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implants

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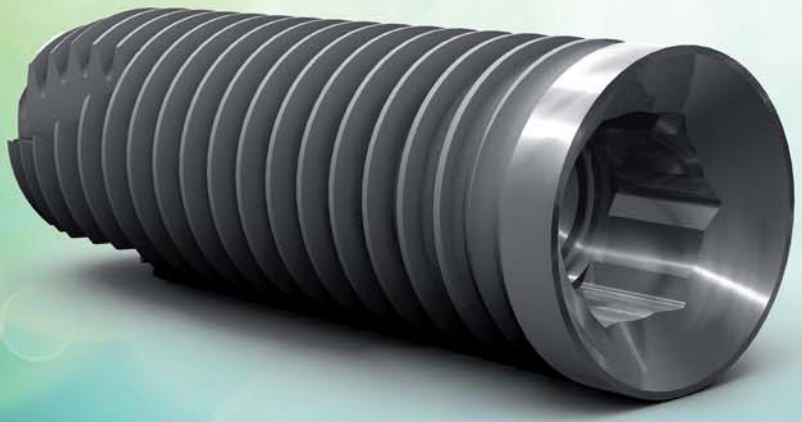

case report

44 Roots—44 Implants

clinical technique

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interview

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Digital implantology —a sign of the times

_It is a sign of the times that the dental industry and dental laboratories are trying to add to the value of implantology through the use of innovative technology and service concepts. Individual dentists practicing implantology are facing a number of current challenges, especially economic ones. Whether in the case of intraoral scanners, 3-D diagnosis and 3-D planning or CAD/CAM manufactured prostheses, the time for stand-alone applications is over. The largest implant manufacturers believe that the future lies in all-in-one solutions which focus in particular on patients' needs—i.e. which are gentle, safe, functional, aesthetic, long-lasting and of high quality.

Implantology associations such as DGZI are under an obligation to inform dentists, dental technicians and dental staff about these new methods, systems and approaches, but also to critique them at the same time. A specialized podium discussion on the topic of "Digital implantology—What will and what must be done?" will look at the topic of digitalization in the fields of general dentistry and implantology, and will play an important role at DGZI's 41th International Annual Congress in Cologne. Experts from home and abroad as well as university professors and dental practitioners will carry out an in-depth discussion and present contemporary concepts.

The board of the German Association of Dental Implantology (DGZI e.V.) looks forward to meeting you on September 30 and October 1, 2011, in Cologne.

Dr med dent Roland Hille
Vice President of DGZI


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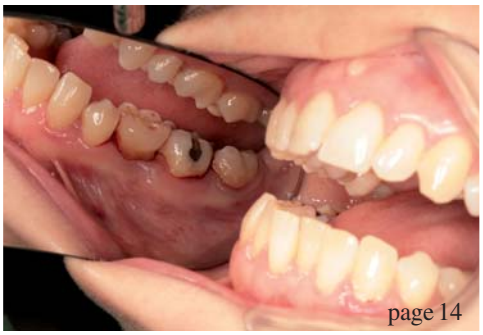
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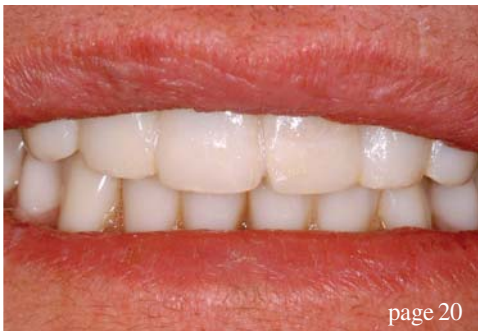
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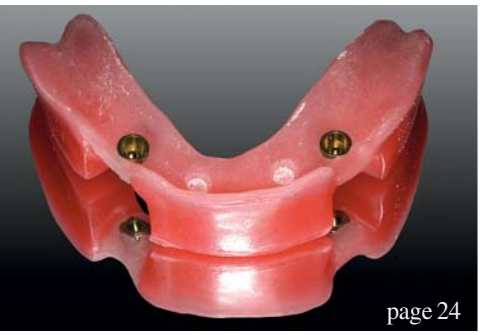
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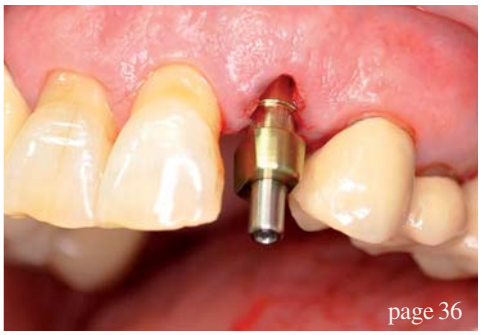
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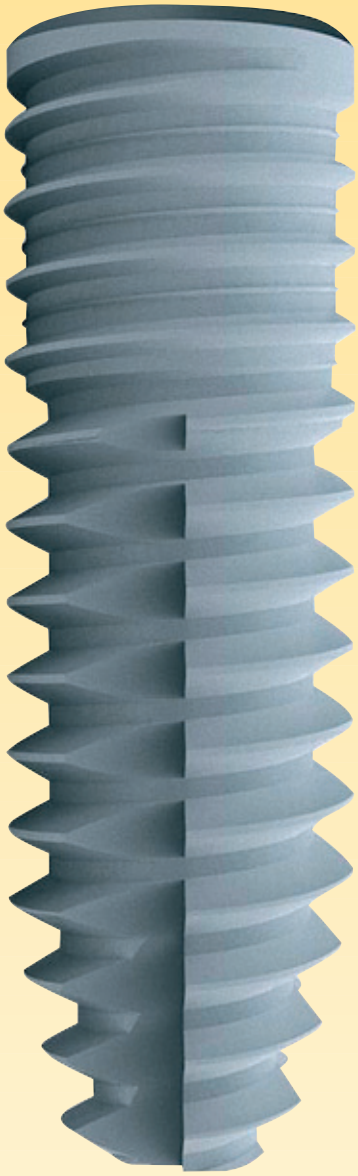

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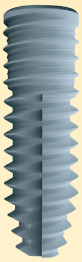

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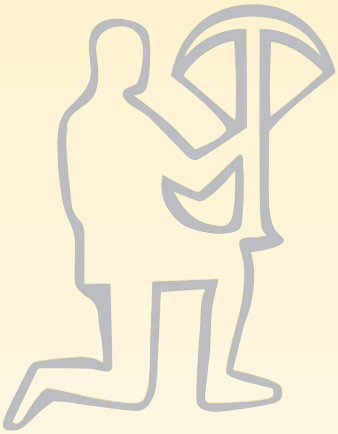

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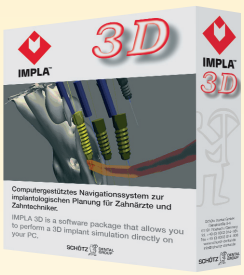

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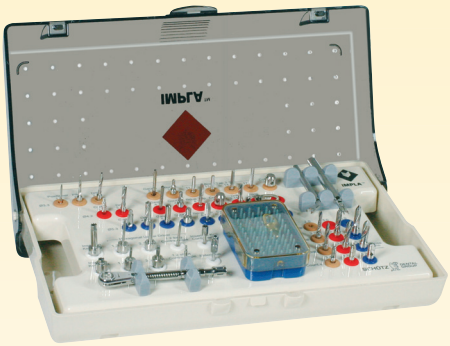

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44 Roots—44 Implants

A case report

Author_Drs Eduardo Topete A., Estela Topete Z., Eduardo Topete Z. & Alberto Topete Z., Mexico

Fig. 1_Jose Conte (1997).

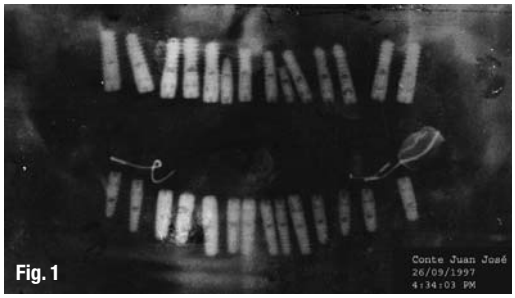

Fig. 1

_Various surgical techniques for bone augmentation of the maxilla and mandible are mentioned in the literature. This article offers viable alternatives to maxillary and mandibular surgery, helping to prevent implant resorption in molar areas.

_Back to the roots: "Implantology 2000"

The implantology profession agrees that a greater number of implants to support the prosthesis is a determining factor of success. A greater number of implants decreases the number of pontics, improves the biomechanics by reducing strain on the prosthesis and dissipates stresses more effectively to the bone structure, especially at the crestal level. The maximum osseous surface area and adequate bone density are requirements for long-term resistance to occlusal loads.[7] In addition, the greatest functional surface area is required in the crestal 5 mm of the implant body. Comparisons between natural tooth roots and implants show that increasing the surface area by increasing the number of implants is a prime requirement for achieving long-term success of dental implants.[10]

Fig. 2_Jose Conte (2007).
Fig. 3_ I.P.S.P.S. diagram for implants of 3.26, 3.76 and 4.10 mm in diameter.

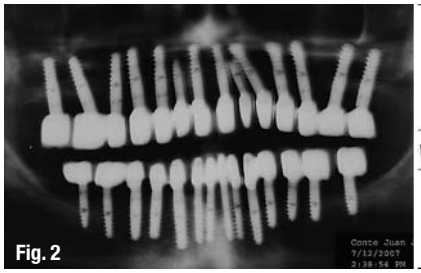

Fig. 2

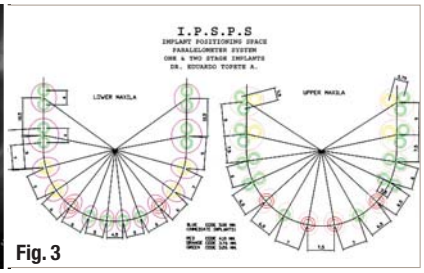

Fig. 3

In the past, the replacement of one molar with a single implant was widely accepted as the recommended standard practice.[8] As an innovative and viable alternative to the current standard practice, replacing mandibular molars with two implants and maxillary molars with three implants has been successfully applied since 1994, in other words one implant per root lost. This technique of using multiple implants preserves the natural crown–root ratio of molars. More importantly, multiple implants reduce and balance the occlusal forces. This reduction in occlusal forces greatly reduces implant–bone stress on the surface contact areas in the posterior regions of the mouth where the maximum stress is placed on the molars.

In the 1980s, force reduction and surface area were difficult to balance in the posterior regions of the mouth. Studies clearly demonstrate that the forces are often 300 % greater in the posterior areas compared with the anterior regions of the mouth. Bone densities and strengths are 50 to 200 % weaker in the posterior regions of the mouth. Yet, implants with a greater surface area (according to length) were inserted in the anterior regions. Natural teeth do not have longer roots in the posterior regions of the mouth, where stresses are greater. Instead, increased surface area is achieved with a greater number of implants, placing two implants in each lost molar. In available bone of adequate width, replacing the lost roots with the same number of implants is recommended, placed in the same position and direction that nature created (within anatomic limitations),[6] especially in cases in which only a few millimetres of bone remain between the cortical floor of the sinus and the crest of the ridge.[10]

This way, the distribution of the bite forces in key points proposed by Misch in his paper at the World Congress of Oral Implantology in Taipei in 2006 could be achieved using thin implants inserted in strategic positions, passing along the sides of the walls of the sinus to create a tripod to support the maxillary molars and along the sides of the dental nerve to form the bipod that mandibular molars need to support the oc-

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Fig. 4_ I.P.S.P.S. diagram for implants of 3.10, 2.75 and 2.50 mm in diameter.
Fig. 5_Case of 27 crowns on 27 individual implants (1991).
Fig. 6_Case of 40 implants in a 58-year-old male patient (2001).

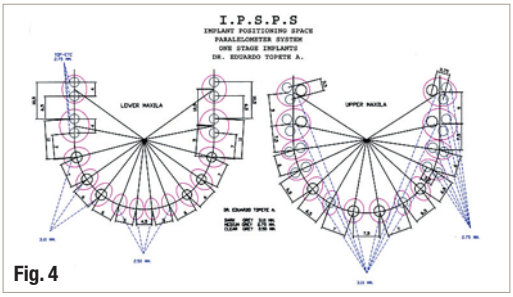

Fig. 4

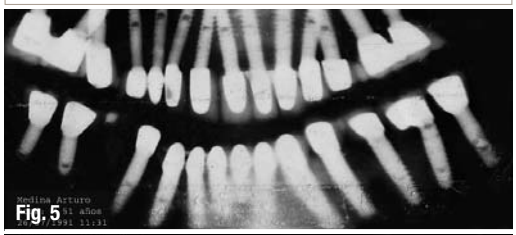
Fig. 5

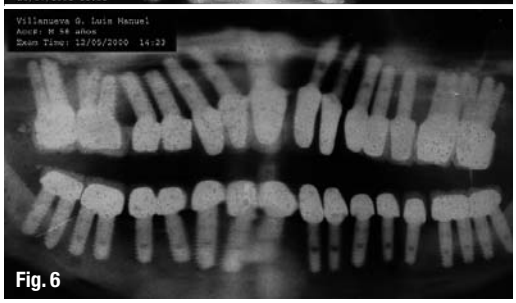
Fig. 6

clusal forces. This could be achieved without transplanting osseous blocks from different parts of the body, which makes it a less invasive implantology. The disadvantages of sinus elevation, taking osseous blocks from different parts of the body and nerve repositioning are well known.

Disadvantages of sinus elevation
1. Extended trauma of soft and hard tissues
2. Operation lasts considerably longer
3. Surgery exposes the wound to a higher risk of bacterial and viral contamination
4. Expanded post-operative swelling and high levels of pain are inevitable with the risk of post-operative complaints
5. Sometimes only 3 to 4 mm can be gained in order to avoid creating large pointed loads on the sinus membrane
6. The following may occur during or after the operation:
   a) Soft-tissue complications
   b) Rupture of the Schneiderian membrane
   c) Contamination
   d) Fistula
   e) Cavity
   f) Infection
   g) Soreness
   h) Lost of bone and resorption of the graft material (resorption of more than 2 mm in two years)
   i) Peri-implantitis
   j) Bleeding
   k) Exuding of pus
   l) Future loss of implants.

Disadvantages of taking osseous blocks from different parts of the body
1. Insensibility of the dental lower nerve when blocks of mandible have been cut
2. Mandibular fractures
3. Numbness of the anterior or posterior mandibular teeth when blocks are taken from the chin or the area of the mandibular branch
4. Exposure of the blocks and fixation screws owing to insufficient soft tissue to close the incision completely
5. Soft- and hard-tissue complications
6. Inflammation
7. Bleeding
8. Exuding of pus
9. Infections that may cause loss of the blocks.

Disadvantages of nerve repositioning
1. Extended trauma
2. Operation lasts considerably longer
3. Surgery exposes the wound to a higher risk of bacterial and viral contamination
4. Expanded post-operative swelling and high levels of pain are inevitable with the risk of post-operative complaints
5. Insensitivity of the lower dental nerve
6. Soft- and hard-tissue complications
7. Inflammation
8. Bleeding
9. Infections.

However, using CT, virtual models and guides could be created to insert implants in the places in which there is good bone quality and no nerves, arteries, sinuses or nose fossae are affected. This operation of inserting implants without soft-tissue reflection is minimally invasive and is usually of shorter duration. In addition, the danger of contamination and post-operative complaints are less likely, the healing and osseointegration times are shorter, inflammation and pain are minimal and, frequently, the patient reports no pain at all.

The distribution of chew forces using individual implants and one implant per root lost eliminates a united rehabilitation,[4] and also avoid the cantilever[5] that causes the resorption of the mesial and distal walls of the implants, owing to the leverage forces applied by the cantilever. Misch mentioned that with a greater number of implants, resorption, bone loss and the consequent loss of the implants can be avoided. In addition, Perel mentioned that poor planning of a case will lead to failure. In his conference paper, "Plan it or lose it", he recounted that any case must entail planning for adequate function in the future and must

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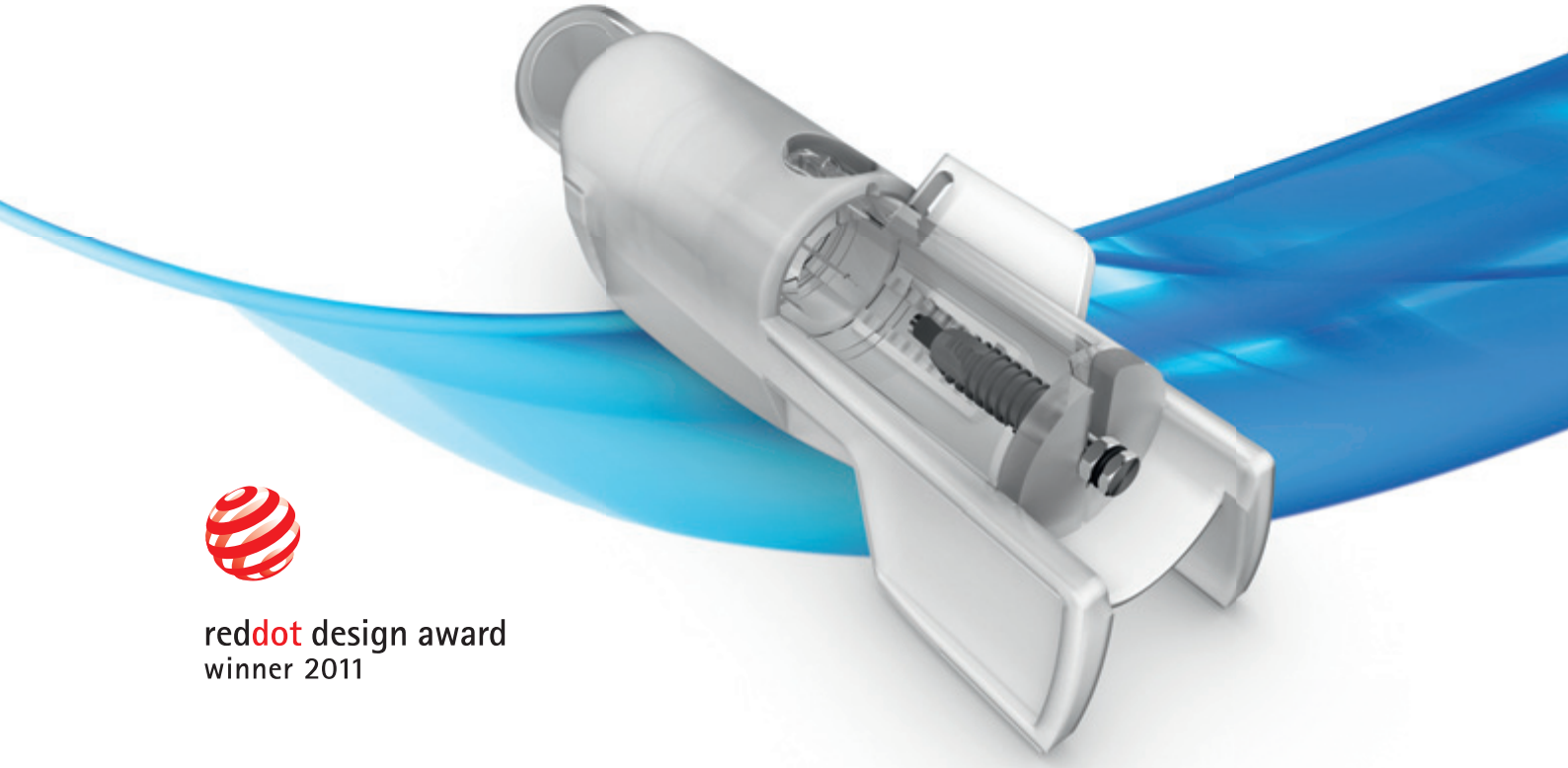

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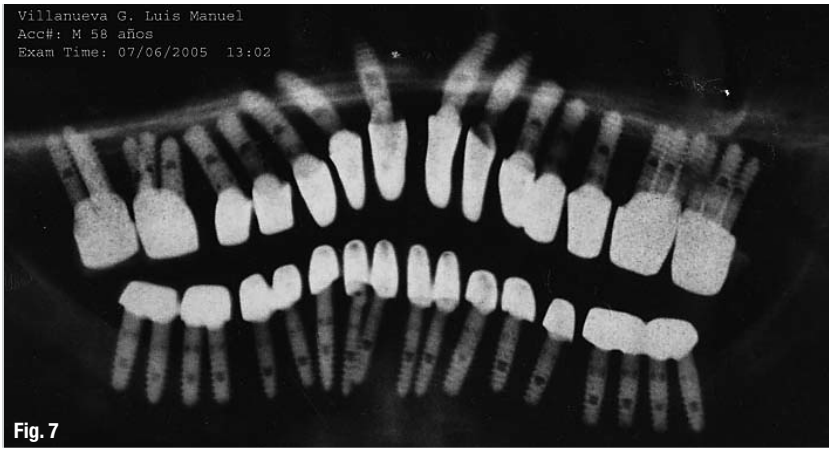

Fig. 7

Fig. 8

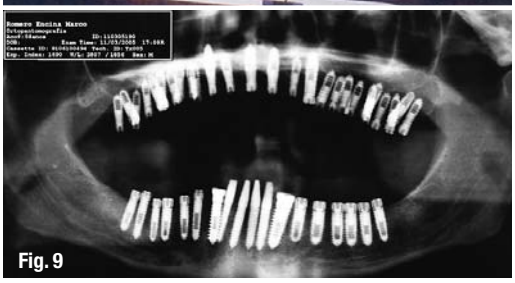
Fig. 9

Fig. 7_Case of 40 implants, five-year follow-up (2005).
Fig. 8_Dr Eduardo Topete presenting his case at the University of Texas Health Science Center (2003).
Fig. 9_Case of 44 implants in a 57-year-old male patient (2005).

have a minimum of five years of good function to be considered a success. If we insert the maximum number of implants while planning the position and alignment that the roots used to have perfectly, we can avoid future resorption[8] and most importantly, pain, inflammation, stress and the time that sinus elevation surgery takes, as well as the placement of autogenic bone blocks or the repositioning of the dental nerve.

