + JE + CT)</td>
</tr>
</tbody>
</table>
The concept of “microfracture” was proposed by Roberts et al., who concluded that crestal regions around dental implants are high-stress-bearing areas. They explained that if the crestal region is overloaded during bone remodelling, “cervical cratering” is created around dental implants. The study recommended axially directed occlusion and progressive loading to prevent microfracture during the bone-remodelling periods.

Progressive loading on dental implants during healing stages was first described by Misch in the 1980s to decrease early implant bone loss and early implant failure. Based on the concept, progressive loading needs to be employed to allow the bone to form, remodel and mature to resist stress without detrimental bone loss by staging application of diet, occlusal contacts, prosthesis design and occlusal materials. Appleton et al. reported a decrease in crestal bone loss in progressively loaded implants, compared with implants without progressive loading, within a similar healing and loading period. In addition, digital radiographs indicated an increase in bone density in the crestal 40 percent of the implant in the progressive loaded crowns.

Greater crestal bone loss observed at the first year of function compared with following years can be explained by a reduced occlusal overload or increased resistance to occlusal overload after the first year of function including a functional adaptation of the oral musculature, wear of the prosthesis material, and/or an increase in bone density after a certain time period.

**Peri-implantitis**

Peri-implantitis is one of the two main causative factors of implant failure in later stages. A correlation between plaque accumulation and progressive bone loss around implants has been reported in experimental studies and clinical studies. Tonetti and Schmid reported that peri-implant mucositis is a reversible inflammatory lesion confined to peri-implant mucosal tissues without bone loss. Peri-implantitis however begins with bone loss around dental implants.

Clinical features of peri-implantitis were described by Mombelli as including radiographic evidence of vertical destruction of the crestal bone, formation of a peri-implant pocket in association with radiographic bone loss, bleeding after gentle probing, possibly with suppuration, mucosal swelling, redness and no pain typically.

In an experimental study evaluating the pattern of ligature-induced breakdown of peri-implant and periodontal tissues in beagle dogs, significantly greater tissue destruction was demonstrated clinically, radiographically, and histo-morphometrically at implant areas than at tooth sites. It was also found that significantly fewer vascular structures existed at implant sites compared with periodontal tissues. The difference in collagen fibre direction (parallel to the implant surface and perpendicular to tooth surface) and amount of vascular structure may explain the faster pattern of tissue destruction in peri-implant tissues than periodontal tissues. Literature has shown that peri-implantitis is similar in nature to periodontitis in that the microbiota of peri-implantitis resemble the microbiota of periodontitis.

However, there has been no evidence that peri-implantitis induces crestal bone loss during healing and, in the first year of function, at a faster rate than following years. Early crestal bone loss may result in an environment favourable for anaerobic bacterial growth.
Innovative Bonding Graft Material & Fully Synthetic Bone Substitute

The MIS Bone augmentation materials include a line of fully synthetic bone grafts. BONDBONE® is a resorbable, osteoconductive bone grafting material, taking the best qualities of hemihydrate and d-hydrate calcium sulfate and combining them into a unique product. It can be used on its own, or mixed with other granular bone grafting materials to form a composite that will help to prevent migration of particles and often eliminate the need for a separate barrier. 4BONE SBS is a fully synthetic bone graft composed of HA (60%) and βTCP (40%). Permeable interconnected micro and macro porosity promotes invasion of osteogenic cells by osteoconduction, which permits the diffusion of biological fluids, leading to fast formation of bone.
growth, thus possibly contributing to more bone destruction in following years.

In the majority of implants however the bone loss is dramatically reduced after the first year of prosthesis loading. Therefore, peri-implantitis as the main causative factor for early implant bone loss may not be justified.

_Micro-gap and the platform-switching concept_

Many implant systems have abutments used with conventional implant types that are flush with the implant shoulder in the contact zone. This results in the formation of microcracks between the implant and the abutment. Numerous studies have shown that bacterial contamination of the gap between the implant and the abutment adversely affects the stability of the peri-implant tissue.

If above-average axial forces are exerted on the implant, a pumping effect may ensue (depending on the positive internal/external connection at the interface), which may then result in a flow of bacteria from the gap, causing the formation of inflammatory connective tissue in the region of the implant neck. If the microcrack is located close to the bone, the creation of the biologic width will occur at the expense of the bone. If the microcrack is located close to the bone, the creation of the biologic width will occur at the expense of the bone.

