Intraoral welding and lingualized occlusion

Extraction Academy offers hands-on Mini Residency Program

Hahn Tapered Implant: 45 years in the making
<table>
<thead>
<tr>
<th>c.e. articles</th>
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<tbody>
<tr>
<td>04</td>
</tr>
<tr>
<td>Luca Dal Carlo, DDS, Franco Rossi, DDS, Marco E. Pasqualini, DDS, Mike Shulman, DDS, Michele Nardone, MD, Tomasz Grotowski, DDS, and Sheldon Winkler, DDS</td>
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<td>08</td>
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<td>Michael Norton, BDS, FDS, RCS(Ed)</td>
</tr>
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<thead>
<tr>
<th>education</th>
</tr>
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<tbody>
<tr>
<td>14</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
</tr>
<tr>
<td>18</td>
</tr>
<tr>
<td>20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>about the publisher</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>on the cover</th>
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</thead>
<tbody>
<tr>
<td>Cover image provided by Glidewell Laboratories. To learn more about the Hahn Tapered Implant, see page 18.</td>
</tr>
</tbody>
</table>
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Intraoral welding and lingualized (lingual contact) occlusion: A case report

Authors_Luca Dal Carlo, DDS, Franco Rossi, DDS, Marco E. Pasqualini, DDS, Mike Shulman, DDS, Michele Nardone, MD, Tomasz Grotowski, DDS, and Sheldon Winkler, DDS

Intraoral welding was developed by Pierluigi Mondani of Genoa, Italy, in the 1970s to permanently connect submerged implants and abutments to a titanium wire or bar by means of an electric current (Fig. 1). The current is used to permanently fuse the titanium to the abutments in milliseconds, so the heat generated does not cause any pathology or patient discomfort.

If possible, the implants are placed without flaps. The titanium wire or bar is bent and aligned passively to the contour of the labial and lingual surfaces of the implants before applying the electric current to permanently connect titanium implants.

The technique follows a strict surgical and prosthetic protocol, which includes using a number of implants as close as possible to the number of teeth to be replaced, achieving primary stability by engaging both cortical plates (bicorticalism), immediate splinting of the implants utilizing intraoral welding and immediate insertion of a fixed provisional prosthesis with satisfactory occlusion. The technique provides for immediate loading and does not jeopardize the integration process.2

Although intraoral welding has been used successfully in Europe, especially Italy, for many years, it has yet to achieve everyday use in the United States.

Members of the Italian affiliate of the American Academy of Implant Prosthodontics, NuovoGISI, have long and successful experiences with immediate loading of maxillary implants connected together by intraoral welding.2

By inserting the prosthesis with adequate retention and stability the same day as the surgery, patient complaints and discomfort can be avoided or substantially reduced. The instantaneous stability that results from the splinting can reduce the risk of failure during the healing period. Intraoral welding can also eliminate errors and distortions caused by unsatisfactory impression making, as the procedure is performed directly in the mouth.

Intraoral welding can fulfill a great need for business and socially active persons, as the surgical and prosthetic procedures are accomplished on the same day. Patients can leave the dental office with a stable, esthetic and retentive prosthesis.

The flapless technique, first proposed by Tramonte,3 can be performed when the bony crest is wide and an adequate amount of attached gingiva is

Fig. 1. Schematic drawing of Mondani intraoral solder unit.

Fig. 2. Preoperative panoramic radiograph of 50-year-old caucasian woman.

(Photos/Provided by Dr. Shulman, et al)
The technique allows for uneventful healing, a reduction of postsurgical inflammation and only moderate inconvenience for the patient, who can eat efficiently the same day.