Since 1994, the following protocol has been in use: the three roots of a maxillary molar are replaced with three implants placed in the locations of the mesial, distal and palatal roots. This allows an increased surface area in a region in which an increased number of implants is particularly important, owing to compromised strength and high occlusal loads.

The maxillary molar sustains masticatory forces of 44 kg; therefore, it is recommended that it be replaced with three implants rather than one or two short implants. These three implants act as a tripod to sustain the pressure and forces generated in the posterior region. When a sinus graft is not part of the treatment plan, a sinus lift may be performed from inside the implant osteotomy. Mesial and distal implants are usually 8 mm or greater in length. The palatal implant may be longer to substitute the palatal root of the first maxillary molar. A modified treatment plan includes the use of at least two implants for each molar. In a case of maxillary molars, 4 mm implants were placed in the alveolar socket (after extraction) using implant insertion without soft-tissue reflection and a delayed immediate loading technique. A retrospective clinical study of implant restorations showed that a greater number of implants placed in such a way resulted in a lower bone resorption.[10]

Another important issue that needs to be considered is that the diameter of clinical crowns is not the same for all pieces. In order to ensure greater precision in collocating individual crowns on molar implants, the use of the Implant Positioning Space Paralelometer System (I.P.S.P.S.) is recommended. With this system, it is possible to equal the diameter of the lost molars by using two or three implants without resorting to the use of voluminous and heavy implants that are unable to provide the necessary bipod or tripod support needed in posterior pieces.

If we are to meet the aesthetic and functional demands encountered in our modern and fast-paced world, a more efficient and immediate unitary individual reposition of lost pieces is needed. This goal can best be achieved by inserting implants without incisions and without soft-tissue reflection. Such a technique offers an enormous advantage.[9] At the same time, it is strongly recommended that the least possible osteotomy be performed, on the basis of the principles of osteo-compression. Otter proved physiologically that utilising osteo-compression results in a potentially massive increase in venous pressure that promotes ossification. As Salzstein and Erickson point out, bone compression causes extra-cellular fluids to flow around the surface of cells charged with osteoblasts, and this produces faster osseous regeneration.

Histological studies carried out at Louisiana State University by Block and Meffert have demonstrated the principle of controlled functional osteo-compression. Within three months, single-piece implants immediately exposed to loads showed more than twice the bone density on the implant interface than two-piece implants (implant plus post) without immediate load exposure. Currently, single-piece implants with built-in posts substantially improve the surgical-prosthetic protocol, since their insertion is faster regardless of whether the angle is 0, 16 or 26°, as is the case using One-Stage Implants.

Previously, complications have arisen with prosthetic parts, but the insertion of single-piece implants with osteo-compression will undoubtedly improve the surgical, as well as the prosthetic prognosis. The bone-compression technique especially improves bone quality at the implant location. Special instruments devised for this procedure ensure that the implants are inserted into the posterior maxillary without elevation of the cavity, since the insertion of implants in the posterior maxillary quadrant is generally recognised as a challenge, even to the most experienced implantologist. This area has very poor bone quality (D4) and deficiency adversely affects the pos-


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sibility of inserting sufficiently stable implants in this area. In the presence of deficient alveolus crests, osteo-compression and artificial bone implants are recommended by Palti and Steigmann.

If we use the "implants without surgery" technique developed in 1997, the general anaesthesia, the anxiety and, most importantly, the traumatic surgery can all be avoided, achieving a shorter healing time and osseointegration. There is no inflammation and no pain during or after the procedure.[9]

_Clinical case report

In 1991 for the first time, a total oral rehabilitation was performed, with 27 crowns on 27 implants in a 51-year-old male patient. Each crown was individually inserted, and the crowns were neither physically nor chemically bonded to one another.[8]

The clinical goal was to follow the example set by nature and copy the original human dentition as closely as possible by setting individual crowns on implants.[9] A physiological prophylaxis of the alveolar bone structure was made, replacing each tooth lost with one implant, through the radicular insertion of intra-osseous implants.[7] Nature did not provide us with bridge prostheses but with individual pieces, each having to achieve optimum mastication function. The patient was clinically evaluated daily for one week following the insertion of the implants and the provisional prosthesis. Similar clinical evaluation was continued following the placement of the permanent crowns for the first year to observe the ongoing osseointegration process. Thereafter, the patient was checked in three-month intervals for three years after the procedure. After three years, however, resorption of bone surrounding the maxillary and mandibular molars was observed, and especially so around the maxillary. On the other hand, no resorption was observed around the front teeth. These clinical observations made in 1994 motivated clinicians to seek a solution that would more closely imitate the shape, direction, size, and number of roots that evolution provided for us. The goal was to recreate, as faithfully as possible, a copy of the natural masticatory apparatus with all its unique root structural configurations, whether unipod, bipod or tripod in nature.

The idea immediately arose of replacing lost pieces and their individual roots according to one implant per root lost by using the same alveolus that nature had created for this purpose. This procedure was developed further, resulting ultimately in the collocation of implants without soft-tissue reflection. This technique is termed "implants without surgery" (without soft-tissue reflection) and was presented for the first time at an international congress in 1997.[9]

Based on the extensive professional experience obtained since 1974, the recreation of the more natural alveoli for every one of the 40 roots that nature provided for our dentition is recommended. (Neither the third molars and the two separate roots of the maxillary first bicuspids nor the two fused roots of the maxillary second bicuspids were considered.)

The case pictured here was completed in May 2000 and was closely monitored thorough check-ups that included orthopantomograms, digital X-rays and CT scans every three months. No apparent resorption was observed in this 58-year-old male patient. He continued to show no periodontal complications, nor any complications associated with his implants. He was instructed on the importance of maintaining daily dental hygiene, including flushing and cleaning of the areas of contact between the implants, gum and crowns with a pressurised water spray, vibrating brushes and vibrating point devices in order to avoid bacterial plaque build-up. It is well known, however, that this principle and ideal technique of one implant per root lost cannot be implemented with all patients. In addition to the great care that patients have to observe in hygienic terms (as we all do), the patient must have sufficient height and width of the maxillary or mandibular bone selected for the insertions. It is also very important to have experience in achieving total oral rehabilitation with 28 individual crowns on 40 implants (one implant per root lost) and without surgery (without soft-tissue reflection). Such a case was presented during the 2002–2003 Preceptorship in Dental Implantology course held at the University of Texas Health Science Center at San Antonio, USA.

Recently, all the roots that made up a human dentition were replaced, one by one. In this case of a 57-year-old male patient, 44 implants were inserted (including maxillary bicuspids with two implants). The goal of

Fig. 10_Case of 44 implants in a 55-year-old female patient (2006).

Fig. 11_One implant per root lost.
Fig. 12_Three implants in each maxillary molar (first and second).

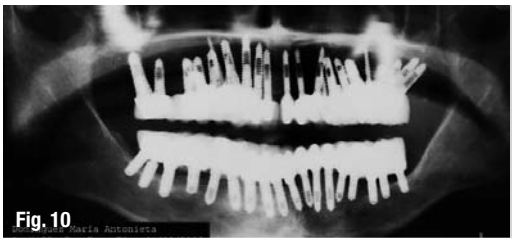


Fig. 10


Fig. 11

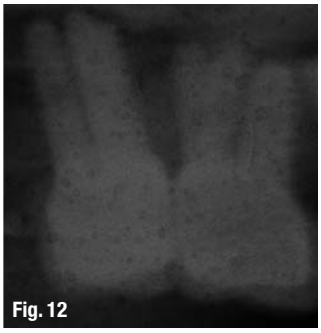


Fig. 12

recreating all the roots equally within the entire masticatory system was achieved on 11 March 2005. In March 2006, 44 implants were inserted in a 55-year-old female patient, including thin implants passing along the sides of the wall of the left sinus, according to one implant per root lost.

_Materials and method

As maxillary molars are exposed to a high level of stress (masticatory forces of approximately 44 kg), it is recommended that lost roots be replaced with three implants rather than one or two short ones. The three implants will then act as a tripod and resist the forces and pressure generated in the upper posterior regions of the mouth. The length used for mesial and distal implants is usually 8, 10, 12 mm or, if possible, a longer implant. The palatal implant can be somewhat longer, since it is replacing the palatal root of a maxillary molar, which is the longest.

Mandibular molars support chewing forces of approximately 31 kg. Therefore, the replacement of each of the two roots with implants of 8, 10, 12 or 14 mm in length is recommended, if the lower dental conduct is too low.[10]

Maxillary bicuspids support forces of 22 to 28 kg. The first one has two roots separated in the apex. This can be replaced with two implants of 3.26 mm in diameter. The second one with two fused roots ending in one at the apex can be replaced with two implants of 3.26 mm in diameter. These implants will give the bicuspids the balance of vestibular and palatal roots.

Maxillary and mandibular incisors receive masticatory forces of about 15 to 16 kg. Since they naturally have only one root, a single implant of the same length as the extracted root is sufficient. When possible, a larger implant may be used (within anatomic limitations).[3]

_Conclusion

It is recommended that in the bone of the posterior quadrants clinicians use two or three implants according to "one implant per root lost in molars"[10] with an osseous quality of D4 to create a greater predictability of treatment outcome. When pieces are substituted with individual crowns over the implants[8] on maxillary and mandibular molars, a greater positive outcome can be predicted. Alternatively, by using the implants without surgery technique (without soft-tissue reflection)[9] developed in 1997, in combination with the technique of osteo-compression for the insertion of one-piece implants, any need for additional appointments to attend to the possible complications of prosthetic components may be negated. The use of these effective, cost- and time-saving techniques will ultimately save the patient unnecessary anguish, fear, stress, or even the possibility of complicated and traumatic surgery. This technique ensures the possibility of replacing all the 44 roots, one by one, with implants that conform a natural human dentition.

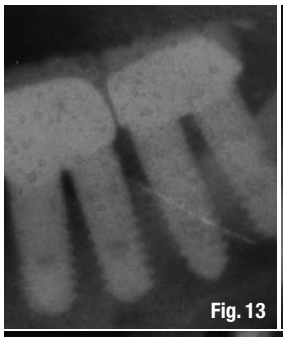
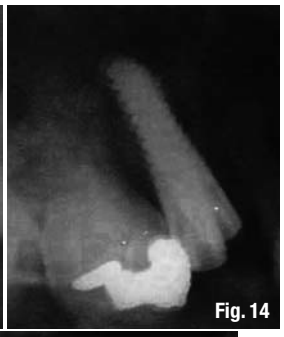


Fig. 13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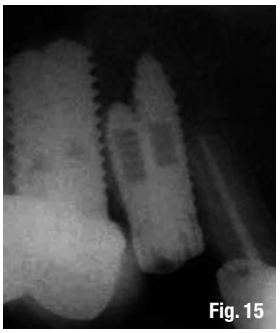
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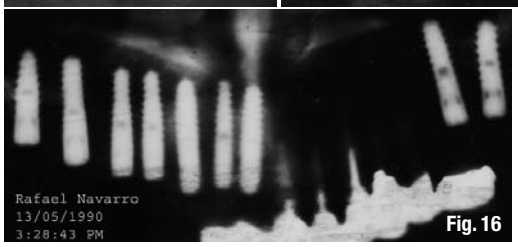

Fig. 16

Fig. 13_Two implants in each mandibular molar.
Fig. 14_Two implants in a first maxillary bicuspid that recreate a more natural root configuration.
Fig. 15_Two implants in a maxillary second bicuspid that recreate a more natural two-root fusion.
Fig. 16_Replacement of each lost tooth with individual implants of 4.10, 3.76 and 3.26 mm in diameter and 16 mm in length.

The techniques mentioned above also have the advantage of avoiding pain and inflammation both during and after the procedure, which allows for a more rapid healing and osseointegration of the implants.[9] Most importantly, these techniques allow reposition and immediate load (with provisional acrylic or polycarbonate crowns) of each lost piece quickly, simply, effectively, economically and with aesthetic concerns in mind. Also, these techniques are less invasive and more affordable; therefore, they can be considered viable alternatives to extensive augmentation procedures._

Editorial note: A list of references is available from the author.

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Ridge preservation and GTR with a xenograft and resorbable collagen membrane

Author_Drs Mariana Baglivo, Prof Hugo Campos, Prof Miguel Angel Carrasco, Prof Andrés Pascual, Prof Paul Levi & Prof José Nart, Spain

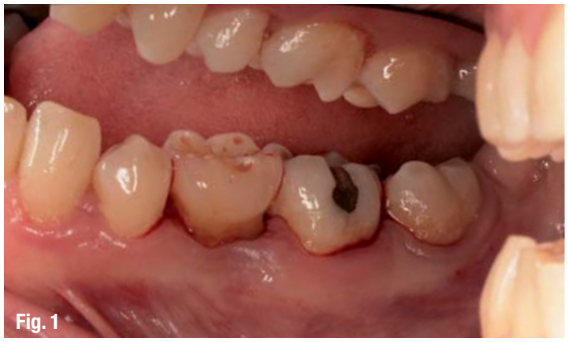


Fig. 1

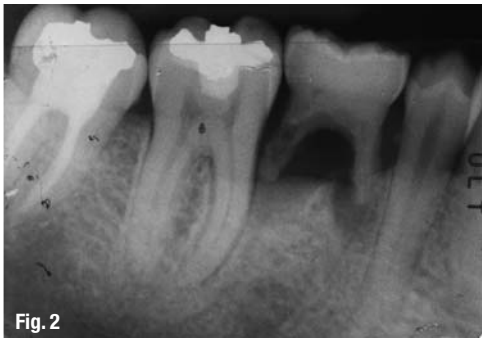


Fig. 2

Figs. 1 & 2_The patient was referred for extraction of a right temporary mandibular second molar.

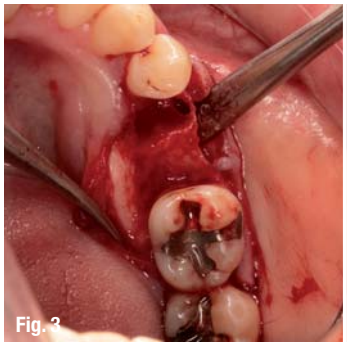
Figs. 3 & 4_Image of the combined two- and three-walled bony defect of 6 mm and 5 mm, and the fenestration of the buccal plate.

Figs. 5 & 6_A ridge preservation technique was performed using a xenograft material and a double layer of resorbable collagen membrane.

_An adequate width and height of bone in an edentulous area is essential when placing an implant in order to obtain an ideal functional and an aesthetic prosthetic reconstruction following placement.

Histological investigations have described the healing of extraction sockets (Amler *et al.* 1960). Tooth extraction results in a loss of alveolar bone volume, both horizontally and vertically owing to resorption. The greatest amount of bone loss happens in the horizontal dimension and occurs on the facial aspect of the ridge. There is also a loss of vertical ridge height, which is most pronounced towards the buccal area. As alveolar bone is a tooth-dependent structure, the normal post-extraction healing is resorptive. Because the crest of the buccal bone is composed of bundle bone, this remodelling results in vertical reduction of the crest (Araújo & Lindhe 2005). The majority of the dimensional alterations of the alveolar ridge (two-thirds) takes place during the first three months following extraction, and an average of 40 % of original height and width is expected to be lost after three years (Lekovic *et al.* 1997; Schropp *et al.* 2003).