Berglundh and Lindhe evaluated the micro-gap of the Brånemark two-stage implant and found that inflamed connective tissue existed 0.5 mm above and below the abutment–implant connection, which resulted in 0.5 mm bone loss within two weeks after the abutment had been connected to the implant. Ericsson et al. coined the term distance-sleeve-associated infiltrated connective tissue to describe this phenomenon. They interpreted this to be a biological protective mechanism against the bacteria residing in the microcrack, explaining the plaque-independent bone loss of approximately 1 mm during the first year.

This bone loss may result in a reduction of the marginal bone level in both the vertical and the horizontal dimensions. If the microcrack is located close to the bone, the creation of the biologic width will occur at the expense of the bone.

The platform-switching effect was first observed in the mid-1980s. At the time, larger-diameter implants were often restored with narrower abutments (Ankylos, DENTSPLY Friadent; AstraZeneca; Bicon), as congruent abutments were often still unavailable.

As it later turned out, this was a remarkable coincidence. The platform-switching concept requires that this micro-gap be placed away from the implant shoulder and closer toward the axis in order to increase the distance of this micro-gap from the bone as a protective measure.

_**Biological width**_

The clinical term biological width denotes the dimensions of periodontal and peri-implant soft-tissue structures such as the gingival sulcus, the junctional epithelium, and the supra-crestal connective tissues. According to measurements conducted by Gargiulo et al., the average biological width (from the base of the sulcus to the alveolar bone margin) is 2.04 mm, of which 0.97 mm is epithelial attachment and 1.07 mm is connective tissue attachment. These dimensions, however, are in no way static but subject to interindividual variation (from tooth to tooth and from patient to patient) and will also vary according to gingival type and implant concepts.

Numerous studies have shown that bone resorption around the implant neck does not start until the implant is uncovered and exposed to the oral cavity. This invariably leads to bacterial contamination of the gap between the implant and the superstructure. Bone remodeling will progress until the biological width has been created and stabilized. This width progresses not only apically along the vertical axis (Fig. 1), but also 1 to 1.5 mm horizontally, according to studies conducted by Tarnow et al. This is the reason for maintaining a minimum distance of 3 mm between two implants and platform switching in the esthetic reconstruction zone in order to obtain intact papillae and stable inter-implant bone.

_**Summary**_

Maintenance of crestal bone around dental implants is one of the critical factors that affect longevity and esthetic soft-tissue architecture. Preservation of such bone is a multifactorial process; as summarized in this article, some other factors related to crestal bone loss have been investigated. These includes bone volume, bone quality, soft-tissue biotype, condition of the adjacent teeth, implant design, implant dimensions, abutment design, augmentation procedures, implant insertion depth, time of loading, time of restoration, frequency of prosthetic secondary-component replacement, suturing techniques and patient compliance.

Proper tissue maintenance and care, regular hygienic evaluations and patient education on proper methods for home care are vital. Continued evaluation via probing, radiographic assessment and oral examination will allow the clinician to ensure long-term maintenance and overall treatment success.

A list of references is available from the publisher.
What is Sinus Physiolift?

“Sinus Physiolift” by Mectron is a new way to elevate the Schneiderian membrane with gentle hydraulic pressure via your implant osteotomy.

Sinus Physiolift is already very popular in Europe and is rapidly becoming popular in the United States and Canada. Sinus Physiolift can be used with virtually any root form dental implant system. It is recommended to use Piezosurgery® to safely prepare your implant osteotomy, however Sinus Physiolift can be used with or without Piezosurgery.

Although various manufacturers offer a number of techniques for performing crestal sinus lifts, they generally involve a rotating bur or a mallet and an osteotome. Both of those techniques can easily perforate the Schneiderian membrane. These manufacturers tend to show cartoons of their products being used on nice flat sinus floors. Have you ever seen a real sinus with a nice flat sinus floor? The Sinus Physiolift performed with the Piezosurgery technique is considered by many practitioners to be the safest crestal technique for accessing and elevating the Schneiderian membrane regardless of the shape of the sinus floor.

Sinus Physiolift is available in the United States and Canada from Piezosurgery Incorporated.

What is the concept behind Sinus Physiolift?

The concept behind Sinus Physiolift is very simple and makes sense. Basically, you prepare a 2.4 mm osteotomy from the crest of the alveolar ridge to the Schneiderian membrane and then use controlled hydraulic pressure to gently elevate the Schneiderian
membrane. Using a stock syringe, you can then place your graft material into the site.

After your graft is in place, simply finish the osteotomy and place your implant.

