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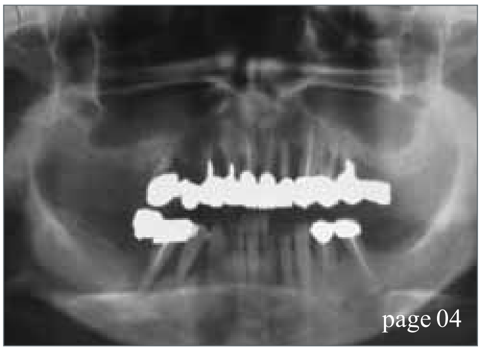
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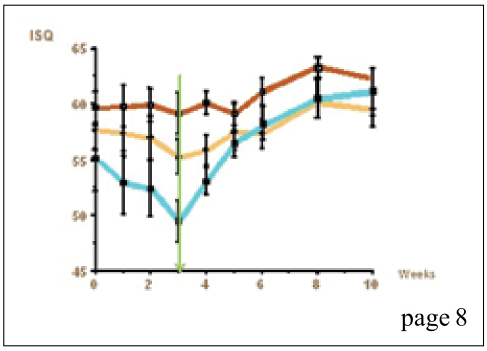

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on the cover

Cover image provided by Glidewell Laboratories. To learn more about the Hahn Tapered Implant, see page 18.


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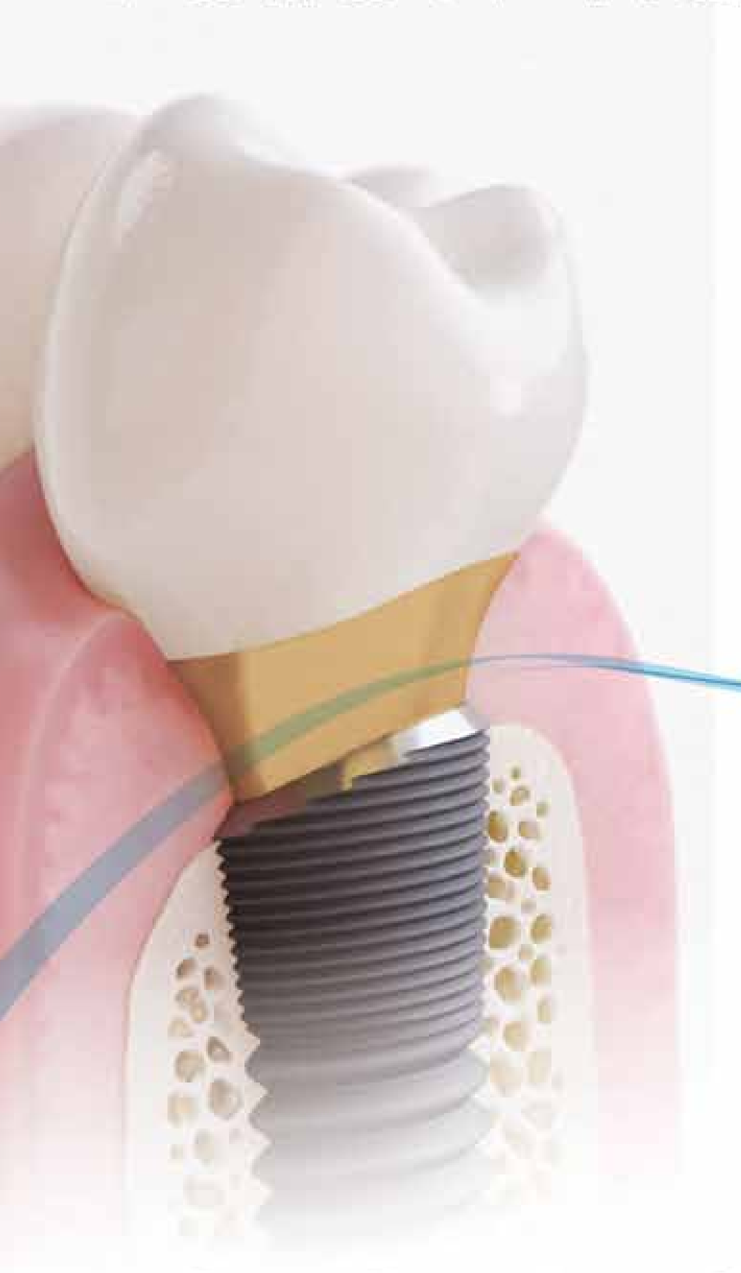