The most predictable way to maintain the width, height and position of the alveolar ridges is to perform ridge preservation at the time of tooth extraction. This procedure requires an intra-socket osseous graft and the use of a membrane and should reduce the morphological changes in alveolar bone (Lekovic *et al.* 1998; Wang *et al.* 2004). In a six-month animal study, Araújo and Lindhe demonstrated that the placement of a biomaterial in an extraction socket may modify the remodelling and ridge resorption that occurs following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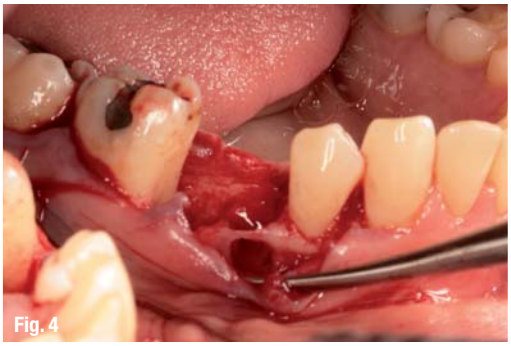
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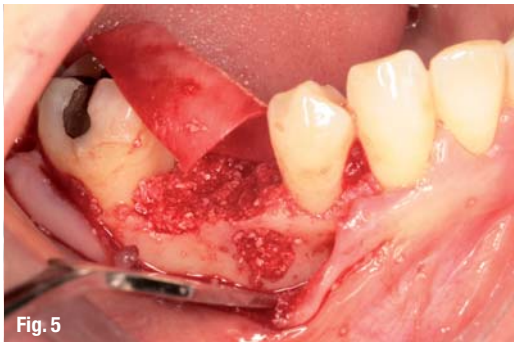
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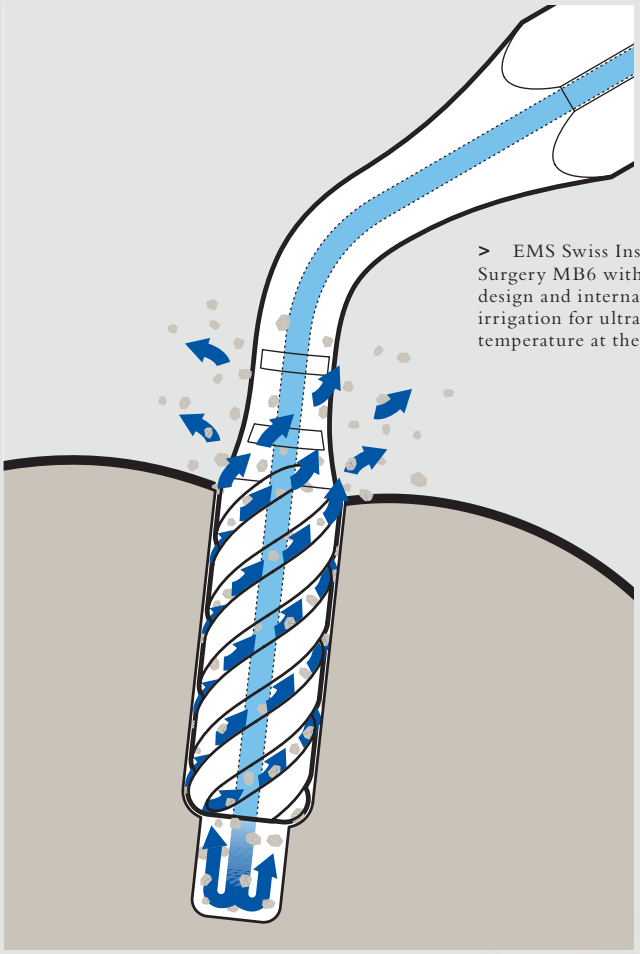

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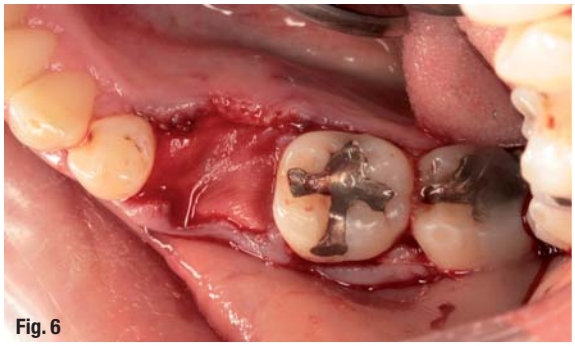
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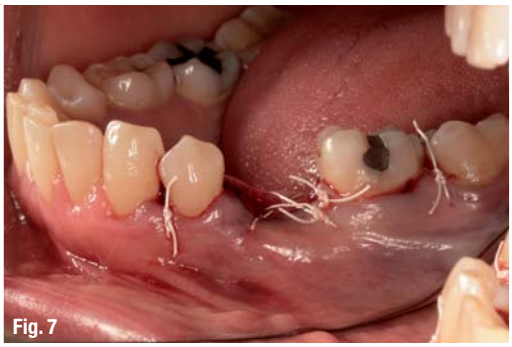
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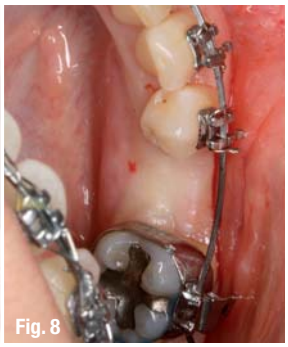


Fig. 8

Fig. 7_The flaps were replaced and were sutured without obtaining complete socket coverage.
Figs. 8 & 9_Clinical and radiographic view at six months following ridge preservation.

tooth extraction. They observed that there was an average of 35 % of ridge resorption in natural healing and only 12 % in the grafted sites (Araújo & Lindhe 2009).

The materials and the surgical techniques in use today simplify ridge preservation before implant placement and enable clinicians to ensure the functional and aesthetic outcome of the implants and subsequent restorations more predictably. Various natural and synthetic bone graft materials are available for the clinician to use for ridge preservation. Bone grafts in general are divided into four major categories: autogenous, allografts, xenografts and alloplasts. Although the gold standard is the autogenous graft, studies have proven the reliability and functionality of using either an allograft or xenograft, which avoids the creation of an additional surgical site for bone harvesting. In addition, there is rapid resorption of autogenous grafts, which is much slower with mineralised allografts or xenografts (Artzi *et al.* 2000; Vence *et al.* 2004; Irinakis 2006).

The use of barrier membranes has become a standard of care in guided bone regeneration and for alveolar ridge preservation and/or augmentation. The membrane excludes fast growing cells—epithelial and connective tissue cells—while enabling mesenchymal progenitor cells to proliferate and to differentiate into osteoblasts. When this surgical technique was established initially, membranes made of expanded polytetrafluoroethylene (ePTFE) were used. Although clinical and experimental studies found excellent treatment results using ePTFE membranes, wound healing complications with infection sequelae arose following the exposure of membranes. Therefore, clinicians and researchers have advocated the use of bioabsorbable barrier membranes (Zellin *et al.* 1995). There are two main materials used to manufacture bioabsorbable membranes: collagen derived from an animal source and synthetic materials. The ability of collagen to promote progenitor cell adhesion, chemotaxis, homeostasis and physiological degradation, along with its ease of manipulation and low immunogenicity, make it an ideal barrier material (Rothamel *et al.* 2004).

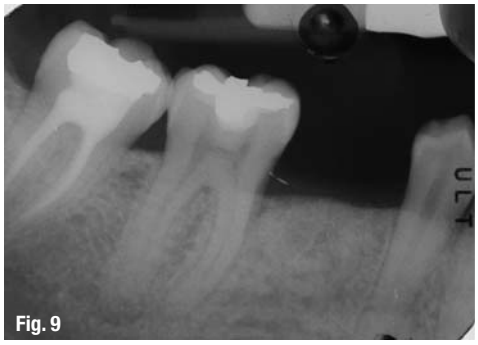
Successful regeneration is possible, provided that cell exclusion and space maintenance prevails for the time needed for repopulation of the site with progenitor cells. This period may vary between three to 12 months for bone regeneration in edentulous areas. The structural integrity of implanted bioabsorbable barrier membranes needs to be preserved for an adequate period to allow maturation of the newly formed tissue under the membrane-protected space.

The purpose of the present case report is to evaluate clinically and histologically a ridge preservation using a xenograft and resorbable collagen membrane following tooth extraction.

_Case

A 40-year-old female patient was selected for this case report. Other than localised periodontal disease around a right temporary mandibular second molar, she had no systemic disease. The patient was referred for extraction of this molar. The reason for the extraction was type III mobility and the radiological image (Figs.1 & 2).

Fig. 10_Surgical re-entry for implant placement. Clinically, xenograft particles were well integrated into the alveolus, and the regenerated area is easily distinguished from the original bone tissue.
Figs. 11 & 12_A bone biopsy specimen was harvested in the area previously regenerated using a bone trephine drill.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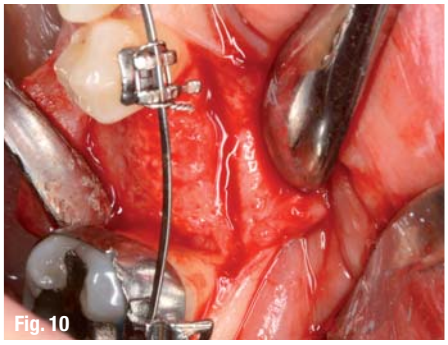
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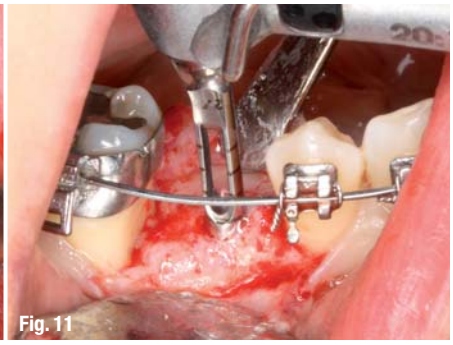
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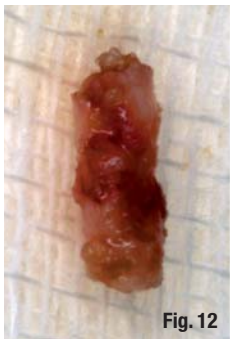
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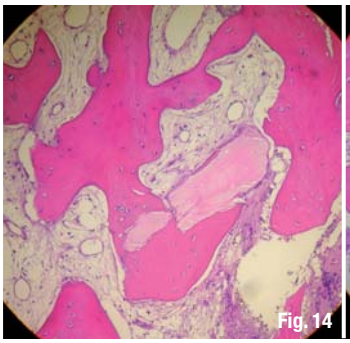
Fig. 13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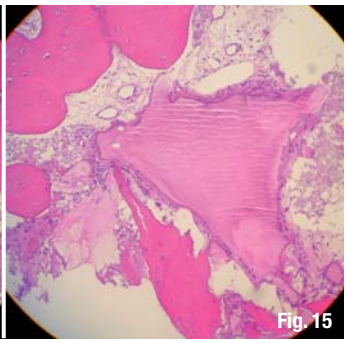
Fig. 15

Fig. 13_Implant placement.
Figs. 14 & 15_All samples show new bone formation with the newly formed bone strongly adherent to the bone graft particles.

Surgical treatment

Following administration of local anaesthesia (4 % articaine and 0.001 % epinephrine), the tooth was elevated and an atraumatic extraction was performed. A full-thickness mucoperiosteal flap was elevated to expose both the labial and the lingual aspects of the alveolar ridge. The extraction socket was then curetted to remove all the soft tissue. A combined two- and three-walled bony defect of 6 and 5 mm and a fenestration of the buccal plate were observed (Figs. 3 & 4). A ridge preservation technique was performed using a xenograft material (a blend of granules of deproteinized bovine bone [90 %] and porcine collagen fibres [10 %]; Bio-Oss collagen, Geistlich) and a double layer of resorbable collagen membrane (BioGide, Geistlich; Figs. 5 & 6). The flaps were replaced and were sutured with GORE-TEX without obtaining complete socket coverage. Thus, the membrane remained exposed (Fig. 7).

Post-operative care

The patient was given 600 mg ibuprofen every eight hours for the first four days and 500 mg amoxicillin every eight hours for the first seven days and 10 ml 0.20 % chlorhexidine gluconate rinses for 30 seconds twice a day (1-0-1) from the day of the operation until day 14 after surgery was prescribed. A toothbrush with extra soft bristles was recommended from the second week. The patient was advised to avoid chewing on the operated side, and refrain from consuming hot food and drinks for two weeks. A follow-up visit was scheduled for seven days post-treatment, and the sutures were removed after 14 days.

Surgical re-entry for implant placement (at six months following ridge preservation, Figs. 8 & 9)

Following local anaesthesia as described above, a crestal incision was done and a full-thickness flap was raised in preparation for implant placement (Fig. 10). A bone biopsy specimen was harvested in the area previously regenerated using a bone trephine drill. Following the biopsy, the planned implant was placed (Figs. 11–13). The specimen was fixed in a solution of 10 % neutral buffered formalin, then dehydrated in ethanol and embedded in methyl-methacrylate resin. Finally, the section was stained with basic fuchsine and toluidine blue, and was observed with an optical microscope at 200 x and 400 x magnification.

Clinical and histological analysis (Figs. 14 & 15)

Clinically, xenograft particles were well integrated into the alveolus, and the regenerated area was easily distinguishable from the original bone tissue. The new bone formed was firmly attached to the particles of xenograft. The histological analysis revealed no inflammatory response or fibrous encapsulation of par-

	Evaluation time (months)	Membrane	New bone (%)	Residual particles (%)	Connective tissue (%)	Inflammatory response
Artzi, 2000	9	No	46,3	30,8	22,9	Minimum
Vence, 2004	4	Collagen	26	16	–	25 % sites
Barone, 2008	7	Collagen	35	29	36	No
Cardaropoli, 2008	4	Collagen	–	24,5	–	No
Lee, 2009	4–6	Collagen	23,6	25,4	34,1	Occasional

Table I

Table I_Histological and histo-morphometric evaluation of the xenograft as an alveolar bone graft material.

ticles of the graft material. All samples showed new bone formation with the newly formed bone strongly adherent to the bone graft particles.

_Discussion

The aim of this case report is to evaluate guided bone regeneration after tooth extraction with a xenograft material. The use of a bone substitute can avoid bone harvesting from a donor site, thus reducing patient discomfort post-operatively.

In a randomised clinical study, Barone *et al.* (2008) compared extraction-only treatment to ridge preservation with xenograft (cortico-cancellous porcine bone) and collagen membrane. Seven months after tooth extraction, a greater horizontal width reduction of the residual alveolar ridge (8.1 mm versus 6.3 mm) in the extraction-only group was observed. A reduction of vertical ridge height was also observed. These findings were in agreement with previous studies (Iasella *et al.* 2003). Deproteinized bovine bone has proven to be a highly biocompatible and osteo-conductive material that acts as a natural scaffold for bone formation, and has a low rate of resorption (Carmagnola *et al.* 2003; Barone *et al.* 2008).

The absence of inflammatory signs around the xenograft particles suggests that this is a safe and biocompatible biomaterial (Barone *et al.* 2008). Many studies have demonstrated the absence or a minimal amount of inflammatory infiltrate (Cardaropoli & Cardaropoli 2008), but in a clinical and histological study evaluating ridge preservation with xenografts in humans, Vence *et al.* (2004) observed some histological inflammation, primarily polymorphonuclear neutrophils in the trabecular spaces, in three of 12 treated sockets, at four months. However, there was no clinical inflammation, and all sites had complete soft-tissue closure by three weeks. The authors suggest that the inflammation may have been related to resorption of the graft particles.

The efficacy of a xenograft as an alveolar bone graft material may be the result of a combination of factors: its osteo-conductive capacity, the increase of mineral content in the grafted area necessary for bone formation and its density in order to provide stability to the graft and to persist for many months (Barone *et al.* 2008; Artzi *et al.* 2000).

The histological analysis revealed that in all samples there are residual particles of the xenograft, including studies at nine months (Artzi *et al.* 2000). According to studies, the volume of residual bone graft material may vary between 16 and 30 %. The volume of new bone formation varies between 23 and 46 % (Table I).

Histological and histo-morphometric studies have observed that the formation of new bone and the resorption of the xenograft particles is a slow and gradual process. In a nine-year study of a sinus elevation with a xenograft, Traini *et al.* (2007) observed an increase in bone formation over time, a decrease in the marrow spaces and a slow resorption of the biomaterial. Sartori *et al.* (2003) presented a case of a sinus augmentation with a xenograft and histo-morphometric evaluation after ten years; he observed that the absorption of the xenograft is slow but constant. He saw a resorption of 3.6 % per year for the first two years and a significant decrease in the next eight years, with an average rate of resorption of 0.58 % per month.

According to several studies, once the xenograft is in contact with mineralised bone, it acts similarly to the host bone, providing a biologic support for dental implants (Haas *et al.* 1998). The success of implants placed in regenerated areas of up to 40 % of xenograft residual particles seems to be similar to those placed in native bone (Carmagnola *et al.* 2003).

_Conclusion

The ridge preservation technique limits hard-tissue resorption following tooth extraction. A xenograft with a resorbable collagen membrane has been proven to be a clinically successful means of restoring a bone defect. The histological examination confirmed the presence of newly formed vital bone almost completely surrounding xenograft particles throughout the biopsy samples._

Interviews for candidates to the 3 year Postgraduate Program (2011-14) in Periodontology at Universitat Internacional de Catalunya are opened until the end of April. All candidates must be DDS and fluent in English and Spanish.

Editorial note: A list of references is available from the publisher.

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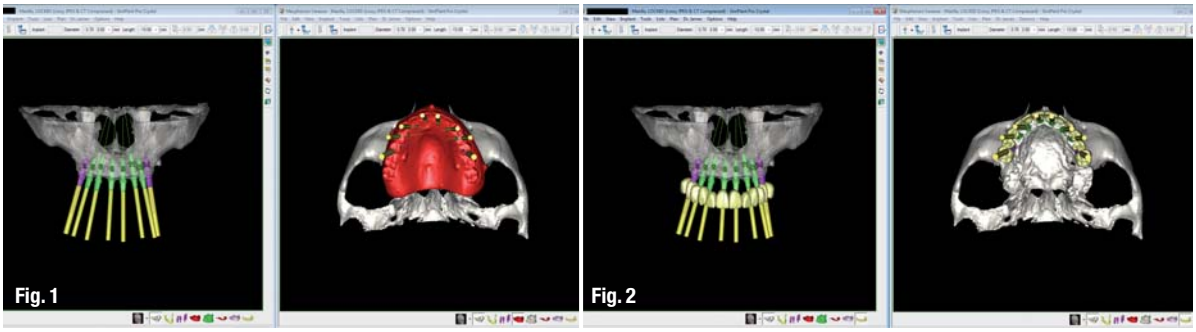
Fig. 1

Fig. 2

_This clinical case required optimal implant placement based upon a restoratively driven treatment plan and guided surgery. To achieve this goal, we made use of CT scans, SimPlant planning software (Materialise Dental), the new Zimmer Guided Surgery Instrumentation and the new Immediate Smile model (Materialise Dental). The patient was a 49-year-old white female in good health, completely edentulous in the maxilla and wore a complete upper denture. On the lower jaw, she wore an implant-retained over-denture.

The planning phase for the case began with a CT scan utilizing the i-Cat and the Dual Scan protocol (Materialise Dental). The patient's existing denture was transformed into a scan prosthesis by gluing eight Dual Scan Markers onto the surface. A radiolucent bite index was made to secure the prosthesis in the correct position.

The patient was first scanned in the i-Cat 17–19 while wearing the conversion prosthesis and the bite index. In a second scan, the conversion prosthesis was scanned alone. The resulting CT data was loaded into SimPlant, and the scan prosthesis was superimposed upon the study using the SimPlant Dual Scan wizard (Fig. 1).