**How is Sinus Physiolift used?**

If you are using Piezosurgery, the technique is performed with three Piezosurgery Insert Tips. First, the IM1-SP (pilot) Insert Tip is used to establish the trajectory of your implant osteotomy.

Second, the IM2P (2 mm) Insert Tip is used to create a 2 mm osteotomy to approximately 1 mm below the Schneiderian membrane.

Third, the OT9 (2.4 mm diamond coated bur) Insert Tip is used to gently buff away the basilar bone (sub-sinus cortex) until you feel the Schneiderian membrane. It will feel somewhat like a trampoline.

The cutting motion of a Piezosurgery Insert Tip only moves about the thickness of a human hair at about 30,000 times per second. Although the cutting action of Piezosurgery Insert Tips cannot physically cut soft tissue, such as the Schneiderian membrane, you still need to be careful not to poke an Insert Tip through the Schneiderian membrane while creating the osteotomy.

If you are using a conventional drilling technique, you will need to carefully prepare a 2.4 mm osteotomy from the crest of the alveolar ridge to the Schneiderian membrane.

Once the 2.4mm osteotomy has been successfully prepared, screw in the special hollow, tapered screw to seal the osteotomy at the crest of the alveolar ridge. This screw can be placed with a handpiece or a ratchet using the adaptors included in your Sinus Physiolift Kit. After the special hollow, tapered screw is in place, remove the sterile syringe from its packaging and draw 4 ml of sterile saline into the syringe. Attach the Sinus Physiolift tubing to the tip of the syringe and press the syringe plunger to expel the air from the tubing. Leave exactly 3 ml of sterile saline in the syringe and attach the open end of the tubing to the special hollow, tapered screw that you have already placed into the 2.4 mm osteotomy.

Now insert the syringe into the Physiolifter and gently twist the dial until the 3 ml of sterile saline has been expressed into the site to gently elevate the Schneiderian membrane. Take a stock syringe and cut the tip to a diameter of approximately 2.4 mm. Place up to 3 ml of graft material into the stock syringe. Gently press your stock syringe into the prepared site and inject your graft material.

Once your graft material is in place, you can finish your implant osteotomy with the implant company’s drills or with the Piezosurgery technique, which utilizes Piezosurgery Implant Insert Tips (drills).

Piezosurgery Implant Insert Tips can safely prepare dental implant osteotomies up to 4 mm in diameter. This technique is recommended when preparing an implant osteotomy near delicate anatomy, such as the Schneiderian membrane or the inferior alveolar nerve.

**How can I purchase a Sinus Physiolift System?**

The Sinus Physiolift System can be purchased in the United States and Canada from Piezosurgery Incorporated. Call (614) 459-4922 or visit www.piezosurgery.us.
Should you load now or later?

Or much later?

Osstell ISQ helps you make optimal implant loading decisions - whether you’re doing immediate, traditional or delayed loading. By measuring before the final restoration, and comparing that value to the baseline value taken at placement, the decision on whether to load or not is made quick and easy.

You’ll find it especially valuable when treating higher risk patients. Osstell offers the only objective quality assurance system that gives you an early warning if osseointegration isn’t progressing as expected. With an objective ISQ-value, it’s easy to explain treatment planning and healing times to your patients and colleagues.

You already have the experience and the judgement. Now Osstell brings you and your patient new certainty.

Visit Osstell at the Annual Meeting of the AAP Nov 12-15, Miami Beach, FL booth #939

US Customer Service 1-877-296-6177

www.osstell.com

Your guide to optimal implant loading decisions
For the fourth year in a row, Dental Tribune Study Club hosts its annual C.E. Symposia at the GNYDM, offering four days of focused lectures in various areas of dentistry. Find us on the exhibition floor in aisle 6000!
Each day will feature a variety of presentations on topics, which will be led by experts in that field. Participants will earn CE credits for each lecture they attend. DTSC is the official online education partner of GNYDM.