**Provisional prosthesis and tooth arrangement**

During the surgical session, a temporary resin prosthesis is inserted. Occlusal plane height must be correct. A lingualized (lingual contact) scheme of occlusion is recommended. The upper anterior teeth are best arranged without any vertical overlap. The amount of horizontal overlap is determined by the jaw relationship. A vertical overlap for appearance can be used, provided that an adequate horizontal overlap is included to guard against interference within the functional range.4

**Lingualized (lingual contact) occlusion**

Lingualized (lingual contact) occlusion maintains the esthetic and food penetration advantages of anatomic teeth while maintaining the mechanical freedom of nonanatomic teeth. Among the advantages of a lingualized occlusion are occlusal forces that are centered over the ridge crest in centric occlusion, a masticatory force that is effectively transferred more “lingual” to the ridges during working side excursions, the “mortar and pestle” type of occlusion that minimizes the occlusal contact area providing for more efficient food bolus penetration and the elimination of the precise intercuspidation that can complicate the arrangement of anatomic denture teeth. Lingualized occlusion also prevents cheek biting by holding the buccal mucosa off the food table by eliminating occlusal contacts on the maxillary buccal cusps; minimizes occlusal disharmonies created from errors in jaw relationships, denture processing changes and settling of the denture base; and simplifies setting of denture teeth, balancing the occlusion and any subsequent occlusal adjustment procedures.5

**Clinical report**

A healthy 50-year-old caucasian woman pre-
Presented for treatment at the office of one of the co-authors (LDC) with a mobile, painful, 12-tooth semiprecious alloy-ceramic fixed prosthesis (Fig. 2). The prosthesis was removed and all of the remaining abutment teeth were found to be nonrestorable with extraction indicated (Fig. 3). After removal of the retained teeth, eight titanium one-piece implants were inserted in one session (Fig. 4).

Immediate stabilization of the eight implants and two additional implants that were previously inserted in the posterior regions was achieved by welding each implant to a 1.5 mm supporting titanium bar, which previously had been bent to fit passively on the palatal mucosa (Fig. 5).

A provisional resin prosthesis was inserted, which provided an acceptable vertical dimension and lingual contact occlusion. Oral hygiene procedures were demonstrated to the patient and reviewed at all future appointments.

After 90 days, a panoramic radiograph suggested complete integration (Fig. 6) and a healthy mucosa was observed. (Fig. 7). The definitive full-arch gold-ceramic maxillary prosthesis was inserted, which greatly pleased the patient and her family.

In the lower arch, the right first and second bicuspids were extracted and implants placed in the first bicuspid and first molar regions. The implants were welded together intraorally (Fig. 8), followed by the fabrication and cementation of a three-tooth fixed prosthesis (Fig. 9).

A seven-year follow-up radiograph (Fig. 10) shows satisfactory preservation of bone surrounding all of the implants. An intraoral photograph of the definitive prosthesis shows healthy gingival tissue (Fig. 11).

Acknowledgement: The technique utilized in the clinical report follows the Auriga procedure developed by Dr. Luca Dal Carlo.
implants

References


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Fig. 10. Seven-year follow-up radiograph shows satisfactory preservation of bone surrounding all of the implants.

Fig. 11. Intraoral photograph of the definitive prosthesis shows healthy gingiva.

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_Although intraoral welding has been used successfully in Europe, especially Italy, for many years, it has yet to achieve everyday use in the United States._
Primary stability vs. viable constraint: A need to redefine

Any regular reader of the Journal of Oral & Maxillofacial Implants or indeed of any other publication on dental implants could not fail to have noticed how much attention has been focused on primary stability. The concept of primary stability is not new; indeed, as early as the 1970s, there were studies emphasizing the need to establish mechanical stability to ensure un-interrupted healing of the bone.1 This was most evident in the orthopedic literature as it pertains to hip prostheses.2

By the 1990s, numerous reports were being published on immediate loading of dental implants, 3-6 and the groundbreaking work by Neil Meredith on the application of resonance frequency analysis (RFA) came to the fore7-9 with statements that achievement of implant stability was a prerequisite for long-term positive outcomes.

At the same time, Meredith recognized it was possible for clinically firm implants with poor axial stability to still be prone to failure.8 Of course, Brånemark recognized this in his early work, proposing as he did a period of submerged healing because of his concerns for any destabilization of the bone-to-implant interface during the early healing phase. However, today, we all recognize that such protective protocols are frequently unnecessary, with widespread acceptance of not only transmucosal healing but also immediate temporization and/or loading.