Using SimPlant, the optimum implant positions were determined, based upon available bone with a minimum of 3 mm between implants, and the design of

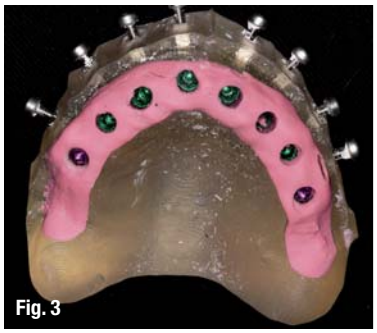
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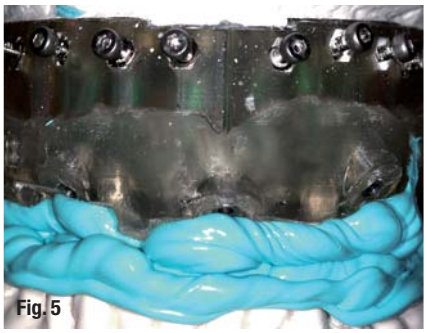
Fig. 4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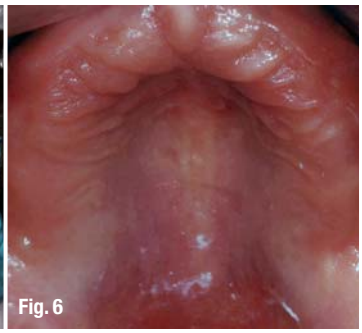
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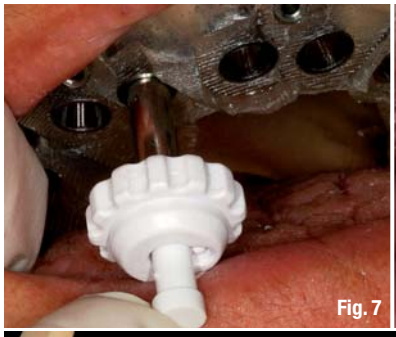
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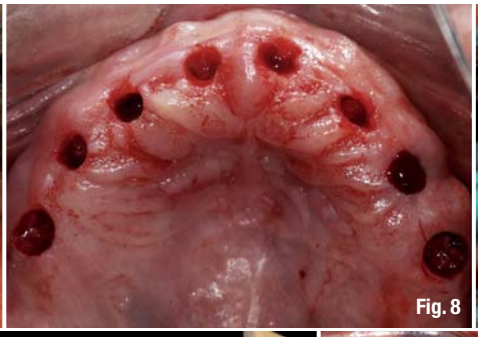
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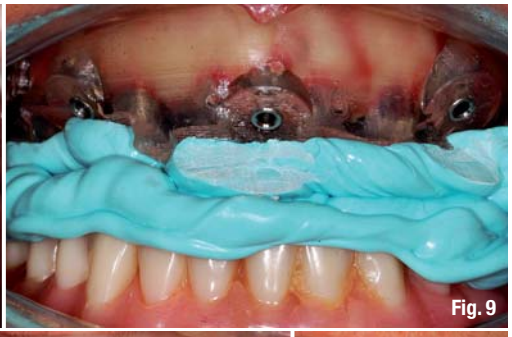
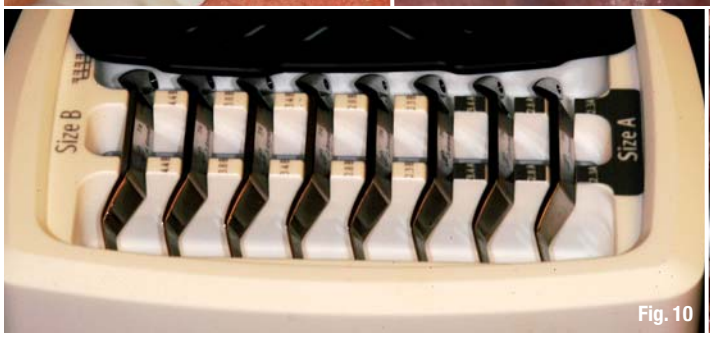


Fig. 9



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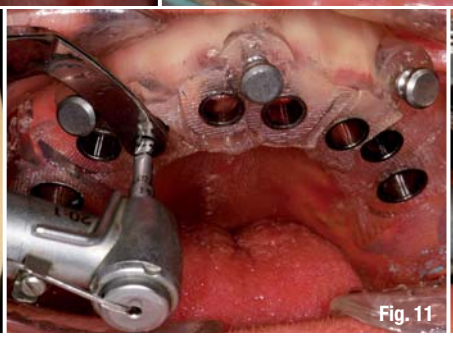


Fig. 11


Fig. 12

the final restoration (Fig. 2). The resulting treatment plan was submitted to Materialise Dental for fabrication of a SurgiGuide and an Immediate Smile model.

I received the Immediate Smile model, which contained a duplicate of the scan prosthesis, a bone model with a silicone soft tissue, and a mucosa-supported SurgiGuide. The bone model came with eight openings corresponding to each of the eight implant positions as designed in the SimPlant plan and corresponding exactly in size to the dimensions of Zimmer analogues.

The bone model came with a screw fixation system, which allowed me to recover the analogues. The silicone soft tissue on the model also corresponded to realistic soft tissue. I also received written drilling instructions and a prolongation report detailing the depth and size of each osteotomy. Zimmer analogues were placed in the Immediate Smile model (Fig. 3). The duplicate of the scan prosthesis was used to mount the bone model with the soft tissue on an articulator (Fig. 4), giving correct orientation and vertical dimension. This made it possible to fabricate a provisional that would be used for immediate loading following implant placement. The mounted model was then used to create an orientation jig for the SurgiGuide (Fig. 5). The jig assured that the SurgiGuide was positioned in the mouth exactly the same way as the scan prosthesis had been positioned in the mouth. This is a very important step for a mucosa-supported SurgiGuide because of the flexibility of the soft tissue (mucosa). Both the duplicate of the prosthesis and SurgiGuide fit perfectly onto the Immediate Smile model, allowing for fabrication of an accurate orientation jig on an articulator.

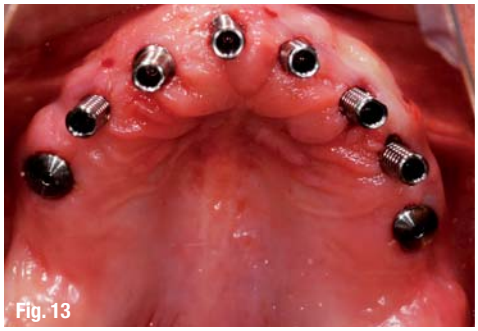
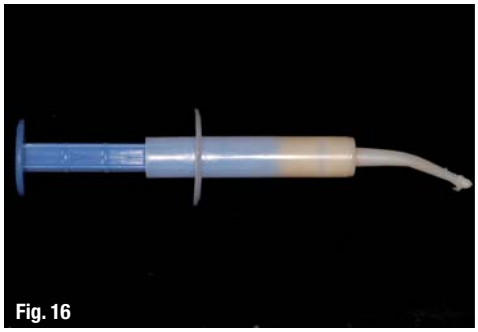


Fig. 13


Fig. 14


Fig. 15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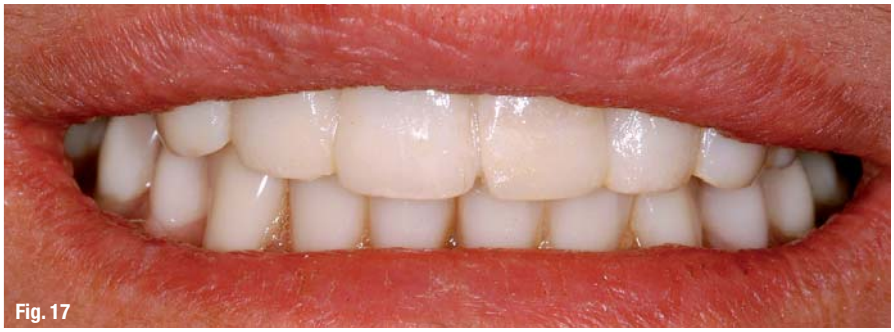
Fig. 17

The surgical guide was placed in the patient's mouth, and the tissue was punched utilizing a tissue punch (Figs. 6–8). Then, the surgical guide was again oriented in the patient's mouth with the orientation jig created on the articulator and stabilized with three SurgiGuide fixation screws (Fig. 9). Utilizing the Zimmer Guided Surgery Instrumentation and Guided Surgery drills (Fig. 10), all eight osteotomies were created and completed using minimally invasive flapless surgery (Figs. 11 & 12). The Zimmer guide is a SAFE system, accurately providing for depth and size.

The right and left molar (teeth #3 and 14) osteotomies were created short of the maxillary sinus. Then, using the new Sinus Crestal Approach Kit (Zimmer), I extended these two osteotomies into the left and right maxillary sinuses. Alloplastic bone (Puros, Zimmer) was placed into the sinus cavity through the osteotomy and spread using the paddle-shaped spreading bur. Then, all eight implants were placed. Each had initial stability exceeding 35 Ncm. I decided to immediately load only the six implants that did not involve the sinus cavity. Therefore, healing heads were placed on implants #3 and 14, and non-engaging titanium temporary cylinders were placed on #5, 6, 8, 9, 11 and 12 (Fig. 13). The provisional, which the laboratory fabricated, was attached to the titanium cylinders using cold cure acrylic, thus creating a screw-retained provisional (Figs. 14 & 15). A post-operative CT scan showed how accurately the eight implants had been placed in the bone using a mucosa-supported SurgiGuide with orientation jig (made on the Immediate Smile model; Figs. 16–18). The accuracy and success of this case was achieved through CT scanning, SimPlant planning with restorative model overlay, the Zimmer Guided Surgery Instrumentation and the Immediate Smile model. The surgical guide allowed for minimally invasive surgery and greatly reduced surgery time. The Immediate Smile model also reduced chair time by allowing for fabrication of the temporaries well in advance of surgery._


Fig. 18

Acknowledgement

Laboratory procedures and photographs were provided by Dr Marcelo Silva c/o Dr Max Cohen.

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Passive fit—for the first time

CAD/CAM bar restoration

Author_Björn Roland & Dr Peter Gehrke, Germany

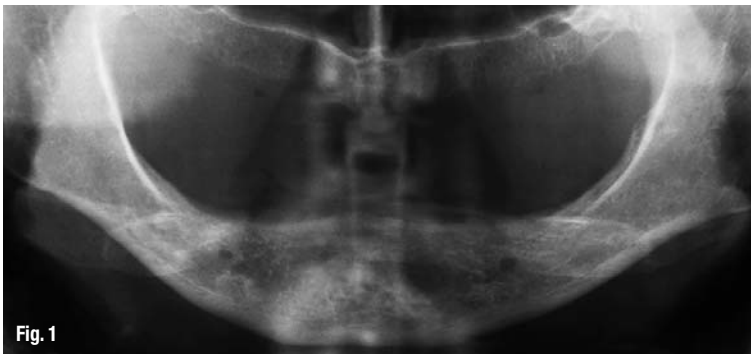
Fig. 1

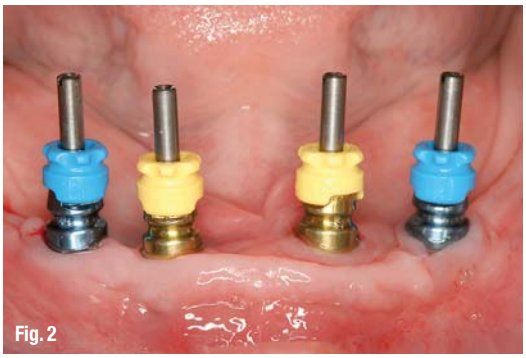
Fig. 2

Fig. 1_The panorama image shows the situation prior to insertion of the XiVE S implants.
Fig. 2_Two weeks after being uncovered, an open pick-up impression is made at implant level with an individual tray.

_Conventional or CAD/CAM? Today, dental technicians and implantologists ponder this question more frequently than ever. More and more often, they tend towards CAD/CAM. Owing to their tension-free fit, CAD/CAM-fabricated solutions are particularly well suited for the restoration of larger jaw sections. Deciding in favour of or against a CAD/CAM restoration should thus always be a team decision. With his expertise and training, the dental technician is able to contribute considerably to an aesthetic and technically perfect result.

To ensure successful prosthetic restorations, all the steps of a procedure—from planning through impression to insertion—need to be performed with utmost care. This is equally true for both conventionally cast work and CAD/CAM-fabricated structures. With both methods, only a precise transfer of the oral situation to the model guarantees success. Precision is vital for both methods, particularly when restoring larger jaw sections. Outstanding results can also be obtained with conventional casting technology if the work is done accurately and with sufficient experience. However, the risk of an ill fit is substantially higher compared with modern CAD/CAM procedures. Furthermore, wide-spanning and solid frameworks in particular enable cavities to arise and the framework to warp. Also, (partial) overheating of the melt, another potential quality flaw, is often observed with large volumes. These problems do not occur with CAD/CAM technology.

_Therapy decision

Our patient wished to regain a firm bite and unimpaired speech. She had already been wearing mucosa-supported complete dentures for 20 years, but was comfortable only with the maxillary denture. The grip of the mandibular prosthesis was inadequate owing to the resorbed alveolar ridge (Fig. 1) and ob-

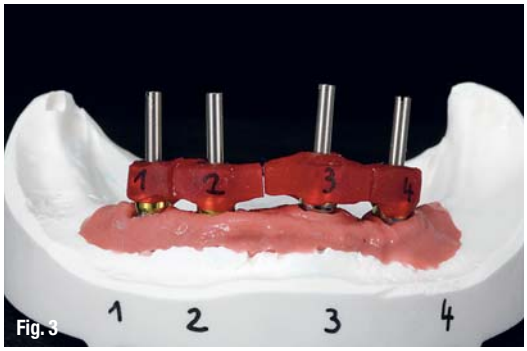

Fig. 3


Fig. 4

Fig. 3_In order to check the accuracy of transfer, a bar made from autopolymerisate is manufactured on a screwed-in Friadent MP abutment and split into segments.
Fig. 4_The individual tray for the pick-up impression with fixed pick-up screws.

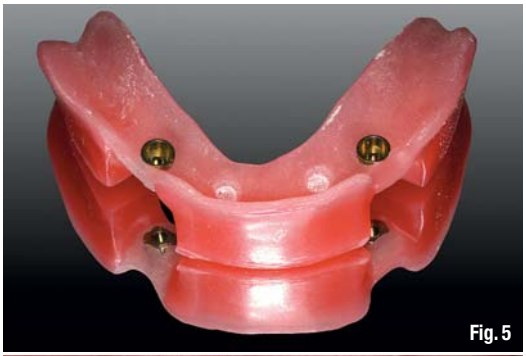
Fig. 5

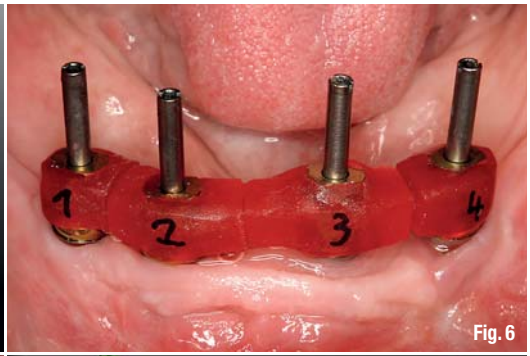

Fig. 6

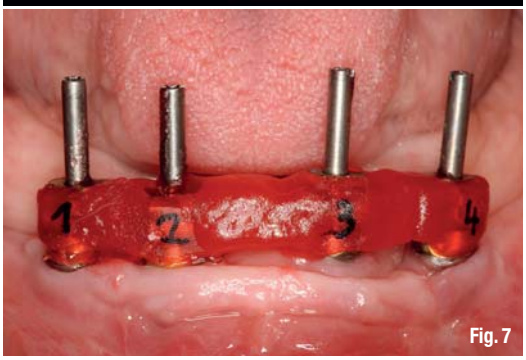

Fig. 7

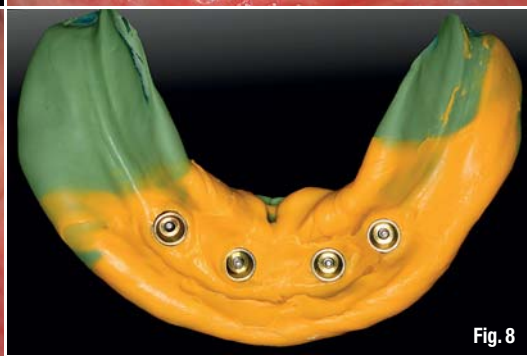
Fig. 8

Fig. 5_The bite template is fixed in the mouth on two implants.
Fig. 6_Preparation for pick-up impression: The four separate parts of the bar are screwed-in in the mouth.
Fig. 7_The segments are splinted with a small amount of autopolymerisate. The Friadent MP abutments are not removed afterwards.
Fig. 8_Double-mix impression.

structed eating and speaking. There were no general medical findings ruling out an implantation. After detailed consultation, we opted for a bar denture on four implants placed inter-foraminally in the mandible. A fixed restoration was not possible owing to cost considerations. A prosthesis on two implants, which would be more economical, was not an alternative from a medical perspective. The patient desired as stable a restoration as possible and we had to avoid degradation of the implant site through tilting motions in each case.

In the current case, the precision, which can only be achieved with this procedure, turned the balance in favour of a CAD/CAM-produced bar construction. This is also the reason that our dental laboratory, whenever possible, uses wide-span superstructures that are fabricated industrially. The result becomes ultra-predictable in conjunction with the two-stage impression process that we have been implementing with a conventionally cast framework for years. We frequently use the two-stage method whenever there are high demands on accuracy of the impression.

_Transfer of implant positions

Four months after insertion, the osseointegrated implants (XiVE S, length: 13 mm; diameter: distal 4.5 mm, mesial 3.8 mm) were restored with gingiva formers. The situation was impressed and an individual tray created. The impression at implant level was made two weeks after uncovering (Fig. 2). The DENTSPLY Friadent pick-up transfer copings were then screwed onto the analogues in the dental laboratory. Precisely transferring the oral situation with the abutments onto the model requires a second impression with an appropriate control key. A bar made from autopolymerisate was used for this. In order to reconcile any tensions, which develop during polymerisation, the bar is divided into four parts (Fig. 3). We went on to make a second individual tray (Fig. 4) and a plastic-based template to determine the relation. We designed the template in such a way that it can be secured with two impression copings onto the Friadent MP abutments (DENTSPLY Friadent) fixed in the mouth (Fig. 5). This is the only way to test the bite reliably, as well as the aesthetics, function

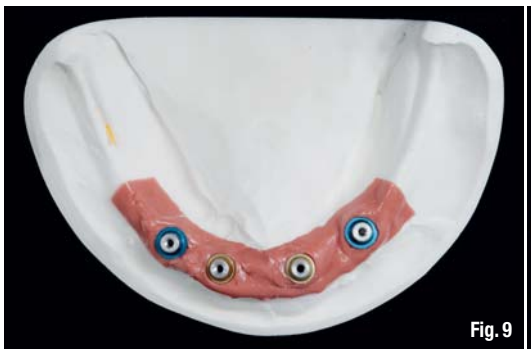
Fig. 9

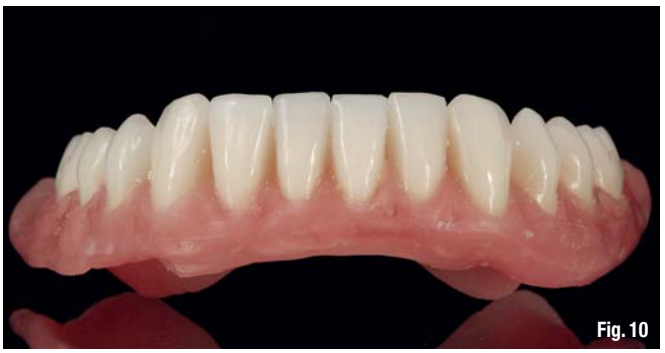
Fig. 10

Fig. 9_The master cast with removable gingiva mask.
Fig. 10_The wax-up.