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SUNDAY, NOVEMBER 27
10:00 - 11:00 DR. HOWARD GLAZER / COURSE NO. 3780
GIOMERS: NEW GIANTS OF MI DENTISTRY

11:15 - 12:15 DR. SHAMSUDIN KHERANI / COURSE NO. 3790
COMPREHENSIVE DENTISTRY USING DIGITAL IMPRESSION TECHNOLOGY

12:45 - 1:45 DR. RON KAMNER / COURSE NO. 3800
MINIMALLY INVASIVE DENTISTRY: TIPS AND TRICKS TO MAXIMIZE SUCCESS

200 - 3:00 DR. LOUIS MALCMACHER / COURSE NO. 3810
THE HOTTEST TOPICS IN DENTISTRY

3:15 - 4:15 DR. BRIAN HOWY / COURSE NO. 3820
TECHNOLOGY TO IMPROVE YOUR CARIES MANAGEMENT

4:30 - 5:30 DR. GEORGE FREEDMAN / COURSE NO. 3830
EVOLVING CONSERVATIVE RESTORATIONS

MONDAY, NOVEMBER 28
10:00 - 11:00 DR. FAY GOLDESTEP / COURSE NO. 4670
WHAT PATIENTS WANT... WHAT DENTISTS WANT: EASY, HEALTHY DENTISTRY!

11:15 - 12:15 DR. DAMIEN MULVANY / COURSE NO. 4680
WHY VIEW YOUR 3D PATIENTS WITH 2D IMAGES? A COMMON SENSE APPROACH TO 3D IMAGING IN THE GENERAL PRACTICE

12:45 - 1:45 DR. LARRY EMOTT / COURSE NO. 4690
REMEMBER WHEN “TE” WAS JUST A LETTER? USE 3D SERVICES TO IMPROVE PATIENT CARE AND INCREASE PROFITABILITY

200 - 3:00 DR. GEORGE FREEDMAN AND DR. FAY GOLDESTEP
DIODE LASERS AND RESTORATIVE DENTISTRY

3:15 - 4:15 DR. SHAMSUDIN KHERANI / COURSE NO. 4710
LASER DENTISTRY OVERVIEW WITH AN UPDATE ON CLOSED FLAP OSSUS

4:30 - 5:30 DR. MARTY JABLOW / COURSE NO. 4720
UNDERSTANDING THE ADVANCES IN SELF-ADHESIVE TECHNOLOGY AND HOW TO INCORPORATE THEM INTO YOUR RESTORATIVE PRACTICE

TUESDAY, NOVEMBER 29
10:00 - 11:00 DR. GREGOR KURTZMAN / COURSE NO. 5690
CORE BUILDUPS: POST & CORES AND UNDERSTANDING FERRUL

11:15 - 12:15 DR. PAUL GOODMAN / COURSE NO. 5700
CAPITALIZE ON THE HIDDEN IMPLANT PRODUCTION IN YOUR PRACTICE

12:45 - 1:45 DR. GEORGE FREEDMAN AND DR. FAY GOLDESTEP
THE DIODE LASER: THE ESSENTIAL SOFT TISSUE HANDPIECE

200 - 3:00 DR. SELMA CAMARGO / COURSE NO. 5720
LASERS IN ENDODONTICS: CLINICAL APPLICATION FOCUS ON DIFFICULT CASES

3:15 - 4:15 DR. STANLEY MACMED AND DR. MC FALKEN / COURSE NO. 5730
LOCAL ANESTHETIC PERFORMANCE: FACTION, FACT AND ADVANCEMENTS (PRECISION BUFFERING)

4:30 - 5:30 DR. ENRICO D'INTO / COURSE NO. 5730
MINIMALLY INVASIVE ENDODONTICS USING PHOTON INDUCED PHOTOACUSTIC STREAMING (PIPS)

WEDNESDAY, NOVEMBER 30
10:00 - 11:00 DR. IRA LAMSTER / COURSE NO. 6060
MANAGEMENT OF THE PATIENT WITH DIABETES MELLITUS: CONSIDERATIONS FOR DENTAL PRACTICE

11:15 - 12:15 DR. GEORGE FREEDMAN AND DR. MARC GOTTULIS / COURSE NO. 5650
ABCS OF BONDING CERAMIC CROWNS AND CERAMIC REPAIR

12:45 - 1:45 DR. RON KAMNER AND DR. ARMIN NEJATI
MINIMALLY INVASIVE IMPLANT DENTISTRY FOR THE GENERAL PRACTITIONER

1:30 - 2:30 DR. DAVID HOXTER
PLUS MORE PREMIUM LASER DENTISTRY LECTURES!
Foresight in implant planning

The field of implants is in a continuous state of evolution. Techniques, methods, equipment and materials are constantly being invented that create greater options for patients with different types of dentitions and desires for treatment. While choices abound for size and shape, the success of any implant procedure is dependent on many factors — bone width and depth, available space between teeth, root angulations, locations of nerves and anomalies that can interfere with placement.