So how do we define primary stability? The most simple definition is one of mechanical friction between the implant and bone. Certainly, we can all appreciate that this contrasts with secondary implant stability where secondary stability is achieved by biological integration, i.e., osseointegration. The gradual shift from primary stability to secondary stability is critically poised at around three weeks. This is seen to be the least stable time point where viscoelastic stress relaxation of the bone along with remodeling results in a loss of primary mechanical stability9 but with an as yet poorly established degree of secondary stability or osseointegration.

This is also apparent in RFA curves, which, like a heartbeat, always register a certain pattern in healthy bone that reflects this loss of stability at the third or fourth week,10 regardless of bone density.

That said, we still need to define what constitutes primary stability, i.e., that which sets it apart from biological integration. As stated above, mechanical stability is one where a friction occurs between the implant and the surrounding bone, giving rise to a resisting torque at time of insertion.

This resisting torque is proportional to the effort required to seat the implant or peak insertion torque; they are in essence one and the same and depend largely on the characteristics of the implant, the density of the bone and the differential size of the osteotomy as it pertains to the diameter of the implant. Mathematically, it can be defined as follows:

\[
\text{Resisting torque} = \mu \cdot P \cdot H \cdot \pi \cdot D^2
\]

Where: \(H \cdot \pi \cdot D^2\) = surface area of implant in contact with bone, where \(H = \) height of the implant cylinder and \(D = \) diameter of implant cylinder

\(P = \) Critical pressure on the bone

\(\mu = \) Coefficient of friction

The important factor in this equation is \(P\), the critical pressure on the bone, as high pressure re-
implants

C.E. article_ primary stability vs. viable constraint

sults in unfavorable bone strain, particularly within the cortical compartment. However, the formula indicates that the resisting torque is proportional to the diameter (D) raised to the power of 2. This means that if you double the diameter the resisting torque becomes four times higher. Put another way, if we use the same insertion torque for a 3 mm wide implant and a 6 mm wide implant, then the critical pressure P will be four times lower for the wider implant!

For example, an implant of 3 mm diameter inserted into 1 mm thick cortical bone with a torque of 20 Ncm will transmit the same pressure to the bone as an implant of 6 mm diameter inserted into 2 mm thick cortical bone with a torque of 160 Ncm. (This assumes that 100 percent of the torque originates from the pressure on the cortical bone, and the contribution to torque from bone cutting, etc., is neglected). Yet manufacturers persist in providing a single target value of insertion torque across the range of implant diameters they offer.

It is therefore reasonable to discuss the virtues of insertion torque and ask the pivotal question: Is insertion torque an appropriate measure by which to quantify optimal primary stability? After all, bone is a living tissue, so any measure of primary stability must also reflect the future viability of the bone.

It is clear that higher insertion torques fulfill the desire to achieve a high degree of mechanical stability as interpreted through manual perception. Indeed, it is usual for manufacturers to provide some guidance on optimal insertion torque with some implant designs being specifically tailored to deliver higher insertion torques, in excess of 75 Ncm. This yields a sense of comfort for the clinician that the implant is initially “stable.”

However, such a high torque has not been shown to be propitious to the surrounding bone. Numerous studies have been published that clearly demonstrate that the critical pressure these high torques create leads to micro-fracture of the bone,11,12 with a net resorption in the cortical zone11,12,13 and, indeed, an unfavorable delayed healing process with a reduced bone-to-implant contact.14 Such a response might well shift the onset for secondary stability and thereby delay or extend the period of potential vulnerability. This is clearly counter to the goal we are trying to achieve with immediate or even early loading protocols, whereby we want to transfer from simple mechanical fixation to full osseointegration in the shortest possible time.