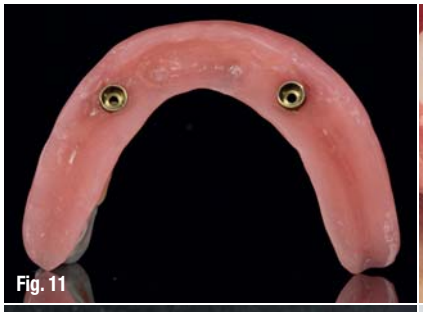
Fig. 11


Fig. 12


Fig. 13


Fig. 14

Fig. 11_The basis of the wax-up with the sunken impression copings.
Fig. 12_Screw-retaining the wax-up with the two distal implants ensures the correct position when fitting.
Fig. 13_The construction proposal supplied by Compartis.
Fig. 14_The bar milled according to the dental laboratory's specifications fits perfectly on the laboratory analogue. The bolt eyes for the planned MK1 locking bolts are clearly recognisable in the distal extensions.

and phonetics during the later wax-up. During the session to determine the relation, an impression was also made at gingiva level using the plastic bar. The individual parts were screwed on the Friadent MP abutment (Fig. 6) and splinted together using as little autopolymerisate as possible (Fig. 7). The final abutments always remain in the mouth from this point in time onwards. This has the benefit that peri-implant bone resorption is limited and the soft tissues can heal undisturbed. The impression was made with two-phase silicon (Aquasil Ultra, DENTSPLY DeTrey; Fig. 8). The master cast was made of class IV dental stone. Making a gingival mask is part of the standard procedure (Fig. 9). Fabricating two precision impressions allows maximum accuracy to be achieved with wide-span superstructures. If any inaccuracies are perceived during the impression and model manufacturing process, the corresponding step has to be repeated in each case.

_Manufacture and try-in of the bar

In order to fabricate the XiVE CAD/CAM bar, only the result of the wax try-in was still necessary. This was performed in a separate session using a plastic-based template (Figs. 10 & 11). The wax try-in is fixed onto two implants to facilitate better and definite positioning (Fig. 12). Together with the master cast, the set-up was then sent to the Compartis, where both were scanned in with a customised system. The data records resulting from the scan served as a basis for constructing the bar. At the latest, the construction proposal leaves the Compartis one day after receipt of the model by e-mail. The construction is checked with the viewer software provided by Compartis at no cost (Fig. 13). The jaws, bar and set-up can easily be shown, hidden and viewed from all angles with the software providing optimal control. At this point, the Compartis still accepts corrections.

After the design has been approved, the data record is e-mailed back to the Compartis. The CAD/CAM structure is delivered within seven days after the approval has arrived. In our experience, any conceivable bar solution in any size and type can be realised with the Compartis offer, for example Dolder bars, round bars or even bars with different retaining elements. At delivery, the bar already exhibited a quality of finish equal to a highly polished state (Fig. 14).

We first checked the accurate fit on the master cast before we sent the bar for a try-in at the dental practice. In order to detect any gap formations on the opposite side, the bar was first screwed in (Sheffield test) on one side. The fit also proved to be very accurate, even intra-orally (Fig. 15). X-ray control of the completely screw-retained bar provided additional security (Fig. 16).

_Completion

After the bar was slightly revised and given a final polish, the Galvano intermediate layer could be made (Fig. 17). After making the model casting scaffold for the denture, the bolts were fitted (Fig. 18). Before completing the bar denture, a second wax try-in was carried out for functional fine adjustment. In order to ensure optimal stability, we always make the basal portions of dentures from cold polymerisate. During the finishing process, the soft tissues were replaced with individually fashioned

Fig. 15_The bar fits accurately onto the implants and has tissue-friendly adaptation to the alveolar ridge.
Fig. 16_The X-ray control after screwing the bar in.


Fig. 15

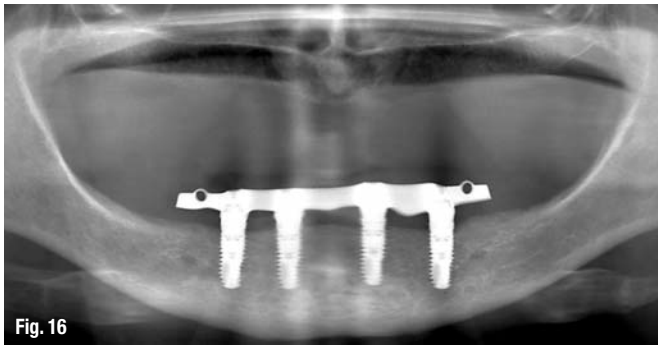
Fig. 16

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Fig. 17_The Galvano intermediate layer.
Fig. 18_The scaffold with the MK1 locking bars.
Fig. 19_The finished bar denture from basal direction.
Fig. 20_The finished dentures.

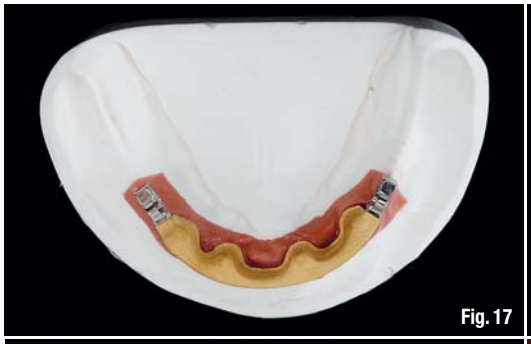
Fig. 17

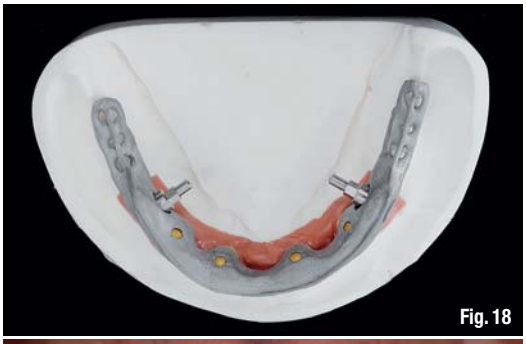
Fig. 18

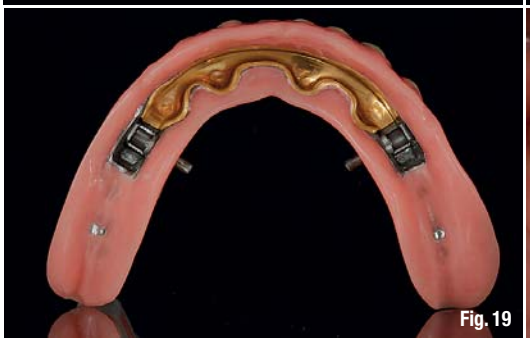
Fig. 19

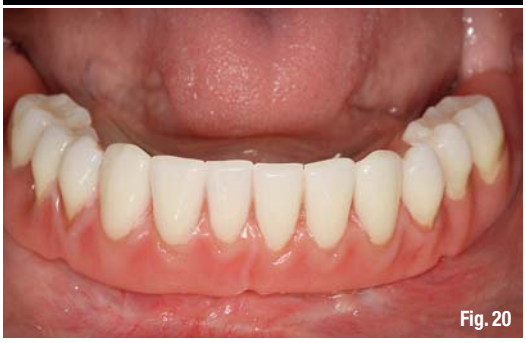
Fig. 20

plastic. As patients recognise the clear aesthetic difference to their previous dentures, individual creation increases their satisfaction quite considerably. This also helps them to better accept the, as yet, relatively high costs of implant restoration. Figure 19 shows a basal view of the finished denture; and Figure 20, the inserted work.

_Process control

The introduction of CAD/CAM-fabricated structures (bars, bridge framework) does not change the cooperation between dentists or oral surgeons and dental technicians. However, producing the superstructure industrially necessitates rethinking the dental laboratory in one respect. The framework is no longer waxed up, but conceived on screen or, as in our case, processed on the dental laboratory PC according to a proposal from the Compartis and, if required, modified to fit individual wishes. External production requires appropriate scheduling.

Steps determining aesthetics and function, such as approving framework design and producing the superstructure, remain in the dental laboratory as it used to be with the conventional procedure. As before, the treatment team controls the entire process. Compartis is merely an external supplier and has no influence on the therapy. The manufacturer's warranty on CAD/CAM structures is also of interest since it is for up to ten years. This is possible because industrial standardisation ensures the high quality of the blanks' material and industrial milling guarantees maximum precision. Thus, the risk of material failure or faulty manufacturing, and hence economically difficult re-manufacture, is minimised.

_Conclusion

The patient was enthusiastic about her new denture. Her wishes for improved function and phonetics were fully met. The procedure described here, developed in "conventional times" according to our experience, has a permanent place in our team. Furthermore, with DENTSPLY CAD/CAM solutions we have a reliable system at our disposal. It substantially simplifies work procedures, increases precision and ensures full control over all working steps._

Editorial note: This article was first published in IDENTITY 2/10. *A list of references is available from the authors.*

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TRIPOD—A new protocol for immediate loading

Complete maxillary implant-supported prostheses

Author_Dr Jean-Nicolas Hasson, Dr Jacques Hassid & Dominique Fricker, France

_Abstract

Complete maxillary implant-based bridgework is amongst the most challenging of restorative procedures. With TRIPOD, a new treatment protocol for planning and surgery, a radiographic template and a surgical guide are secured to three fixed reference points, such as natural teeth and previously placed dental implants. CT-based software enhances treatment by first validating the surgical guide, and then allowing chairside postmodification options. Open-flap surgery is initiated with sterile templates and impression trays. Implant sites are prepared with the surgical guide to a final depth with pilot drill and 2.8 mm diameter drill. Further site preparation involves implant-specific drills, piezosurgery and bone expanders. These developments improve the reliability of complex implant-based restorations.

_Introduction

Immediate loading of complete maxillary implant-supported bridgework is an increasing request by patients who have high aesthetic and functional demands and attach great importance to a neat appearance and their self-image. Since 1977, positive results have been obtained in immediate loading[1,2], but these were limited to mandibular, bar-retained removable dentures. In 1997, Tarnow *et al.*[3] published a study showing similar results for maxillary and mandibular full-arch, implant-supported bridgework, and, more recently, the focus has turned to the development of computer-based techniques for improved results. Highly sophisticated technical tools such as Nobel-Guide (Nobel Biocare) and the SAFE SurgiGuide® (Materialise Dental) have entered the market and related techniques such as All-on-4 (Nobel Biocare) are being promoted[4,5] to help meet patients' demands. All techniques are based on full maxillary bridgework with a screw-based retention. The screw-retained bridgework allows all procedures to be performed during the treatment, i.e. impression taking, bridge modification and repair for aesthetic or functional purposes.

Amongst the more challenging difficulties in carrying out such a therapy is implant positioning, especially for a single crown in the anterior region. Precise placement is essential in achieving good aesthetics, phonetics, function and cleanability. Most of the time, implant placement has to be within the limits of 0.5 mm (Fig. 1). Another factor to consider is the possible loss of alveolar bone after tooth extraction, leaving a minimal residual volume, and thereby increasing the difficulty of the procedure.

The positioning of implants depends on the guide's positional accuracy in a definitive place at the time of the surgery and on the accuracy of the guide itself. In

Figs. 1a–c_Precision positioning of dental implants is mandatory for adequate abutment and screw placement.


Fig. 1a

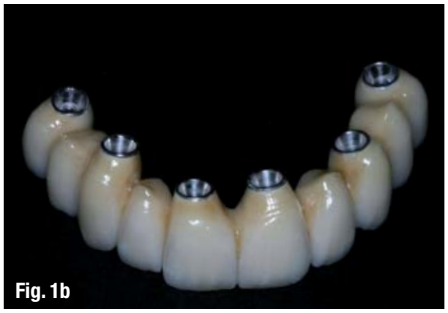
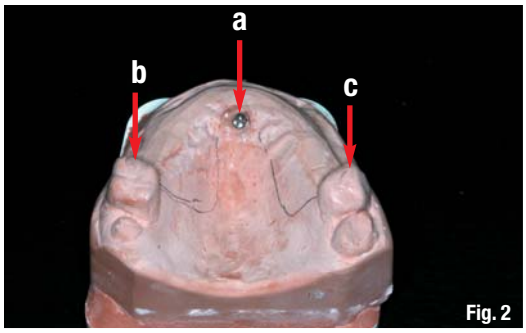


Fig. 1b


Fig. 1c



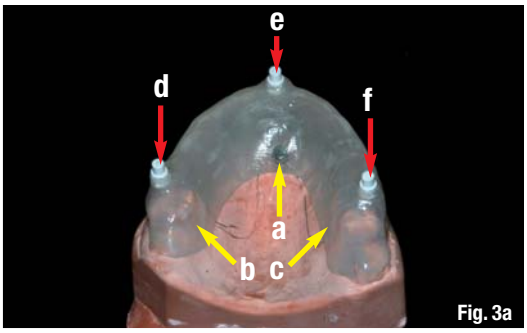


Fig. 2_The Positioning TRIPOD is based on a temporary implant (a) and two residual teeth (b & c).
Fig. 3a_Radiographic template fixed on the Positioning TRIPOD (a, b & c) with standardised X-ray opaque resin pins (d, e & f).

the case of NobelGuide, accurate positioning depends on the patient's ability to bite reproducibly and precisely, with even gingival thickness and consistency, and assumes that bone shows a similar degree of hardness at different screw-retention sites. Unfortunately, as recently reviewed by Schneider *et al.*[6] and detailed by Valente *et al.*[7], the deviation between entry point and orientation consistently differs between the planned and actual position of the implants. This generally accounts for the results obtained by guides used in flapless surgery. Other failure factors may be related to poor cooling ability during the drilling procedure.[8]

As cited above, inaccuracies may arise from the positioning of the guide or of the patient, or be related to the radiological technique itself. In the case of flapless surgery, the position of the guide is conditioned by the thickness and consistency of the underlying soft tissue, as well as the patient's ability to bite precisely in a replicable manner. In addition, there is always some degree of patient movement during the CT scan, which can hardly be controlled, an inaccuracy termed a 'mechanical artefact'. Of course, any study performed on cadavers or models cannot reproduce this particular radiological aspect.[9, 10] Other inaccuracies are related to the radiological equipment itself and include geometric, hardening and threshold artefacts. Geometric artefacts are related to the ability of software to reconstruct a 3-D space based on the serial addition of 2-D images that are filtered by the software.[11, 12] Hardening artefacts are due to the different densities of adjacent objects. An X-ray beam is composed of individual photons with a range of energies. As the beam passes through an object, it becomes 'harder', that is, its mean energy increases because the lower-energy photons are absorbed more rapidly than higher-energy photons.[13] The last significant artefact, the digital artefact, is due to the segmentation masks that are used to obtain volumes. In order to obtain a mask, an interval of radiodensity is defined by choosing the Hounsfield values at both ends of the tissue(s) under interest. By using this method, an area of lower or greater density can be discarded and missed in the final volume. This may be particularly true when digitally producing a surgical template based on hard or soft tissue. Finally, images produced by available techniques are too unreliable to be used directly for this type of treatment. We propose a new protocol in this article with the aim of reducing inaccuracies in terms of reliability, aesthetics and function.

TRIPOD: Description of a new clinical technique

Initially, a treatment plan is performed to adequately evaluate a case, propose alternate solutions and decide whether the patient is a suitable candidate for a fully implant-supported maxillary bridge. This requires a first assessment that includes a possible wax-up and a radiographic stent for visualising the crown position on the CT scan, as well as an evaluation of a potential need for bone- and soft-tissue augmentation procedures. Patients often present with their own cement-retained bridgework on natural teeth in place that, when adequate, may be used as a reference guide for implant placement. It is essential to evaluate the implant site within the maxillary bone precisely. In order to perform these measurements, a Positioning TRIPOD and a Computing TRIPOD need to be determined.

The term 'Positioning TRIPOD' is used to denote the selected pre-existing three fixed points (Fig. 2) in the mandible or maxilla, which can be based on:
_teeth that are stable enough to support the surgical guide during surgery;
_implants placed in posterior areas;
_temporary mini-implants that will be removed at the end of surgery.

The choice of appropriate bases for the Positioning TRIPOD is critical for its accuracy. Owing to its compressibility, soft gingival tissue has to be avoided. Problems with remaining teeth may arise due to advanced periodontal disease causing excessive mobility. In some cases, temporary mini-implants are used, but often the amount of maxillary residual bone is so reduced that these implants only interfere with definitive implant placement. Nevertheless, they may be useful when no other alternative is available. Anecdotal cases in which there is sufficient bone for temporary and definitive implants at the same time have been reported, but are rare. The best choice is to use posteriorly placed implants before inserting anterior implants. In this case, an extremely precise positioning

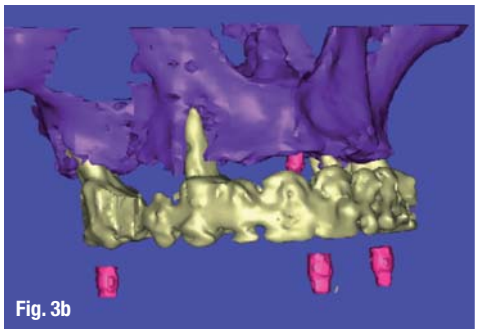


Fig. 3b

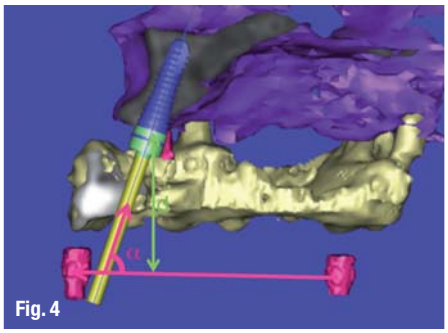


Fig. 4


Fig. 5a

Fig. 3b_The Computing TRIPOD.
Fig. 4_The position of standardised X-ray opaque resin pins allows the calculation of implant coordinates.
Fig. 5a_The drill sleeves being placed in the radiographic template with the transfer table.

is not required since the large volume of the corresponding teeth provides some degree of freedom to the laboratory technician designing the prostheses. These posterior areas often require some bone reconstruction (such as sinus lift or onlay bone grafts), thereby prolonging time to loading. The corresponding implants will then ensure not only the most precise positioning for radiographic templates and surgical guides, but also for the occlusal guide and impression tray, since all these parts will be screw-connected to these previously placed and osseointegrated implants. In order to transfer the planned implant position from the planning software to the surgical guide, a Computing TRIPOD is necessary. This Computing TRIPOD is made with three SKYplanX reference pins (Bredent) placed on the radiographic template with the reference plate (Fig. 3a). The patient is scanned with the radiographic template fixed on the Positioning TRIPOD. The position of the standardised X-ray opaque reference pins is detected by the software, building the Computing TRIPOD (Fig. 3b), and used to calculate the implant coordinates (Fig. 4). This data is then set in the transfer table (Fig. 5a) to place the drill sleeves accordingly and transfer the radiographic template into a surgical guide (Fig. 5b).

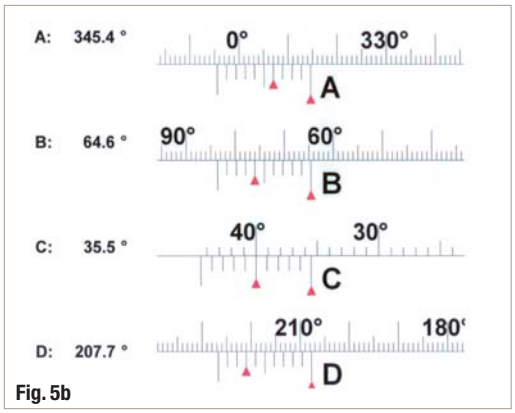


Fig. 5b

Fig. 5b_The implant coordinates for the transfer table.