CBCT imaging offers a “surgical” view of the teeth, gums and bone that is unattainable with 2-D imaging methods. The new i-CAT® Precise™ provides a cone-beam 3-D and panoramic imaging solution for general dentists and specialists who want to place implants with more confidence and efficiency.

CBCT imaging with the Precise offers 3-D images of soft tissue, hard tissue and bone structures, and its patented image processing provides a scope of data that other types of imaging cannot provide. This information allows the practitioner to avoid potential surgical complications with the knowledge of critical anatomical details on each patient’s unique area of interest.

Additionally, seeing a 3-D scan of their own anatomy increases patients’ understanding of the process. Implant dentist Justin Moody states, “The true anatomical representation shown on my i-CAT 3-D images encourages education and communication. As a result, this improves the patient’s confidence in my diagnosis and gives me more confidence for a successful treatment outcome.”

i-CAT Precise features the exclusive, integrated Tx Studio™ software, a comprehensive treatment tool that guides each case from plan to completion for increased surgical predictability. This application gives the dentist total control of all aspects of treatment — implant, abutment, and restoration. When used in conjunction with CAD/CAM, CBCT scanning saves hours of time in the chair and in additional appointments. Once the initial scan is taken, the case is planned and the surgical guide is ordered.

Dr. Michael Wing notes, “Having the E4D system allows me to mill crowns in the office. I can do a
guided implant placement, place a custom abutment, mill the crown and actually place the crown in the same day. 3-D is such a predictable treatment-planning situation. By seeing the scan, the dentist is essentially ‘doing surgery’ before touching the patient. You can predict what kind of abutment you are going to use, and be able to carry the case forward with CAD/CAM after you place the implant.”

Dr. John Russo relays the value of knowing the exact dimensions of prospective implant sites. “Before I had cone-beam 3D, I rarely placed implants in the mandibular second molar site. I can now take accurate measurements, and with the help of implant planning software, perform a virtual implant placement. Often, I can then place a 9 or 10 mm implant in the area without that guessing about the location of the nerve. This foresight can save my patients from numbness, which can be a long-lasting negative outcome.”

Besides avoiding surgical complications, the Precise as well as other i-CAT-powered systems, manages radiation dose by selecting the best possible image size and resolution.

Dr. Steven Guttenberg, notes, “I am confident that while I am getting the information that I need with my CBCT, my patients are getting the best treatment possible with the least exposure to radiation. My scanner also offers me the ability to collimate the beam, limiting the radiation exposure even more.”

The i-CAT Precise helps implant dentists to accomplish their surgical goals, with more success and less guesswork. That results in a more positive dental experience for both the dentist and the patient, and implants that continue to produce functional smiles for years to come.

Please visit www.imagingsciences.com for more information.
Quick Up method eliminates risk of accidental locking of dentures to implant, cuts procedure time in half

Millions of Americans wear dentures. Unfortunately, the majority of denture wearers are dissatisfied with their prosthesis — their chief complaints being poor retention, discomfort or difficulty speaking and eating. Supporting and stabilizing dentures with small diameter implants (mini-implant retained dentures) can resolve these problems and significantly improve denture retention, offering long-term clinical success.

The procedure involves creating a removable connection between the implants and the corresponding attachments, or secondary components, of the denture. Attachment bonding can be done by a lab in the indirect procedure, which causes a second appointment and is inconvenient for patient and clinician.

As an alternative, it can be done directly in the pick-up method. The direct pick-up method has the advantage that it can be done in one appointment and it is more accurate. However, the biggest fear of clinicians is the accidental locking of the denture to the abutment. VOCO now introduces Quick Up, a complete system that virtually eliminates the risk of interlocking and cuts chairside time in half.

The Quick Up product

With everything in one system, Quick Up improves workflow and chairside efficiency, saving time and money. The system includes Quick Up self-curing composite in the QuickMix syringe. Designed specifically for bonding attachments, such as ball, Locator® and telescopic attachments as well as other attachments in acrylic-based dentures, Quick Up self-curing composite can also be used for reattaching secondary elements in a denture, such as bar retainers.

Easy to use, Quick Up self-curing composite demonstrates exceptionally high strength, a physical attribute that’s essential for the long-term stability of denture attachments.

Other components of the system include: Fit Test C&B, used to check whether the openings in the denture base provide enough space to receive the attachments and for blocking out undercuts in the overdenture; Quick Up adhesive, a strong adhesive material that is applied to the underside of the denture to improve composite retention; and Quick
Up LC, a light-cure composite used to correct minor surface defects in the denture.