The most fascinating aspect of this debate is the lack of correlation between insertion torque and the implant stability quotient (ISQ) as measured by RFA, which appears to be counterintuitive. How is it possible for an implant that is driven in at 30 Ncm to have the same ISQ as one that required 100 Ncm of torque? Nonetheless, the weight of literature would seem to suggest this to be the case.15-18

Because ISQ is measuring axial stiffness, it must be clear that frictional rotational resistance is a completely different parameter. After all, I don’t doubt we have all have experienced the “spinner” (an implant that exhibits little or no rotational stability) that went on to osseointegrate, and there are a number of studies published that report high success rates for immediately loaded implants that were inserted with low insertion torque.19-22

By contrast, implants with an ISQ of less than 50 rarely go on to integrate successfully, and ISQ has been described as a good predictor of success.23,24 It is this dichotomy that has got me thinking and has led me to write this editorial piece. Could it be that axial stiffness is far more pertinent than rotational friction in ensuring an implant integrates? We already know from the literature that an implant can tolerate a degree of micro-motion, thought to be circa 100-
150μm\textsuperscript{26,28} and this is in essence what ISQ measures.

Studies have also demonstrated that insertion torque correlates closely to the degree of micro-motion\textsuperscript{25}. However, it is not the aim to seek complete elimination of micro-motion, a valuable lesson learned in orthopedics\textsuperscript{27}. If it is possible to place an implant with lower insertion torque and still achieve axial stiffness with an ISQ ≥60, surely this provides us with a more optimal evaluation of primary stability. Our goal must be the rapid onset of secondary stability, with minimal critical pressure to the poorly vascularised cortical bone so unfavorable resorptive responses and delayed healing are avoided. At the same time, we need to employ an objective measure of constraint that reliably ensures the implant can tolerate early or immediate loading. As much was recently proposed by Barewal et al\textsuperscript{17}.

I have labeled this objective measure viable constraint (vC), whose central purpose is to obtain a clinically relevant degree of stability while maintaining a low critical pressure on the vulnerable cortical tissues through which our implants are inserted.

Bone is not wood. It is not inanimate. It would behoove us all to remember this, and avoid the carpenter’s approach to implant dentistry.

So I would take this opportunity to ask that we think in terms of viable constraint. It will, of course, take controlled prospective studies to determine the optimal conditions for vC, but if I were a gambling man (which I most certainly am!), I would guess for a 4.5 mm implant in bone with a cortex of <1.0 mm thickness that a maximum torque of 20 Ncm and an ISQ of 60 represent the optimal measures we are looking for to ensure safe immediate loading.

In the past, we used to think length was important with implants, whereas today there is increasing focus on short implants. However, I would point out that a strong correlation has been shown to exist between ISQ and implant length\textsuperscript{28,29,30} and, as such, for immediate loading, I also believe a longer implant with a higher ISQ, inserted at a lower insertion torque, will yield a more favorable outcome.

\textbf{Note}

This content originally appeared as an editorial in The International Journal of Oral & Maxillofacial Implants, published by Quintessence Publishing.

\textbf{References}

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Extraction Academy offers hands-on Mini Residency Program

Author: Extraction Academy Staff

Under the guidance and mentorship of the Extraction Academy faculty, dentists from around the world can participate in a hands-on, live patient extraction course. The faculty includes a dentist/pharmacologist, a periodontists, two oral surgeons and three general practitioners. During the two-day live surgical sessions (next on Sept. 12-13 in Los Angeles, 26 C.E. credits), doctors can take their clinical and surgical skills to the next level. Attendees will be provided with access to the Extraction Academy’s online library for the didactic portion of the series (10 C.E.), which they can review at their own convenience, prior or after the live surgical sessions.

The live surgical sessions are uniquely designed to include brief morning lectures and discuss different approaches to successful exodontia procedures, prior to prescreened surgical cases, each day.

The comprehensive program will include clinical preparation, overview of head and neck anatomy, pharmacology, medical emergencies, informed consent policies and protocols, risk management, suturing techniques, management of complications and post-operative care.

The late morning and afternoon interactive sessions are supplemented by doctors assisting in shoulder-to-shoulder surgeries and video demonstrations. The faculty and presenters will engage with questions, clinical cases and input from the audience, throughout each day.