Some days prior to the full-arch surgery, once an adequate TRIPOD has already been planned and initial implants placed, an initial impression (Fig. 6) will be taken for the model to prepare the impression tray, occlusal guide, surgical guide from the radiographic template, as well as the provisional prostheses. The surgical guides are produced in sterilisable resin with radiopaque sleeves (DéPlaque). Special attention is given to the impression tray that will extend to all maxillary surfaces, but room for the impression material is exclusively limited to the planned implant sites. They must be ready at the time of surgery.

On the day of the surgery, the practitioner begins by reducing all remaining crowns that would interfere with the surgical guide, which is then placed on teeth or preferably screwed onto previously placed implants forming the Positioning TRIPOD (Fig. 7). A CT is performed to verify all drilling sites. If any modification has to be done, there is still time to adjust the drill sleeves to adequate positions and to re-sterilise the guide.

The next step is the transfer of the occlusion to the articulator. Usually an occlusion guide is engineered before surgery and screwed into an adequate position. It is then adjusted and some silicone material is added

Fig. 6_Initial impression of two initially placed implants.
Fig. 7_Surgical guide placed on teeth and screwed onto previously placed implants forming the Positioning TRIPOD.
Fig. 8_Occlusal guide screwed onto posterior implants.

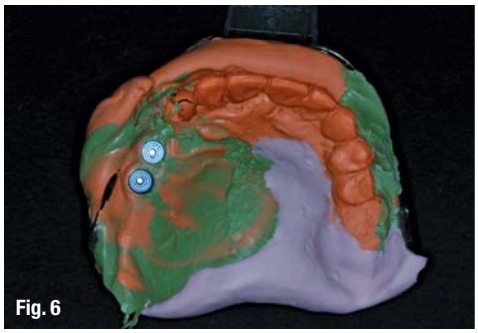


Fig. 6

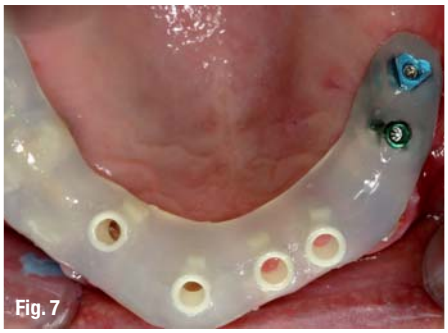


Fig. 7


Fig. 8

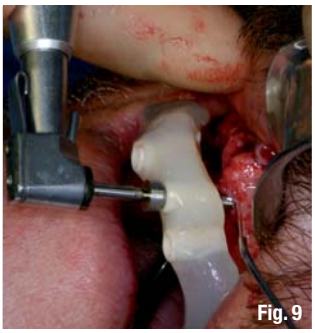


Fig. 9

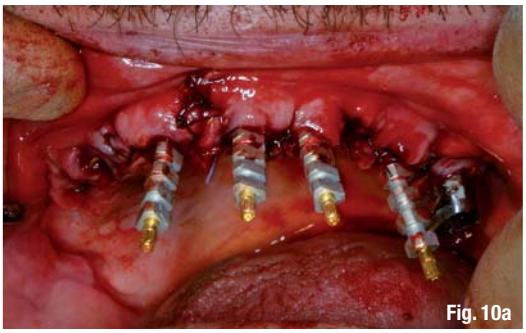


Fig. 10a

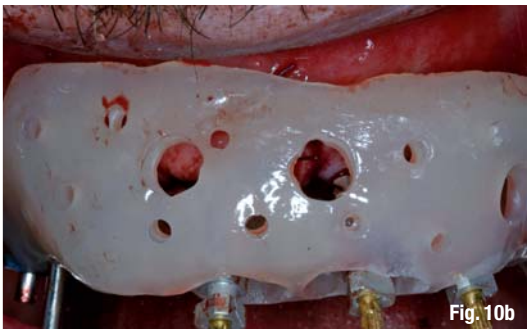


Fig. 10b

Fig. 9_Adequate cooling and visualisation during drilling.
Fig. 10a_Second impression taking at time of surgery with Thommen impression copings on SPI®ELEMENT implants.
Fig. 10b_Placing of the individualized open tray.

to ensure a perfect bite (Fig. 8). The transfer is made to the articulator before starting surgery. It is sometimes possible to retain a molar with compromised prognosis until the end of definitive prosthesis, thereby keeping a reference point of initial occlusion.

When all materials are sterile, surgery can be initiated under the usual conditions. The flap is raised, the remaining teeth planned for extraction are removed and the surgical guide is placed on teeth or screwed onto implants. Holes of 2.0 and 2.8 mm are drilled through the sleeves using the VECTOdrill™ (Thommen Medical) with a smaller tip fitting in and following the prepared drill hole. Control of the depth is visual, since depth marks on the drills can be easily seen on the facial aspect of the surgical guide. Speed and torque are according to the manufacturer's instructions. Cooling is performed on the facial side (Fig. 9); the flap is maintained properly by the guide on the palatal side. Once the drilling has been completed, the surgical guide is removed and the last step of implant site preparation is done using implant-specific drills, bone spreaders or piezosurgery inserts. The choice of the implant relies not only on the diameter, but also on the implant length and profile to achieve the best possible implant stability. Implants with advanced surface technology, providing additional security in the early healing phase such as the super-hydrophilic Thommen implant lines SPI®ELEMENT (cylindrical profile) and SPI®CONTACT (conical-cylindrical profile) with INICELL® (Thommen Medical), are preferred. In order to perform immediate loading, the implant should be inserted with a minimum torque of 25 Ncm. If the bone provides poor primary stability, then a two-stage approach is required to ensure proper osseointegration before placing the prostheses. SPI®VARIOmulti abutments (Thommen Medical) are connected to the implants by selecting proper width, height and angulation. Next, impression copings are connected to the SPI®VARIOmulti abutments and bone-grafting material such as BioOss® (Geistlich) is then spread on the facial bone in order to avoid facial bone resorption.[14] All synthetic bone graft material is covered by a thin and long-lasting membrane such as Remotis® membrane (Thommen Medical) and flaps are sutured with particular attention to ensuring wound closure.

The impression tray is connected to the initially placed implants and silicone material is injected into the tray around implant transfers where room has been preserved for the impression material (Fig. 10). Once the impression tray has been removed, protective caps are positioned on the SPI®VARIOmulti abutments in order to maintain gingival spacing during the last laboratory prosthetic phase. A panoramic X-ray is performed to ensure proper positioning of implants and abutments, and to ensure that no radiopaque sterile silicone material remains.

The maxillary plaster model is trimmed to leave space for abutment analogues and plaster is poured to fill this open space after the impression tray has been secured to the trimmed model (Fig. 11). The modified model simultaneously shows two parts: the first part corresponding to the initial impression and the other corresponding to the second impression (Fig. 12). The provisional prostheses are fitted to the model and occlusion is validated. When this laboratory phase is over, the protective caps are removed, and the prostheses are screwed into position (Figs. 13a & b). If well done,

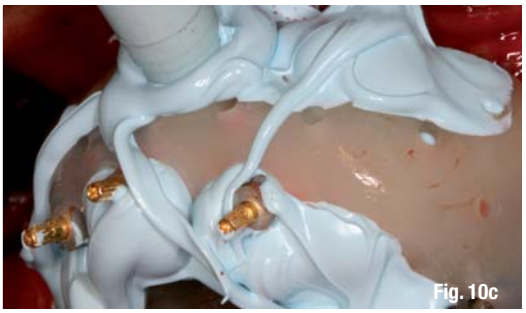


Fig. 10c

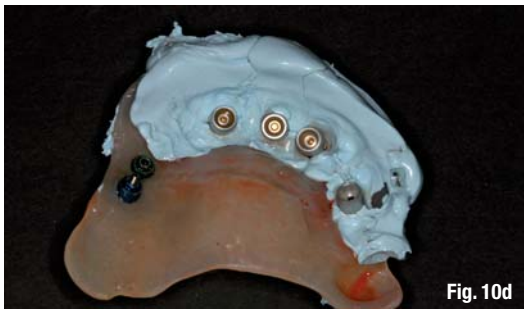


Fig. 10d

Figs. 10c & d_Injection of silicone material and final second impression.

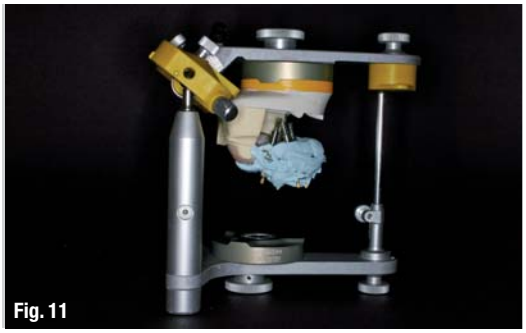


Fig. 11


Fig. 12

Fig. 11_Second impression secured to reduced inital model mounted in the articulator.
Fig. 12_Modified model: the yellow part corresponds to the initial impression; the pink part was poured at the time of surgery.

occlusal adjustments should be minimal, even perhaps none being required. Thommen SPI®VARIOmulti temporary caps on are filled with temporary light-cured material to close the screw channel and the patient is advised to treat the temporary bridgeworks in a gentle manner.

Sutures are removed after ten days. The aesthetics is re-evaluated three months after surgery, before initiating the final prostheses, owing to subsequent loss of tissue volume. Additional temporary bridgework is often required to test that the final aesthetic will be adequate before proceeding with the definitive prostheses. The final prostheses is either manufactured as a casted bridge using SPI®VARIOmulti caps or by CAD/CAM technology such as NobelProcera from Nobel Biocare.

_Discussion

There are multiple technical benefits of the TRIPOD procedure. Precision implant placement is achieved by removing positional and mechanical artefacts, particularly when the actual surgical guide is screwed onto stable implants. In other words, there is no movement evoked by a bite variation or tissue differences, and if the patient moves during the CT scan, the guide moves with the anatomical structures. However, there is no way to conquer geometric, hardening or digital artefacts. There is still room for a small degree (< 1 mm) of freedom in implant placement and, if necessary, final correction can be done after the initial drilling with the 2.8 mm drill. This results in a maximum freedom of approximately 0.7 mm in diameter for a final implant site with a diameter of 3.5 mm. However, considering that the last drill at the centre is just half of this value, this freedom corresponds radially to 0.35 mm, providing an opportunity to adapt the implant site preparation to anatomical conditions slightly. This distance of 0.35 mm is sufficiently important to become particularly significant for leaving some buccal bone, but it is still small enough to be handled by the dental technician for ideal prosthetic screw placement. Nevertheless, the initial implant placement cannot exceed this limit, which evokes the necessity of very precise initial drilling and, at the time, an additional step to verify that the surgical guide is actually suitable for use. Compared with flapless techniques, open flap surgery not only allows the visual opportunity for controlling bone site preparation, but also retains precious keratinised tissue that is important for both marginal tissue stability and volume. The patient's reaction to this procedure, with its associated pain and discomfort, still has to be examined in future studies.

Another benefit of this procedure is that sterility is maintained throughout the surgery, since all materials used can be sterilised, which is not the case with common guides such as NobelGuide or the SAFE SurgiGuide®, which are both made of a stereolithic resin and are currently not capable of undergoing sterilisation. In addition, the precision of the procedure allows the impression tray to remain unmodified—and thus sterile—throughout the surgery.

Yong and Moy[8] state that implant loss was probably primarily related to the absence of proper cooling ability when using NobelGuide, since most of the late implant failures involved long implants in cases in which the guide was used directly at the gingival contact. In-

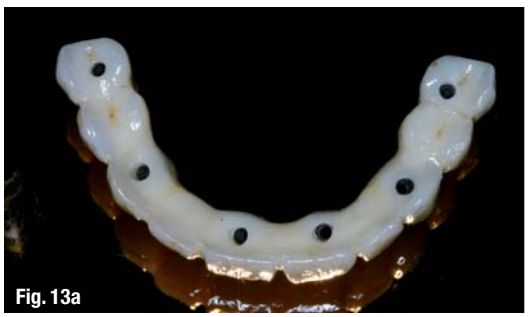


Fig. 13a

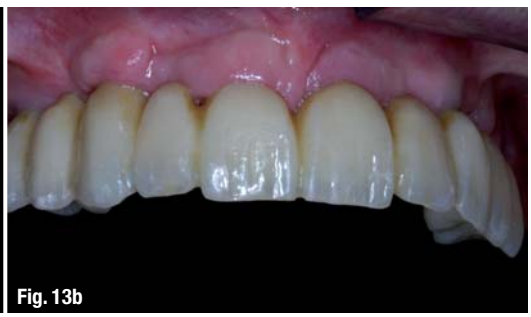


Fig. 13b

Figs. 13a & b_Initial provisional bridgework on Thommen SPI®VARIOmulti temporary caps in place.

deed, only the rear part of the drill (thus far from the tip) can be cooled efficiently, and thereby probably makes the cooling procedure ineffective. In contrast, during the described TRIPOD procedure, the guide is placed on the gingiva at the time of fabrication, leaving an open space for cooling at the time of the open flap surgery. In addition, the bone becomes visible, which allows the practitioner to visualise the depth marks of the drill right at the crestal ridge, making the instrumentation less expensive and easier, as no special drill with mechanical depth limitation is required. Site preparation may be modified by using piezoelectric bone surgery, since this device can grind bone on a particular wall from the previous drilling, in contrast to conventional drilling, which grinds all walls from the previous drilling, with a preference for softer tissue and resulting in facial bone perforation. In some situations, one might also consider changing from drills to bone spreaders; this would compact the surrounding bone and provide additional stability to the corresponding implant. Finally, the implant could be adapted to a recipient site by choosing an appropriate diameter, length and even the profile (e.g. from conical to conical-cylindrical) once site preparation has almost been completed.

The previously placed implants not only add useful precision to implant site preparation with the guide, but also provide essential stability to immediately loaded bridgework in an area where stability in the initial healing phase is probably vital to success. Most patients are already older, with a history of periodontitis, tooth loss and associated impaired medical conditions, and possibly reduced healing capacity. Therefore, it is of major interest to be able to assess the healing capacity by the stability of previously placed implants, before undergoing and performing a full-arch maxillary bridge immediately loaded on implants, preferably with advanced surface technology. Most of the cases require some sort of bone grafting in the posterior areas and this technique leaves time for initial healing before occlusal loading. In fact, some of the implants would be subjected to immediate loading, while others—the most critical in terms of bone volume availability and location—could be loaded according to a classical schedule. This should be considered when making a comparison with other procedures with surgical guides.

The INICELL® surface found on Thommen Medical implants showed more bone-to-implant contact and a higher removal torque at two weeks than unconditioned implants did.[15] This aspect should be particularly useful in the early stages of healing and providing additional security in this crucial phase. In addition, this company provides implants of various diameters, length and profiles to satisfy various implant site requirements and which provide the best possible stability.

_Conclusion

The TRIPOD protocol is based on our latest clinical experience. It utilises CBCT, as well as the vast developments of implant placement planning software and computer-guided implant dentistry. The efficiency of the technique must still be validated by analysis of implant survival in different clinical environments, specifically investigating adequate positioning between planned and final implant position, and the need to verify the surgical guide after the learning process has been completed. Finally, a study on patients' satisfaction with the procedure in terms of pain and aesthetic outcome needs to be performed. We must still determine whether the benefits of open flap surgery in combination with surgical guides outweigh the related discomfort and pain for the patient: does this pose a major problem for patients, are the final aesthetics improved by preserving keratinised tissue, and does such a technique fulfil expectations, considering that bone volume loss is often difficult to limit in these areas?

The proposed TRIPOD procedure is certainly more labour-intensive than current flapless guide systems, since a flap has to be raised and no definitive prosthesis is placed right after surgery. Nevertheless, it is also more versatile because maintaining or increasing bone volume is considered in the treatment plan and is adapted to the individual situations. The risk of failure is considerably reduced by connecting immediately placed implants to osseointegrated implants. Furthermore, this procedure allows using the last millimetre, as typical cases show reduced bone volume and require the widest and longest implants within anatomical restrictions. Although knowledge and close collaboration with the laboratory technician are required, this procedure adds fundamental security and predictability for success, and will certainly be adapted to different practice situations and one-day procedures._

Editorial note: A list of references is available from the publisher.

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Success factors for immediate implantation with immediate loading

A case example

Author_Dr Rouven Bönsel, Germany

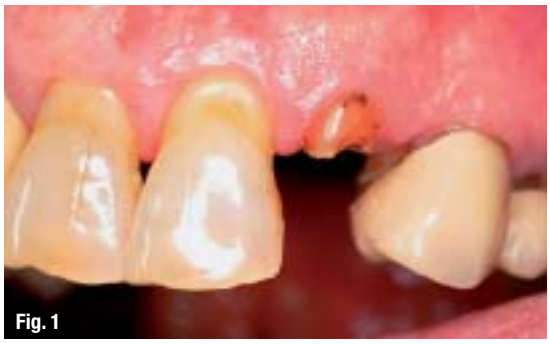
Fig. 1


Fig. 2

Fig. 1_Following fracture of the crown of tooth #22 treated with a root post, only remnants of the root remained. The patient did not want the neighbouring teeth ground.
Fig. 2_The panoramic radiograph shows, in addition to other findings (see text), the remnants of root 22 with incomplete root filling and a generalised horizontal bone defect. The reference ball for implant planning can be seen at position 22.

_The replacement of lost teeth with implants can be very time-consuming for patients. During the temporisation phase, aesthetic limitations often have to be accepted. The quickest and most patient-friendly option is immediate implantation with immediate temporisation. However, in order not to precipitate failure just as quickly, this form of treatment requires some experience and a working knowledge of the success factors.

Classical concepts that call for late implantation and load-free healing are increasingly being called into question. On the one hand, modern implant surfaces and designs now permit shorter healing times than were possible in the past. Usually, restoration is successful after just six to eight weeks.[1] This also leads to shorter overall treatment times for implantations in areas that are already fully healed or have been edentulous for some time. On the other hand, where possible and sensible, many experienced dentists and surgeons place implants in the fresh socket immediately after extraction. The major advantage of this approach for patients is treatment that is not only uniquely time-saving, but also less traumatic and costly. Immediate temporisation also provides direct soft-tissue

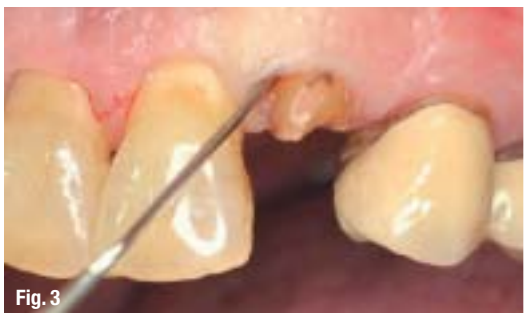
Fig. 3

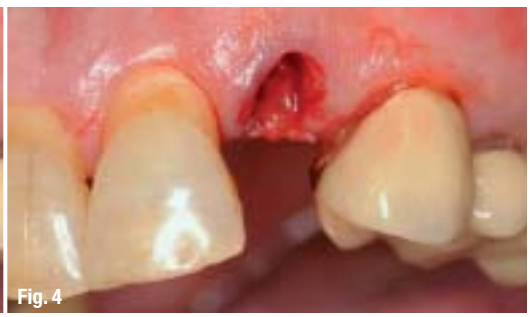
Fig. 4

Fig. 3_The remnants of root 22 were removed with a periotome, while sparing the buccal lamella and soft tissue.
Fig. 4_Probing of the extraction socket showed intact bony walls, especially the buccal walls.

support with a natural-looking temporary restoration. Augmentation is usually performed at the same time as immediate implantation. This applies both to immediate temporisation and to transgingival or closed healing. If the tissue deficit is small, minor controlled tissue regeneration is sufficient. This can be achieved, for example, with the help of a slowly absorbed bone replacement material and a membrane. However, for larger defects this can be technically challenging owing, especially, to the frequent lack of soft-tissue volume.[1] In such a case, a two-session procedure is recommended with socket preservation and implantation in the augmented alveolar ridge or simultaneous implantation using suitable soft-tissue techniques to cover the implant cleanly.[2]

A requirement for successful immediate implantation with immediate temporisation is a largely intact bony alveolus, particularly an intact and sufficiently thick buccal lamella. Even with the use of 3-D radiology techniques, this cannot be determined with certainty until after extraction. Another requirement for the success of immediate implants is adequate primary stability of at least 35 Ncm.[3] During the process of osseointegration, the bone is able to convert mechanical forces into biological stimuli. In this context, the degree of bone expansion under force plays a key role. It is absolutely essential to avoid micro-trauma that could overstrain the interface between the implant and bone.[4]

Moreover, the risk of recession appears to be less in patients with thick gingival tissue than in patients with thin tissue.[5, 6] This can be easily determined with a PA probe inserted vestibularly into the sulcus. If the metal is visible through the tissue, the patient has a 'thin' gingival phenotype, otherwise a 'thick' one.[7] Finally, the choice of treatment also depends on extraneous factors such as the patient's laugh line, as well as his/her expectations with regard to aesthetics, cost and treatment time.