**The Quick Up method**

After the mini-implants have been placed into the jaw, a recess is prepared into the denture. The Quick Up method does not require vent holes. To ensure that the openings in the denture base provide enough space to receive the attachments, the kit includes Fit Test C&B, a control silicone (Fig. 1). This step is optional, but highly recommended for best results. Fit Test can also be used to block out any undercuts around the attachments, teeth or implants (Fig. 2).

Quick Up adhesive is applied and then recess filled only 2/3 full with the fast-setting Quick Up self-curing composite using the Quick Up automix syringe (Fig. 3). By under filling the recess, the risk of interlocking the denture with the intraoral attachments is virtually eliminated.

Furthermore, it saves time by eliminating the time-consuming step of removing excess composite material later. After seating the denture in the patient’s mouth, the material will set intraorally in only 2.5 minutes. After removal, any deficiencies can easily filled with the light-cured Quick Up LC (Fig. 4).

**Optimized work flow improves the bottom line**

The new Quick Up method not only improves the clinical success rate, but also optimizes work flow. In difficult economic times, it becomes more and more important for clinicians to optimize work flows without compromising quality. The Quick Up method is a great example how a product can not only improve results, but improve the work flow, save time, and therefore, money.

Compared to indirect lab-processed bonding of denture housings, the clinician saves impression material, disinfection, chairside time and lab fees. Yet even if the direct pick-up method is chosen, there are differences.

The new Quick Up method can cut the procedure time in half and save the clinician up to $125 in chairside time for each procedure.

**Table 1.** The example at right illustrates two implant pick ups. According to the American Dental Association, the average chair time cost is $300 per hour. Depending on each clinician’s skills and cost structure, the results may be different than those shown in this table. Voco recommends doing your own calculation based on your experience and individual office costs.

<table>
<thead>
<tr>
<th></th>
<th>Classic Method</th>
<th>Minutes</th>
<th>Quick Up Method</th>
<th>Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepare recess</td>
<td>10</td>
<td>Prepare recess</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Prepare two vent holes</td>
<td>4</td>
<td>No vent holes</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Block out attachment parts with silicone or wax</td>
<td>8</td>
<td>Block out attachment parts with Fit Test</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Apply primer</td>
<td>1</td>
<td>Apply primer</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Apply pick-up material/rel ine by over-filling and let it set</td>
<td>8</td>
<td>Apply Quick Up by under filing (2/3) and let it set</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>Remove excess material</td>
<td>10</td>
<td>Use Quick Up LC to fill gaps</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Polish</td>
<td>10</td>
<td>Polish</td>
<td>3</td>
<td></td>
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<tr>
<td>Total Minutes</td>
<td>51</td>
<td>Total Minutes</td>
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<tr>
<td>Total Chairside Cost ($5 per min)</td>
<td>$256</td>
<td>Total Chairside Cost ($5 per min)</td>
<td>$128</td>
<td></td>
</tr>
</tbody>
</table>
D4D Technologies releases E4D Compass

Software solution combines intraoral scanning and 3-D imaging for restoratively directed implant therapy

D4D Technologies, an award-winning manufacturer of dental CAD/CAM systems, announces the introduction of its new education, communication and collaboration implant planning solution, E4D Compass™. E4D Compass integrates 3-D data from leading cone-beam systems with E4D scan data to provide dental professionals a comprehensive and interactive view of the complete oral environment before implant placement.

Leading the way with restorative-based implant therapy, E4D Compass can aid in the design of the ideal restorative plan (via E4D’s DentaLogic™ software) and then on the same system import, DICOM data from compatible cone-beam systems to reveal the underlying 3-D data for ideal implant positioning.

D4D Technologies has worked with the leading cone-beam manufacturers, including Imaging Sciences International i-CAT®, Gendex Dental Systems and Instrumentarium/SOREDEX, to coordinate compatibility and efficiency of the entire treatment planning process.

The success of implant therapy is based upon the final restorative or prosthetic result in regards to form, function and esthetics. E4D Compass enables clinical operators to explore and educate themselves on the possible treatment options before offering or initiating treatment.

“The ability to do this at the chair is great for patient education and treatment plan acceptance because it demonstrates the individual patient’s real data instead of using stock images or demonstration models. The patient is engaged in the process from the beginning,” said Dr. Gary Severance, VP of marketing and clinical affairs for D4D Technologies.

E4D Compass integrates laser intraoral, model or impression scans (E4D Systems) and cone-beam data (i-CAT, GXCB-700™, SCANORA® 3D or Orthopantomograph® OP300) The intuitive E4D Compass software guides the operator through the entire process of determining optimal positioning and design for restorative-driven implant therapy.