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Intraoral welding and lingualized (lingual contact) occlusion: A case report

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

_c.e. credit part I

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_Intraoral welding was developed by Pierluigi Mondani[1] 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 prosthodontic 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 prosthodontic 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

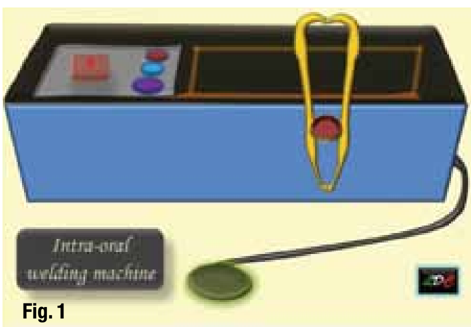


Fig. 1

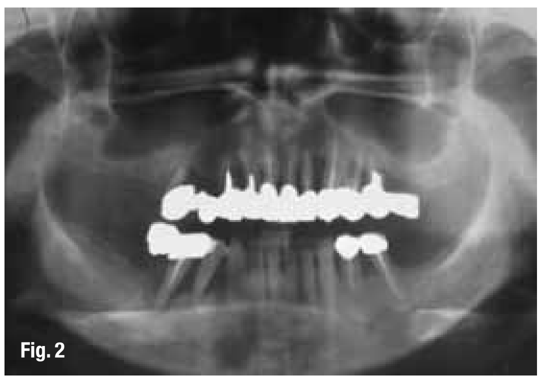
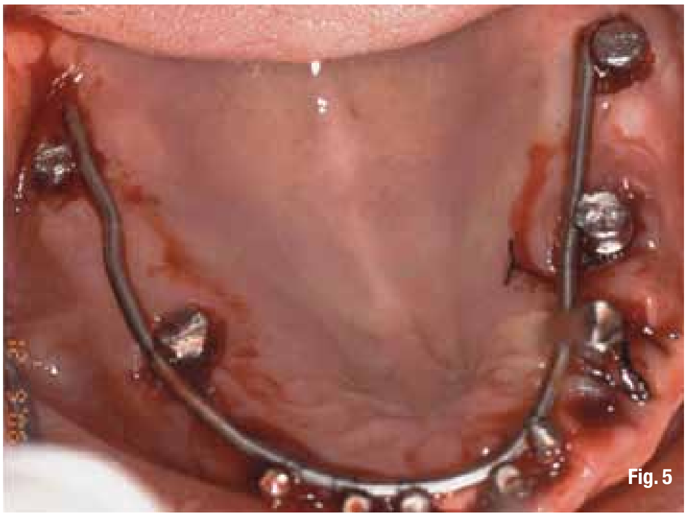


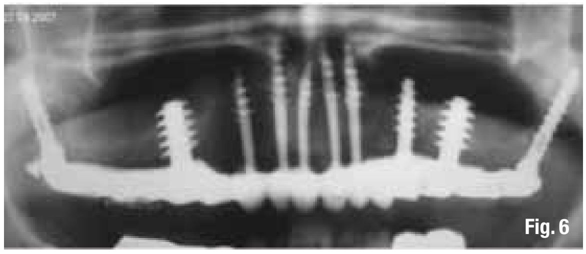
Fig. 2

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*)





present. 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 intercuspation 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-

Fig. 3_Nonrestorable teeth visible after removal of the patient's prosthesis.

Fig. 4_Eight titanium one-piece implants are inserted.

Fig. 5_Immediate stabilization of the eight implants and two additional implants previously inserted in the posterior regions, by welding each implant to a 1.5 mm supporting titanium bar.

Fig. 6_Panoramic radiograph after 90 days suggests complete integration.