According to recent studies, if all these factors are taken into account, immediate temporisation—also in conjunction with immediate implantation—can achieve hard- and soft-tissue results that are just as stable as those obtained with conventional loading after three to six months.[8–12] The bone contact rate at the implant interface also appears comparable for immediate and late protocols.[11] However, in the case of immediate temporisation static and functional contact points should be avoided if possible. The risk of integrating the final restoration immediately is too great owing to unpredictable tissue changes during the healing phase.

_Case report

In a 66-year-old male patient, the crown of tooth #22 was fractured (Fig. 1). The tooth had been endodontically treated with insertion of an abutment post and crown about 15 years previously. The patient had no pain and there were no periapical abnormalities. However, in view of the slender root, a new post and crown did not appear advisable (Fig. 2). Because the patient did not want the neighbouring teeth ground ("I want a new lateral incisor. I certainly don't want the healthy neighbouring teeth ground"), only an implant came into consideration.

The panoramic radiograph showed incomplete filling of the root remnants, a generalised horizontal bone defect and endodontic and dental restorations in all four quadrants (Fig. 2). The pocket depth was neither unremarkable at 3 to 3.5 mm, nor was there bleeding on probing. The periodontitis was evidently accompanied by tissue recession, largely without pocket formation or acute inflammation. The soft tissue was somewhat rough and was classified as belonging to the 'thick' phenotype. Other findings were periodontitis originating from the pulp of tooth #45, an implant at position 44, tooth #37 inclined strongly into gap 36 and a retained tooth #38. There were no functional abnormalities. The patient did not smoke and, apart from pharmacologically controlled hypertension, was healthy. As a manager of an


Fig. 5


Fig. 6

Fig. 5_The implant (Replace Select Tapered, Nobel Biocare) is relatively short owing to the horizontal bone defect (10 mm with diameter 4.3 mm). The planned vertical apical position approximately corresponded to that of the extracted dental root.
Fig. 6_ The shoulder of the primarily stable (35 Ncm) inserted implant is located approximately 1 mm apical to the buccal crestal bone edge. The transverse position is approximately 1 mm palatal for optimum distance to the buccal lamella. The buccal orientation of one of the three internal channels can be clearly seen.
Fig. 7_ The radiograph shows the implant with the temporary abutment. The distance from the bone edge to the contact point of the crown is approx. 5 mm owing to marginal bone loss.
Fig. 8_The impression coping for open impression taking was screwed on. The implant position was transferred to the laboratory with the help of a plastic key.
Fig. 9_In the laboratory, the dental technician prepared a custom-made titanium abutment (Esthetic Abutment) and fashioned the temporary composite crown, which was cemented in place just 24 hours after implantation.

industrial company with attendant social obligations, the patient did not want a removable temporary restoration. Because he was also a busy man, it was desirable to insert an immediate implant with a temporary restoration within 24 hours, depending on the state of the post-extraction alveolus. This procedure involved a minimum number of appointments over a clearly defined period. With the help of the clinical findings and a planning template using a radiopaque steel ball (panoramic radiograph; Fig. 2), it was possible to determine the implant length and suitable diameter preoperatively.

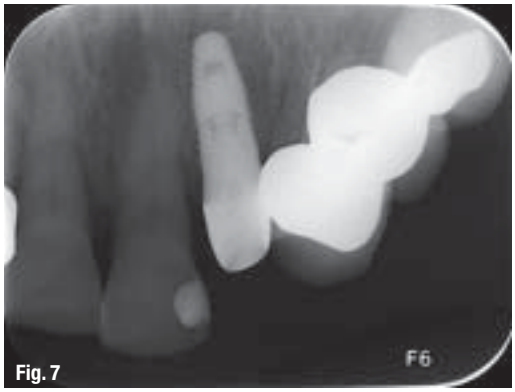
Fig. 7

During extraction with a periotome, great care was taken not to traumatise the hard or soft tissue unnecessarily (Fig. 3). Soft-tissue detachment was thus avoided. The tooth socket was then probed, revealing an intact buccal lamella (Fig. 4). The granulation tissue present was removed. There was no sign of acute inflammation. Figure 5 shows the size relationship of the extracted root remnants to the implant (Replace Select Tapered, Regular Platform 4.3 × 10 mm, Nobel Biocare). Figure 6 shows the implant inserted in its final position. The implant shoulder in the buccal direction was approximately 1 mm sub-crestal (see also Fig. 7) with a buccally oriented channel of the internal connector (Fig. 6).

The palatally displaced implant position, resulting in a safety distance of up to 2 mm to the buccal wall (bone jumping distance), can also be seen in Figure 6. Following implantation, the gap was augmented with a mixture of Bio-Oss (Geistlich) and endogenous bone. Endogenous bone was removed from the left tuber region with a bone scraper. A covering membrane was not used. The follow-up radiograph (Fig. 7) shows the correct distances to the neighbouring teeth and the vertical position, corresponding approximately to that of the extracted root (cf. Fig. 2).

The shape of the implant also closely matches the conical root shape. In this way, it is possible to avoid perforation of the facial alveolar wall, especially in patients with thin buccal bone. For this reason, the pilot hole should always be drilled palatally to the natural root tip, and expansion holes should be drilled while exerting pressure in the palatal direction. The area was prepared in accordance with the standard protocol. The implant was then inserted with a torque of 35 Ncm. With this primary stability achieved, the most important requirement for immediate loading was met. Because the patient wanted an immediate high-quality aesthetic restoration, fitting a laboratory-fashioned temporary crown of composite material

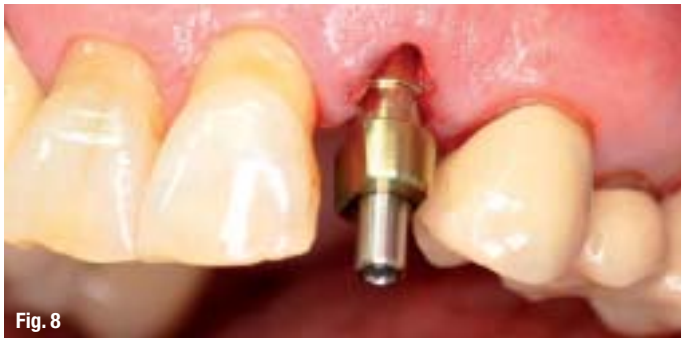
Fig. 8


Fig. 9

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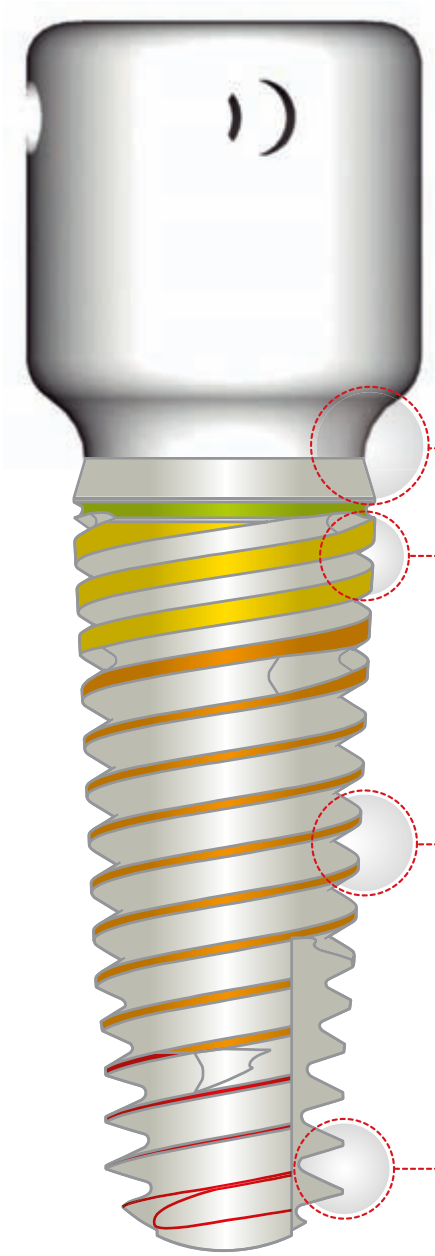

Image: Esthetic Healing Collar (TVHC 50-60-A)
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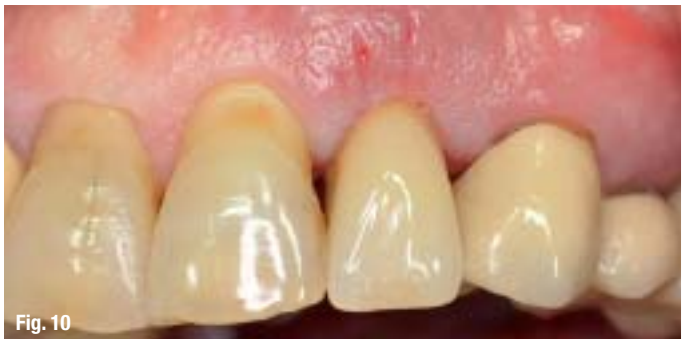
Fig. 10

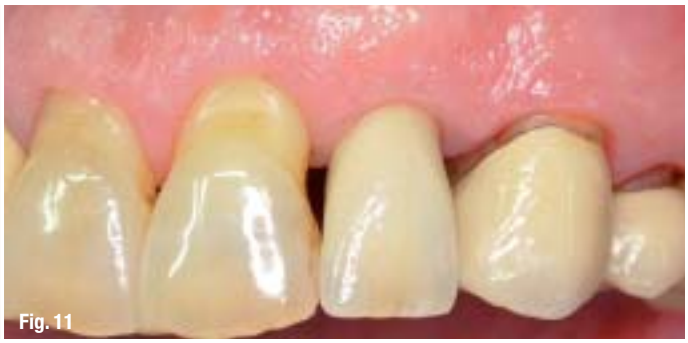
Fig. 11

Fig. 10_Two months later the soft tissue was stable and free of inflammation. The temporary crown was designed in such a way that there were no static or functional contact points.

Fig. 11_A new impression was taken another four weeks later. A zirconium dioxide abutment was screwed in, and the final full ceramic CAD/CAM crown was put in place. The patient was delighted with the result.

was planned. An open impression was taken with a custom tray (Fig. 8). In order to minimise the laboratory time required, the implant position was transferred to the original model by means of a plastic key (Pattern Resin, GC Europe). The titanium abutment used for the temporary crown (Esthetic Abutment) is characterised by scalloped edges that follow the soft-tissue contours and provide support (Fig. 9). In order to achieve further optimisation, the abutment was custom-made by the dental technician. However, it was still possible to make fine adjustments in situ with the help of rotating carbide-tipped instruments.

Just 24 hours after implantation, the custom abutment and the temporary composite crown were fitted (Figs. 9 & 10). Correct seating of the abutment on the implant was checked with the help of a dental radiograph (cf. Fig. 7). Care was taken when fashioning the crown to avoid static or dynamic contact points. This was rechecked in situ. The crown was then fixed in place with temporary cement (TempBond, Kerr Dental). The patient was also instructed to exert as little pressure as possible on the crown when eating.

Three months later, after a new impression had been taken, a custom Procera Esthetic Abutment (Nobel Biocare) was screwed into place, and the final full ceramic CAD/CAM crown was fixed using glass-ionomer cement (Fig. 10). The Periotest score for the implant was very good at this stage (-7).

_Result and prognosis

Despite the recession and less than optimum fit of the restorations of the neighbouring teeth, the crown blended in harmoniously with the surrounding teeth. Soft-tissue integration was also convincing. The immediate implantation with immediate temporary restoration yielded a quick, straightforward and aesthetically attractive result in just a few sessions and without a removable temporary restoration. This met the patient's wishes, and he was accordingly delighted with the result. Distress caused by the single surgical intervention was minimal. The prognosis of the restoration is also good. The literature shows that the procedure leads to stable long-term results in both the crestal bone and soft tissue.[13] The same applies to the Replace Select Tapered implant system used. In a case study with 66 implants in 48 patients, none of the implants was lost over a period of five years, and the hard and soft tissues remained healthy.[9] The biologically optimised TiUnite surface, which promotes fast and reliable deposition of bone cells, also contributed to this favourable outcome.[13, 14]

However, the procedure described here also carries risks. The outcome can be affected by errors in diagnosis, indication and execution. In the present case, only a panoramic radiograph with a reference standard was prepared in advance for diagnostic purposes. Because the circumstances of the case were ideal, more elaborate procedures were not required. If additional information and safety margins are desired, working with 3-D diagnostic techniques and possibly computer-aided implantation is recommended. In many cases, it is not necessary to prepare a flap. This spares the patient, as in the present case, and helps the peri-implantation tissue heal without complication.

The Replace Select Tapered implant system used is distinguished by a high degree of user friendliness. The well thought-out and straightforward procedure makes it particularly suitable for integration in modern implantological/surgical referral practices that aim to involve the prosthetist and dental technician actively in the treatment process._

Editorial note: A list of references is available from the publisher.

_contact implants

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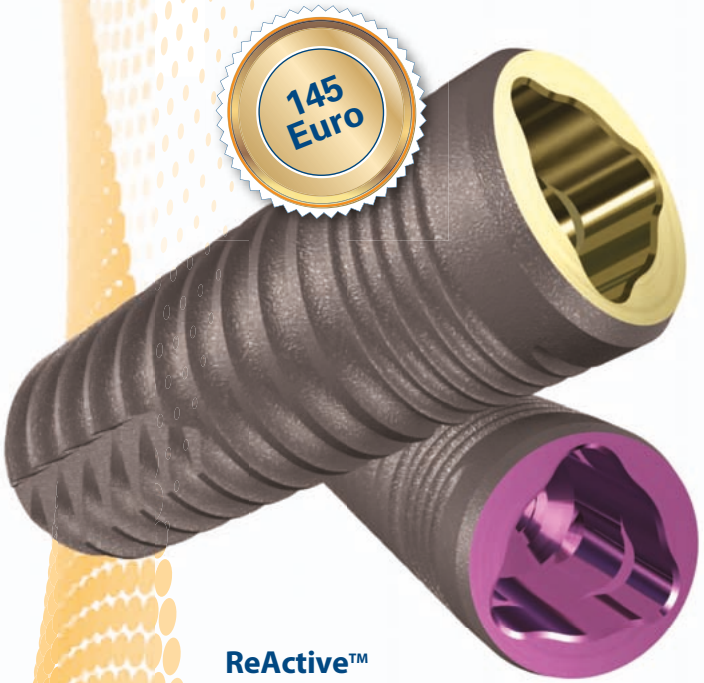

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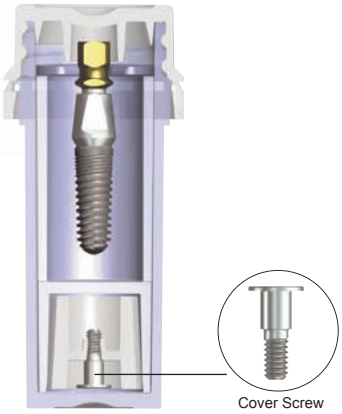

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41. INTERNATIONAL ANNUAL CONGRESS OF THE DGZI

Implantology today—Requirements, possibilities and prospects

September 30// October 1, 2011 in Cologne// Maritim Hotel

SCAN ME pictures video

DGZI Deutsche Gesellschaft für Zahnärztliche Implantologie e.V.

PROGRAM FRIDAY, SEPTEMBER 30, 2011

09.00 – 10.30 a.m. 1st PART WORKSHOPS

1.1 OT Medical *Dr. Daniel Ferrari, M.Sc./DE*
The basics of internal and external sinuslift using the latest generation of endopore and screw-type implants with identical prosthetic platforms—Part 1

1.2 Straumann *Prof. Dr. Anton Friedmann/DE*
New materials for bone regeneration—Theory, first-hand experiences, and practical exercises

1.3 BIOMET *3i*
Dental impressions without an impression post—Direct, intraoral implant scanning with Encode®, and 3M ESPE's C.O.S. system

1.4 BioHorizons *Dr. Marc Hansen/DE*
The narrow jaw—Update regarding ultrasonic surgery and diameter reduced implants in the aesthetic zone—A theoretical introduction with practical exercises on artifical jaws

1.5 Degradable Solutions *Dr. Dr. Karl-Heinz Heuckmann/DE*
Two genuinely minimally invasive techniques: BLC (Balloon Lift Control) and augmentation using the tunnelling technique.

1.6 OSSTEM *Dr. Olaf Daum/DE*
Sinuslift—A minimally invasive therapy method using CAS-KIT

1.7 Henry Schein *Prof. Dr. Dieter Wember-Matthes/DE*
The optimization of sinus floor elevation—Part 1

1.8 DT Medical *Milan Michalides/DE*
Modern marketing for successful implantology

10.30 – 11.00 a.m. Break/Visit of the Dental Exhibition

11.00 a.m. – 12.30 p.m. 2nd PART WORKSHOPS

2.1 OT Medical *Dr. Daniel Ferrari, M.Sc./DE*
The basics of internal and external sinuslift using the latest generation of endopore and screw-type implants with identical prosthetic platforms—Part 2

2.2 RIEMSER *Prof. Dr. Dr. Frank Palm/DE*
External sinuslift with CERASORB® M
Dr. Dr. Rabih Nahas/DE
External sinuslift with REVOIS®: PRO implants

2.3 Dentegris *Drs. Guido-Jan Kisters/DE*
Biomaterials—State of the art. How do current biomaterials perform, and where should they reasonably be used?

2.4 m&k dental *Dr. Dr. Carsten Engel/DE*
Update: Backward planning, minimally invasive procedures, two and one component implant systems, and synthetic blocks

2.5 Schütz Dental *Dr. Mazen Tamimi/JO*
Management of the severely atrophied mandible supported by 3-D computer-aided planning and fully guided surgery

2.6 bicon *Prof. Dr. Mauro Marincola/IT*
Broader range for indications when using Short® implants—A minimally invasive therapy concept without augmentation and sinuslift

2.7 Henry Schein *Prof. Dr. Dieter Wember-Matthes/DE*
The optimization of sinus floor elevation—Part 2

12.30 – 1.00 p.m. Break/Visit of the Dental Exhibition

MAINPODIUM

Simultaneous Translation German/English, English/German
Chairmen: Prof. Dr. Dr. Frank Palm/DE, Dr. Roland Hille/DE

1.00 – 1.15 p.m. Opening ceremony
Prof. Dr. Dr. Frank Palm/DE
President of the DGZI

Dr. Roland Hille/DE
Scientific chairman

1.15 – 1.45 p.m. *Prof. Dr. Rainer Buchmann/DE*
Implantology: Medical and economic aspects

1.45 – 2.15 p.m. *Dr. Hilt Tatum/FR*
Is Implant dentistry headed in the right direction?