“It is exciting to work with the E4D Dentist System to combine two incredible technologies into one powerful solution. By combining the surface data from E4D with the underlying anatomy from the cone-beam 3-D scan, doctors now have access to the full picture for complete implant and restorative treatment planning.

One of the best aspects of the E4D Compass system is how easy it is to use and the fact that the entire plan can be created chairside with the patient in a matter of minutes,” said Mark Hillebrandt, director of marketing at Imaging Sciences International.

E4D Compass is available exclusively through Henry Schein Dental and is compatible with E4D Dentist systems running DentaLogic 2.0 and i-CAT and i-CAT Precise (Imaging Sciences International), GXDP-700 (Gendex), Scanora 3D (SOREDEX) and Orthopantomograph OP300 (Instrumentarium) cone-beam systems.

For more information, contact D4D Technologies at (972) 234-3880 or at info@e4dsky.com.
Today, due to patient treatment expectations, there are increasing demands on dental implant designs and performance. BIOMET 3i has answered these demands with the introduction of a new implant designed to help achieve primary stability and improved clinical success rates, the new OSSEOTITE® 2 parallel walled implant.

The new OSSEOTITE 2 parallel walled implant is based on macrogeometric design enhancements of the legacy OSSEOTITE implant and is designed for more immediate bone-to-implant contact (IBIC) for achieving better primary stability.

The new design has a longer parallel-walled section for more direct implant body contact with the osteotomy walls. The shorter apical taper and cutting flutes provide more apical stability, while the long and narrow thread profile for the 5 mm and 6 mm implants generates an anchoring "bite-in-bone" engagement. This helps to reduce the risk of excessive micromovement early in the healing process. In addition, a clinical evaluation indicates at least 98 percent success rates.¹

OSSEOTITE 2 parallel walled implant are available in 3.25, 4, 5 and 6 mm configurations and are manufactured from biocompatible commercially pure titanium. To facilitate a transition to the new design, existing OSSEOTITE parallel walled prosthetic components, drilling instrumentation and guidelines remain compatible with OSSEOTITE 2 implants with one exception: tapping with new Dense Bone Taps for 5 and 6 mm OSSEOTITE 2 Implants is required.

Comments from clinicians who have used OSSEOTITE 2 parallel walled implant:

“In my opinion, the OSSEOTITE 2 Certain® implant can be a great help in achieving better primary stability in soft bone.” ~ Dr. Michael Christgau, Germany ²

“I found the implant provided higher primary stability, particularly in immediate placement scenarios!" ~ Dr. Tiziano Tealdo, Italy ²

“The implant provides a nice stable feeling. I believe it’s the best straight-wall implant I have ever placed.” ~ Dr. Pär-Olov Östman, Sweden ²

About BIOMET 3i

BIOMET 3i, a division of Biomet, Inc., is a leading manufacturer of dental implants, abutments and related products. Since its inception in 1987, BIOMET 3i has been on the forefront in developing, manufacturing and distributing oral reconstructive products, including dental implant components and bone and tissue regenerative materials.

The company also provides educational programs and seminars for dental professionals around the world. BIOMET 3i is based in Palm Beach Gardens, Fla., with operations throughout North America, Latin America, Europe and Asia-Pacific.

For more information about BIOMET 3i, please visit www.biomet3i.com or contact the company at (800) 342-5454; outside the U.S. dial (561) 776-6700.

¹ Data on file
² These clinicians have a financial relationship with BIOMET 3i, LLC resulting from speaking engagements, consulting engagements and other retained services.
The implant-abutment connection: Key to prosthetic success

In 1991, Compendium published an article by Dr. Gerald Niznick (Vol. XII, No. 12) with the same title as the heading above. The principles Niznick expounded 20 years ago are even more valid today with Implant Direct’s broad line of application-specific and industry-compatible implants shown by the company’s one- and two-piece implants below.

Dr. Gerald Niznick, a prosthodontist, revolutionized the implant industry with the introduction of the Screw-Vent® implant (now sold by Zimmer Dental) with its patented internal connection platform that featured a lead-in bevel for lateral stability and an internal hex for insertion and accurate transfer capabilities (Niznick U.S. Patent #4,960,381). This implant-abutment connection has become the cornerstone of modern implant design, licensed to eight implant companies and copied by many others following the expiration of the patent in 2007.