The course is designed to teach minimally traumatic tooth extractions, focusing on alveolar ridge preservation, whenever and wherever possible. Participants will learn everything from single-, multiple-, full-mouth to impacted teeth extractions. The presenters will touch upon IV sedation, guided-bone regeneration (GBR) and tips and tricks. Students and faculty will also perform advanced procedures such as root tip extractions, wisdom teeth, calcified teeth, sinus precautions or involvement, infected teeth and exposing teeth for orthodontic treatment. Dental instruments nomenclature, proper use, maintenance and application will also be discussed.

The program will include concierge service and hotel accommodations for distant travelers, visa application invitations for international doctors, breakfast, lunch and a group dinner. All instruments and materials will be provided. California licensure is not required. Any dentist with a desire to increase his or her knowledge in oral surgery is welcome. Students with a California license can perform surgeries with the instructors.

The Extraction Academy specializes in continuing education workshops and lectures for general dentists, periodontists, oral implantologists, oral surgeons and endodontists as a multidisciplinary approach. Extraction Academy courses are designed around practical hands-on lectures. Courses start with extraction basics and progress to advanced techniques. The learnings will allow attendees to go back to their offices and immediately implement the techniques learned from Extraction Academy and add more revenue to their practices.

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Piezomed: Minimally invasive, maximally effective

Author: W&H Staff

Current developments focus on minimally invasive procedures with less postoperative pain for the patient and a faster healing time. Piezo technology has increasingly been finding its way into oral and maxillofacial surgery (OMFS) and implantology for more than a decade.

Maximum precision in surgical use and gentler treatment for the patient are just some of the advantages of this cutting-edge drive technology. With the new Piezomed, W&H can use state-of-the-art ultrasound technology for even the most demanding tasks in bone surgery, providing surgeons with optimal support in their daily work.

“Our product development has a clear aim: to consistently fulfill the many different needs of the patients and also to satisfy the users’ requirements. The new Piezomed minimizes the invasiveness of surgical treatments. Safe working thanks to automatic instrument detection and unique instrument design takes on a completely new meaning for the user,” said Andreas Lette, strategic W&H product manager and head of product innovation.

New dimension in bone surgery

The new surgical instrument from W&H employs state-of-the-art ultrasound technology. High-frequency micro-vibrations enable high-precision incisions while the so-called cavitation effect ensures an almost blood-free surgical site and an excellent view of the treatment area.

In addition to these benefits, W&H offers maximum safety during operation with its patented automatic instrument tip detection. Piezomed detects the instrument during tip insertion and sets the correct power class automatically. This significantly lowers the risk of harming a patient and overloading the instruments, according to the company.

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W&H offers a selected range of 24 intelligently created working instruments to provide optimum cover for the wide variety of tasks dealt with by surgeons.

“For example, the bone saws have a specially developed tooth design that enables bone block harvesting with low bone loss. We also offer a special saw that boasts extremely high-cutting performance.”

“Many of the surgical instruments developed by W&H are an absolute world first in the global dental sector. Our developments are patented to protect our unique expertise,” Lette said.

The instruments have another advantage with their efficient cooling concept. The spray exits near the instrument’s work area, thus protecting the instrument from thermo-mechanical material stress. The user benefits from even safer and cooler processing of the operating field, according to W&H.

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The operating modes store a variety of performance characteristics. Equipped with a multi-functional foot control, the surgical device offers freedom for the users’ hands.

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Since placing his first implant nearly 45 years ago, Dr. Jack Hahn has spent much of his career as an implantologist thinking of ways to make treatment more accessible to the practitioner as well as the patient. Implant design has improved dramatically during that time, with Hahn spearheading key innovations that have helped make implant therapy the essential mode of dental treatment it is today. From the endosseous blade-form implant he helped Miter Inc. develop in 1978 to the newly released Hahn™ Tapered Implant, Hahn’s efforts have been driven by the desire to continually improve in order to make treatment simpler and more predictable.