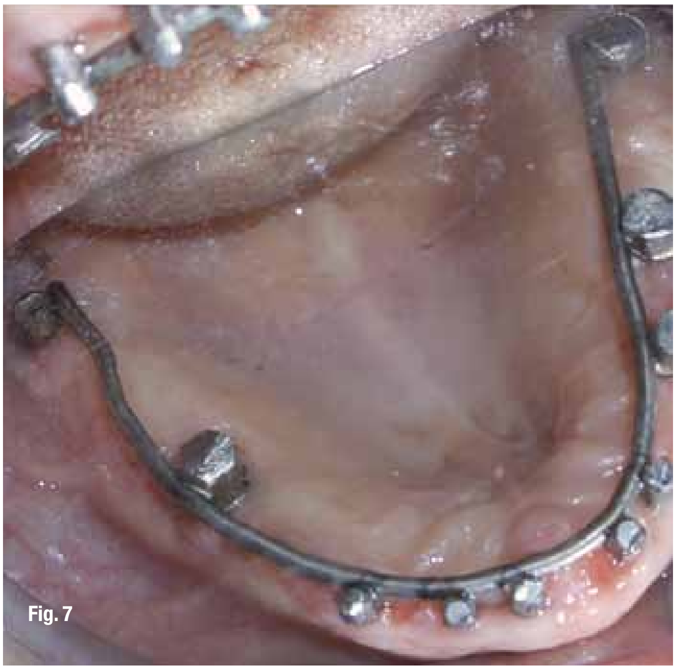


Fig. 7


Fig. 8


Fig. 9

Fig. 7_Healthy gingiva was observed after 90 days.

Fig. 8_Lower implants welded together intraorally.

Fig. 9_Three-tooth mandibular fixed prosthesis.

sented 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.*_

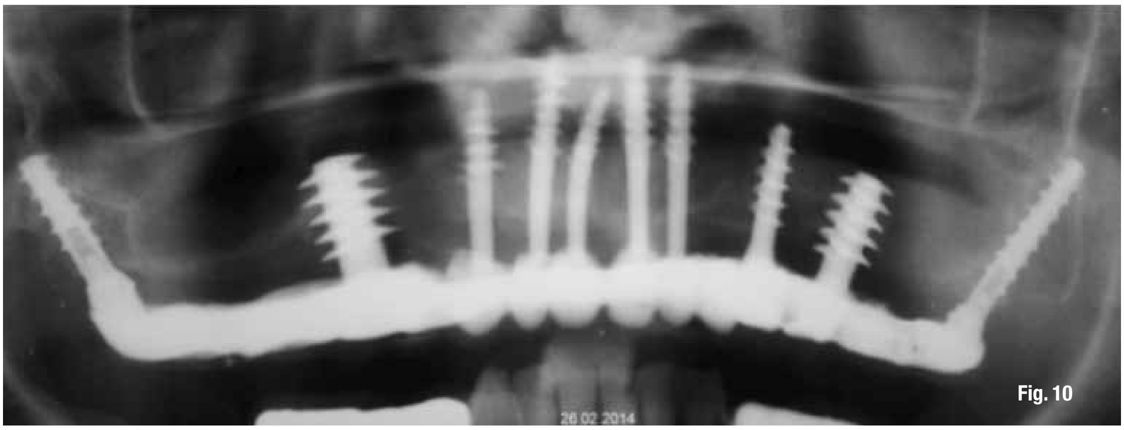


Fig. 10


Fig. 11

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

Author_Michael R. Norton, BDS, FDS, RCS(Ed)

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_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 fore[7-9] 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 stability[9] 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:

$$\frac{\text{Resisting torque}}{2} = \mu * P * H * \pi * D2$$

Where: $H * \varpi * D^2$ = 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

μ = Coefficient of friction

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

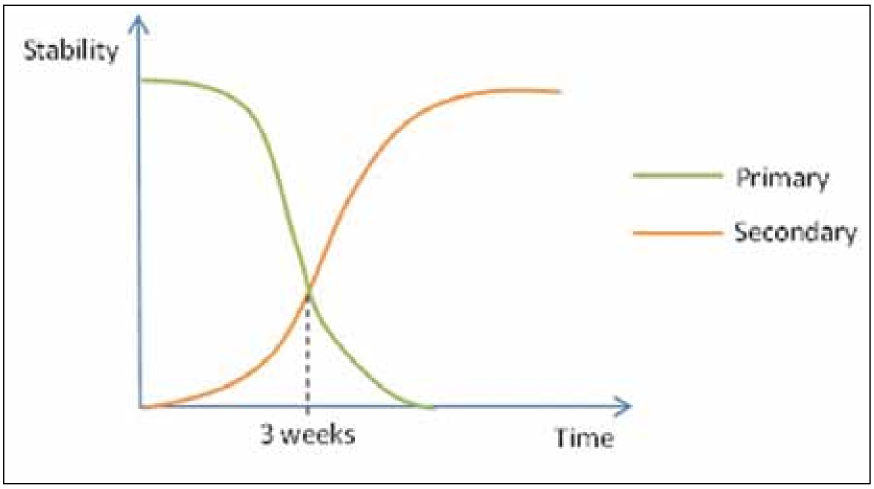

Fig. 1

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 fulfil 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 zone[11,12,13] 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-