One such replication is the lead-in bevel/inter-nal hex of Nobel Biocare’s NobelActive™ implant. Whether the lead-in bevel is 45 degrees, as in the original Screw-Vent implant, or 8 degrees (Straumann®), 11 degrees (Astra™) or 12 degrees (NobelActive), a “conical” interface provides lateral stability, reducing the occurrence of screw loosening in comparison to butt joint connections (tri-lobe and external hex implants). The original 45-degree bevel, present in Implant Direct’s Legacy™ System, has the added advantages of increased strength and improved tactile sense for seating an abutment without the need to take an X-ray as recommended by Nobel Biocare for NobelActive.

Dating back to the early 1980s, Niznick’s focus has been to provide high-quality products at value-added prices with simplified surgical procedures and versatile prosthetic options. Following this strategy and with a strong focus on use of the Internet for education, sales and marketing, Implant Direct has been credited with bringing about a price-point shift in the implant industry in just four years. The industry changes and recent economic factors have prompted...
Implant Direct has recently launched a complete line of GPS™ abutments that are compatible with the LOCATOR system. Another Spectra-System one-piece implant, ScrewIndirect™ provides a multi-unit abutment platform for bar overdentures and fixed-detachable, hybrid prostheses — making Teeth-in-1Day™ a practical and cost-effective procedure.

In addition, Implant Direct offers implant solutions with industry-compatible internal hex, tri-lobe and octagon connections. The Legacy System offers surgical and prosthetic compatibility with Zimmer Dental’s Tapered Screw-Vent developed by Niznick in 1999. Legacy abutments are compatible with several other internal-hex implant systems, such as BioHorizons®, BlueSky and MIS®.

Implant Direct’s RePlant®, RePlus® and ReActive® Tri-lobe system provide prosthetic compatibility with Nobel Biocare’s Replace implants and Implant Direct’s SwishPlus™ and SwishPlant™ internal octagon tissue-level implants provide prosthetic and surgical compatibility for Straumann customers. Implant Direct does not make clones. It designs updated versions of these popular competitors’ products by adding features to improve self-tapping insertion as well as increase strength and surface area.

Implant Direct is in the process of increasing its manufacturing capacity from 40 CNC machines to 68 to keep up with the demand for its products. The additional manufacturing space will allow Implant Direct to offer CAD-milled titanium bars, custom abutments and surgical guides.

In addition to an already broad product line, Implant Direct will be launching the InterActive implant system (Q12012) with prosthetic compatibility to Nobel Biocare’s NobelActive implant plus surgical compatibility with Nobel Biocare’s Replace, Zimmer Dental’s Screw-Vent and Implant Direct’s Legacy implants. Implant Direct will also launch a full line of 3i Certain™ compatible abutments.

With 60 outside sales representatives and 40 inside customer support representatives in the United States, plus the industry’s most intuitive online support and shopping cart, it’s no wonder that Implant Direct received the highest customer satisfaction rating among seven implant companies in an independent study by Millennium Research Group.2

Implant Direct is truly transforming the implant industry and allowing implant treatment to become an affordable part of conventional dentistry._

1. LOCATOR is a registered trademark of Zest Anchors Company. The GoDirect and GPS Systems are neither authorized, endorsed, nor sponsored by Zest Anchors Company.

submissions: formatting requirements

Please note that all the textual elements of your submission:
- the complete article,
- all the figure captions,
- the complete literature list and
- contact info (bio, mailing address, e-mail address, etc.)

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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, contact us for additional instructions before you make your submission.

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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.

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Group Editor Robin Goodman
r.goodman@dental-goodman.com
Managing Editor Sierra Rendon
s.rendon@dental-tribune.com
implants
the international C.E. magazine of oral implantology

Managing Editor
Kristine Coiker
k.coiker@dental-tribune.com

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

Managing Editor
Robert Selleck
r.selleck@dental-tribune.com

C.E. Director
Christiane Ferret
c.ferret@dtstudyclub.com

Marketing Manager
Anna Wlodarczyk-Kataoka
a.wlodarczyk@dental-tribune.com

Marketing Assistant
Lorrie Young
l.young@dental-tribune.com

International Product/Account Manager
Jan Agostaro
j.agostaro@dental-tribune.com

Accounting
Melissa Chan
m.chan@dental-tribune.com

List Manager
Robert Spencer
database@dental-tribune.com

Product/Account Manager
Mark Eisen
m.eisen@dental-tribune.com

Product/Account Manager 
Interactive
Gina Davison
g.davison@dental-tribune.com

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