“The easier we make it to position the implant for a restoration that looks like a natural tooth, the better results we’ll have,” Hahn said. It was this line of thinking that inspired Hahn’s idea for the first tapered implant. After a long day that included several cases in which he had difficulty placing parallel-walled implants in the anatomically restricted space of the anterior maxilla, Hahn had an epiphany: “The tooth I was replacing was taper-shaped, so why was I putting in a square peg?” That very night, he sketched out the concept.

Steve Hurson, former chief scientist for Nobel Biocare, has said: “Dr. Hahn identified a need for an implant with a narrower apex, which would achieve higher primary stability in soft bone. The concept was to have an implant design that would have the tapered shape of a tooth root … resulting in a system with outstanding predictability.”

In essence, this was an extension of the philosophy that inspired the design of the machined collar Hahn helped Steri-Oss develop. “By designing a 4 mm machined collar that was more like the neck of a natural tooth root, we were able to prevent crestal bone loss and improve outcomes,” Hahn said.

This drive to constantly improve, however, has not always been met with open arms. In fact, his role with Steri-Oss was borne of a disagreement with Miter Inc. “The Titanodont implant had some problems, including an abutment attachment that lost its retention after a few years and fins that would become exposed if there was any crestal bone loss. So I proposed a machined collar with a new prosthetic connection,” he said. “They couldn’t do it because it would be too expensive to change the machinery. I didn’t want to have my name associated with the implant any longer if they weren’t going to correct the problems.”

This led Hahn to other endeavors, including his role with Steri-Oss and, eventually, Nobel Biocare.

After the NobelReplace® tapered implant system launched in 1997, Hahn continued placing and restoring implants, completing thousands of cases. This experience afforded clinical observations that would serve as the basis for a new implant design that Hahn considers his best. “I came to Nobel with my idea for a new implant in 2012, conceptual engineering drawings in hand, and they said, ‘Replace is so successful; why change now?'” Hahn replied: “Apple has become one of the most successful companies in history by constantly innovating. Why shouldn’t we do the same in implants?”

Wanting to take his design concept to the next level, Hahn began pursuing alternatives, which eventually led him to Glidewell Laboratories. The resulting partnership culminated in the recent launch of the Hahn Tapered Implant System, and Hahn couldn’t be happier with the results.

“When I first visited their facilities, it was immediately apparent that their manufacturing capabilities are state-of-the-art,” he said. “Their engineering team has the technology and know-how to bring design concepts to life with astonishing speed and precision, and their expertise on the prosthetic side of implant dentistry has been invaluable in creating an implant that is as simple to restore as it is to place.”

With a career that speaks volumes on the importance of continual innovation, Hahn is proud to have his name on an implant that contributes to the forward progression of implant dentistry while reducing the cost of treatment. “The better we make implant design, the more accessible we can make implant dentistry to doctors so they can improve their practices and the quality of life of their patients,” he said.

Note: The Hahn Tapered Implant is a registered trademark of Glidewell Laboratories. NobelReplace is a registered trademark of Nobel Biocare.
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Offering 360-degree bone preservation even in sloped ridge situations

Author: DENTSPLY Implants Staff

Fig. 1a. When a standard implant is placed level with the lingual bone, the implant neck is exposed buccally, compromising soft-tissue esthetics.

Fig. 1b. When a standard implant is placed level with the buccal bone, unsupported lingual marginal bone is lost.

Fig. 1c. OsseoSpeed Profile EV is placed level with both buccal and lingual marginal bone, preserving soft-tissue esthetics and helping reduce the need for bone augmentation.

It is well-documented that crestal bone resorbs after tooth extraction or tooth loss. Often resorption is pronounced on the buccal side, resulting in a lingual-to-buccal sloped ridge. This situation occurs even if a standard implant is immediately placed in the extraction socket. Because bone-to-implant support is three-dimensional, it is important to have marginal bone support around the entire implant. Preserving the buccal and lingual marginal bone in a sloped ridge situation will also positively influence mesial and distal marginal bone levels, which optimizes soft-tissue esthetics.

The OsseoSpeed Profile EV is a unique* implant specially designed to follow the existing bone in sloped ridge situations, maintaining soft-tissue esthetics and helping to reduce the need for bone augmentation, DENTSPLY asserts.

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