2.15 – 2.45 p.m. *Dr. Dirk U. Duddeck/DE*
Separating the wheat from the chaff—Investigating implant surfaces using SEM (scanning electron microscopy)

2.45 – 3.15 p.m. *Dr. Michael Stimmelmayr/DE*
Possibilities for modern softtissue management in implantoogy

3.15 – 3.30 p.m. Discussion

3.30 – 4.15 p.m. Break/Visit of the Dental Exhibition

1 INTERNATIONAL PODIUM

Chairmen: Dr. Rolf Vollmer/DE, Prof. Dr. Amr Abdel Azim/EG, Dr. Mazen Tamimi/JO

4.15 – 4.30 p.m. *Dr. Shoji Hayashi/JP*
Implant Overdenture

4.30 – 4.45 p.m. *Dr. Mazen Tamimi/JO*
Nerv transpositioning procedures, 16 years follow up

4.45 – 5.00 p.m. Dr. Dr. Wolfgang Hörster/DE
Computer-aided implant planning: When is it necessary, and when not?

5.00 – 5.15 p.m. *Dr. Fumio Kobayashi/JP*
Verification of sinus floor elevation in 256 cases

5.15 – 5.30 p.m. *Dr. Yasuhiro Nosaka/JP*
Postoperative sinus membranes swelling occuring a week after maxillary sinus floor elevation and related complications

5.30 – 5.45 p.m. *Prof. Dr. Nabil Jean Barakat/LB*
The Evolution in the treatment of the totally edentulous Mandible

5.45 – 6.00 p.m. *Dr. Suheil M. Boutros/US*
Periodontal Plastic Surgery around Natural Teeth and Detal Implants

6.00 – 6.15 p.m. *Dr. Nadim Abou Jaoude/LB*
The Anterior Missing Teeth: the Challange

6.15 – 6.35 p.m. *Dr. Monish Bhola/US*
Biomimetics—The Future of Implant Dentistry

6.35 – 6.45 p.m. Discussion

PROGRAM FRIDAY, SEPTEMBER 30, 2011

2 CORPORATE PODIUM 4.15 – 6.45 p.m.
For further information on the podiums please refer to www.dgzi-jahreskongress.de
Chairmen: Dr. Rainer Valentin/DE, Dr. Peter Gehrke/DE

3 CORPORATE PODIUM 4.15 – 6.45 p.m.
For further information on the podiums please refer to www.dgzi-jahreskongress.de
Chairmen: Dr. Bernd Quantius/DE, Dr. Detlef Bruhn/DE

8.00 p.m. *Evening Event in the „Wolkenburg"*

PROGRAM SATURDAY, OCTOBER 1, 2011

MAINPODIUM
Simultaneous Translation German/English, English/Geman
Chairmen: Chairmen: Dr. Friedhelm Heinemann/DE, Dr. Dr. Wolfgang Hörster/DE

9.00 – 9.30 a.m. *Prof. Dr. Dr. Knut A. Grötz/DE*
Sinulift and simultaneous implantation:
Results of a long-term study

9.30 – 10.00 a.m. *Prof. Dr. Dr. Frank Palm/DE*
Bone augmentation in cases of atrophy.
Can long-term success be achieved?

10.00 – 10.30 a.m. *Prof. Dr. Dr. Jörg Wiltfang/DE*
Maxilla augmentation: Innovative techniques,
complications, and results

10.30 – 10.45 a.m. Discussion

10.45 – 11.15 a.m. Break/Visit of the Dental Exhibition

11.15 a.m. – 1.45 p.m. SPECIAL PODIUM
Digital implantology—What will, and what must, happen?
Moderation: Prof. Dr. Dr. Frank Palm/DE

////////////////////////////////////Discussion with the Speakers////////////////////////////////////

- *Dr. Peter Rammelsberg/DE*
  Modern implant prosthodontics and their risks in clinical application
- *Priv.-Doz. Dr. Hans-Joachim Nickenig, M.Sc./DE*
  Navigated implantology—Current insights and comparative studies
- *Dr. Dr. Bilal Al-Nawas/DE*
  Navigated implantology—Less is more!
- *Prof. Dr. Bernd Wöstmann/DE*
  Digital impression taking in the dental practice—Curent insights and comparative studies

1.45 – 2.45 p.m. Break/Visit of the Dental Exhibition

Chairmen: Dr. Georg Bach/DE, Dr. Elmar Erpelding/DE

2.45 – 3.15 p.m. *Dr. Sönke Harder/DE*
A focus on implant abutment connections—The possibilties and limitations of platform switching, conical design, and others

PROGRAM SATURDAY, OCTOBER 1, 2011

3.15 – 3.45 p.m. *Priv.-Doz. Dr. Hans-Joachim Nickenig, M.Sc./DE*
Guided surgery—Presentation of an overall concept

3.45 – 4.15 p.m. *Dr. Georg Bach/DE*
ZTM Chistian Müller/DE
Implant prosthetic troubleshooting—Cases where dentists and dental technicians start to sweat!

4.15 – 4.30 p.m. Concluding discussion

ORGANIZATION DETAILS

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"Paradigms are beginning to shift"

An Interview with Prof Friedrich Neukam

_In mid october, thousands of dental professionals will be gathering in the capital of Greece for the annual congress of the European Association of Osseointegration (EAO). Dental Tribune Group Editor Daniel Zimmermann spoke with Scientific Chairman Prof. Friedrich W. Neukam from the University of Erlangen-Nuremberg in Erlangen, Germany, about the event and what is on the cards for the field of dental implantology.

_Prof Neukam, how are preparations for the EAO Congress in Athens coming on?

Prof Friedrich Neukam: Preparations for the 20th Annual Scientific Congress of the European Association for Osseointegration (EAO) have been completed and, as has been the case in previous years, we can look forward to an outstanding scientific programme in Athens in October. The four-day conference will focus primarily on transferring the latest scientific findings into dental practice. The central theme of this year's EAO event is "Treatment Planning in Implant Dentistry", a topic that a number of renowned international experts will be presenting on.

_According to the latest figures from the EAO, a record number of abstracts has been submitted for this year's conference. How do you explain this huge interest?

Prof Friedrich Neukam: Indeed, our latest figures show that more than 500 abstracts on the surgical and prosthetic aspects of long-term results following implantations and augmentative procedures have been submitted for the congress. This continuous rise in submissions could be due to the fact that the EAO conference has become the scientific and clinical annual event for many of our colleagues in the dental and implant community in Europe. In addition, more participants from other parts of the world, notably Asia and the Middle East, have attended our congress in the last few years. We expect the same level of participation for the conference in Athens.

_Based on these submissions, is it possible to predict where the specialty is heading?

Prof Friedrich Neukam: Upcoming developments in the field will definitely be influenced by a significantly higher degree of precision in imaging technologies that are the basis for computer-simulated implantations and 'flapless surgery'. Of course, these rather complex procedures will not be necessary for simple implantations, but with regard to augmentative procedures or complex individual solutions, dentists will be increasingly applying these techniques in the future.

_Last year's congress was all about clinical controversies in dental implantology. What topics will be the focus this time?

Prof Friedrich Neukam: Besides treatment planning in implant dentistry, our main topic, the prevention and management of complications and risk factors will be discussed. Furthermore, speakers are expected to shed light on other important aspects such as loading, treatment protocols and the predictability of clinical results.

_Do you think that dentists have much catching up to do with regard to treatment planning?

Prof Friedrich Neukam: There are standard planning procedures prior to treatments such as

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implantation, augmentation, as well as prosthetic and surgical therapy. However, paradigms are beginning to shift, especially in cases with high requirements for aesthetics and for procedures, like for immediate-load implants. In these areas, we are noticing a technical leap forward in digital imaging and computer-assisted implantation. In my opinion, these things have proven worthy to be discussed extensively.

_What are the most common mistakes in implant treatment planning nowadays?

Prof Friedrich Neukam: Generally, we have to take some degree of error into account when transferring the results from the analysis of X-rays, CBCT or CT images to the final treatment protocol. Another important matter is the complexity of treatment planning with regard to the treatment protocol selected. Things are in flux here as well and the congress hopes to offer some clarification, especially for colleagues working in private practice.

"The use of digital instrumentation based on 3-D imaging has brought new dimensions to implant therapy."

Prof Friedrich Neukam

_The increasing use of digital instrumentation has broken new experimental ground in almost all clinical areas in dentistry. What impact has it had on implant-based restorations?

Prof Friedrich Neukam: The use of digital instrumentation based on 3-D imaging has brought new dimensions to implant therapy. With the help of these innovations, it has become possible for dental practitioners to get a highly precise, 3-D representation of the local soft-tissue conditions, bone structure, and the loss of hard and soft tissue caused by resorption. This has given us a number of new therapeutic approaches. For me, the main advantage is that by using these techniques our knowledge is now far greater before we actually start a treatment, so that we are able to achieve a more precise and safer implantation for our patients.

_EAO congresses are considered to be exceptionally well-organised events. How has cooperation been with local organisers in Greece?

Prof Friedrich Neukam: As usual, the EAO Congress is organised in cooperation with local scientific organisations. This year, the Hellenic Association for Oral and Maxillofacial Surgery, the Greek Society for Osseointegration, and the Hellenic Society of Periodontology have helped with the preparations. This cooperation has turned out very fruitful and I would like to take the opportunity to thank all colleagues from these associations for their support.

In addition to the main scientific programme of the EAO Congress, they have also been organising their own meeting, the "Greek Session", which will give congress participants from all over the world the opportunity to inform themselves about the current status of technologies and trends, as well as the high level of implantology in Greece.

Together with the Paris Team of the Colloquium Group we have invested a great deal of attention to detail and effort into the preparations for the Congress, as well as in the scientific and auxiliary programmes and we are very confident that participants can look forward to a highly professionally organised event.

_What are your personal and professional expectations of the congress?

Prof Friedrich Neukam: For someone like me having been personally involved in the preparations, one first hopes that the congress will be a success. It is my sincere belief that all involved in our field will be able to learn a lot from the scientific studies that are being conducted, as well as from colleagues around the world who will be presenting their latest scientific data.

Personally, I am also looking forward to the exhibition. The EAO Congress will present the largest showcase of implantology-related products and technologies in Europe, and I am eager to see which novelties the industry will pull out of the hat. Not forgetting the numerous talks and exchanges with friends and colleagues, whom, unfortunately, I only have the pleasure to meet during our congress.

Last but not least, I am looking forward to seeing Athens, which has been the cultural, economic and scientific centre of Greece for over 7,000 years.

Thank you very much for this interview.

Editorial note: The interview was led by Daniel Zimmermann, Germany. Translation provided by Annemarie Fischer, Germany.

Manufacturer News

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Implant Direct Sybron

Implant Direct Sybron expands prosthetic portfolio

Implant Direct Sybron, Europe's No. 1 Online Provider for Dental Implants, has developed new additions for its prosthetic portfolio. The expanded range contains 14 different abutments and offers an adequate prosthetic solution for every clinical indication. The abutments are available in a wide range of options, which vary depending on the implant line. Among others, the product portfolio includes straight and angled GPSTM and Zirconia Abutments for an attractive price of 85 and 95 Euro. The high-performance material of zirconia ensures an optimal esthetic result, extremely high-loading capacity and longtime durability. An anodized titanium base for customized zirconia abutments is also available separately for 45 Euro. Additional practical solutions for customized restorations are the Gold/Plastic Abutments for 75 Euro and the lab abutment for 55 Euro.

More information on this impressive prosthetic portfolio, please visit www.implantdirect.eu. Implant Direct Sybron offers every new client the opportunity to order 5 abutments and receive the lowest-priced item free. Orders can be placed over our Tollfree Infoline 00800 4030 4030 or the online shop.

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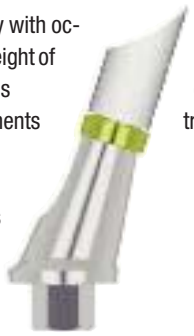
www.implantdirect.de

Thommen Medical

VARIO Abutments—high precision for unsurpassed esthetics

Thommen Medical Vario gold abutments allow the utmost flexibility with occlusal screw-retained crowns/abutments or bridges. The minimal height of Vario abutments is particularly useful in cases when occlusal space is limited. The final restoration requires a minimal number of components and can be fixed directly onto the implant using an abutment screw.

The new 17° angled Vario abutment is ideally suited for restorations where implant angulation would not allow conventional screw retention. The abutment is available in two different rotational orientations with respect to the hexagon connection. This flexibility allows optimal alignment of the angled abutment, especially in the anterior region. The cast-on prefabricated gold alloy screw seat ensures a precise and stable connection between the crown and abutment. Thanks to the unique design of the Thommen implant-abutment connection, all abutments are compatible with all implant models of the Thommen implant system, thus allowing great restorative freedom. Due to this sophisticated connection geometry and high precision manufacturing, the abutment stands out for its high precision fit and excellent stability – another important prerequisite for ensuring long-term success of patient treatment.



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Omnia

Surgical equipment is now better off

The multifunctional surgical trolley LC Implant Suite by OMNIA is developed to improve the organization of the dental office. Thanks to LC Implant Suite electronic equipments are properly stored, cables and wirings are hidden, the level of hygiene in the whole office is improved, and the organization of the surgical room is quicker as all the instruments are ready for usage.

LC Implant Suite is an essential instrument for those who practices oral surgeries and implants using Phisiodispenser or Piezosurgery instruments and for those who practice endodontics and parodontics. LC Implant Suite is the ideal solution for the equipment any modern surgical room.

Main features:

1. Flat tray with scratch proof surface and integrated handle (45 x 54 cm).
2. Two removable supports for cooling liquids included
3. Available with 3 removable shelves with safety stop and adjustable height (ref. 30.E0050) or 2 removable shelves with adjustable height and an internal drawer (ref. 30.E0060)
4. Teflon support for 3 hand pieces/contrangles included – inside part removable and autoclavable
5. Scratch proof front glass window, which can be opened at 270°
6. Lower part for pedals or various accessories
7. Lateral opening for equipments cables and/or cords
8. Socket with automatic spool

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Schütz Dental

IMPLA™—a professional implant system does not have to be complicated!

The precursor of today's IMPLA™ implants can pride itself with a documented history dating back to 1958.

Our IMPLA™ research and development team is composed of in-house engineers as well as external professional users such as implantologists, oral surgeons and dentists. Over the years, the goal of this team has always been to create an implant system that leaves nothing to be desired for beginners as well as for advanced implantologists. The system features all necessary tools and accessories, from a well-appointed surgery box all the way to platform switching, to make implantation as easy and as safe as possible for all parties concerned.

The IMPLA™ family, produced completely in Germany with highest quality standards, has grown significantly over the years. One traditional part of the family is the classic IMPLA™ Dual Surface implant, a conical screw implant with a passive thread and a polished implant shoulder. A newer member of the family is IMPLA™ Micro Retention with its special primary stability. This implant is especially suited for very soft bone. A micro thread at the implant neck gives this implant the little bit of extra stability necessary for implantation in combination with a sinus lift.

IMPLA™ Cylindrical is the all-rounder and suitable for nearly every indication. Its self-cutting thread offers the necessary flexibility required by beginners as well as advanced users. Integrated platform switching reduces the marginal bone loss to a minimum. All IMPLA™ implants have a high-purity surface which is obtained with a special surface treatment procedure and a specific acid formulation. This method creates an ideal surface roughness superior to that of many other implants available in the market. Furthermore, IMPLA™ implants are manufactured with a highly precise internal hexagon which ensures an accurate fit between implant and abutment.

Brand new and available since the beginning of 2011 is our latest development, the new onestage Mini Implant, supplied with a conical or a ball-abutment.

Just imagine that you would not even have to decide between those many options beforehand! The IMPLA™ surgical box contains all tools necessary to insert each of these different implants, leaving you with the flexibility to decide which implant you prefer as each case presents itself. In addition, with the computer navigation system IMPLA™ 3D for precise planning and template-guided implantation, IMPLA™ offers you a great tool for virtual planning using a three-dimensional bone model.

Join one of our many international courses and trainings. From placing your first implant on to more complicated methods such as sinus lift and bone spreading —we are certain that we will find the right course for you!

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ULTRADENT

Premium class with new design

With the ongoing enhancement of the premium treatment units U 1500, U 5000 S and U 5000 F, dental manufacturer ULTRADENT has created a modern class of unit that provides the highest possible quality in the compact treatment unit segment. ULTRADENT's special modular design makes it possible to equip units in line with dentists' individual requirements and specifications. Extremely high standards are also set in terms of design, construction and quality of workmanship.

The 19-inch flatscreen monitor and the completely reworked spittoons are particularly striking. The assistant's control console now has a new holder, making it even more ergonomic. In terms of positioning, programming and information, the dental unit fulfills every possible requirement and supports treatment with numerous exclusive instruments and all possible options. The central unit can be used to control everything—from the tartar remover and autoclavable micro motors with torque control and wide speed range to the intraoral camera, the electrosurgery unit and an integral saline pump. Naturally, this workstation can also be fitted or pre-configured with the ULTRADENT-VISION multimedia system.

Various details, such as the new touch-screen display, an optional wireless foot control, replaceable control valves, and a non-drip filter system, make treatment easier and promote dental practice hygiene. The supersoft chair upholstery, which is available in 12 colors and includes an individual headrest system with magnetic supports, ensures comfort. The exclusive comfort padding with air conditioning or massage function is another feature developed by ULTRADENT. Here, six silent ventilators in the backrest and seat provide pleasant fresh air, or special electric motors provide a gentle massage which calmly relaxes the patient. The ULTRADENT Premium class realizes many technical visions, while its overall design creates the kind of fascination and customer satisfaction that is only possible in the top-of-the-range segment. Almost every wish can be catered for here. Treat yourself to perfection and gain inspiration for your practice.

ULTRADENT
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Dentaurum Implants

International Jubilee Congress from 22-25 September 2011 in Malta

The 125th anniversary of Dentaurum, a family-owned company and the 15th anniversary of Dentaurum Implants—these are reasons enough for celebrating together with our clients at this International Jubilee Congress themed "Partners in Innovation—Be Successful with Dentaurum Implants". A top class international team of lecturers from Egypt, Germany, Iran, Italy, Jordan and Poland will hold lectures on implantology and multidisciplinary topics covering science, research and everyday practice and guide the participants through numerous practical workshops.

Apart from topics such as three-dimensional implant planning and aesthetically perfect implant-borne prosthetics, the congress programme will also include reports on experience gained with surgical and prosthodontic cases spanning 20 years of implantology and the biomechanical analysis of Minis and Shorties. The interesting lectures will be rounded off with a live operation carried out by Dr Joachim Hoffmann and broadcast directly from a renowned dental practice in Valletta.

Dentaurum Implants will also organise an equally interesting social programme during your stay in Malta. Continuing education credits will be awarded in accordance with the recommendations of the German Dental Association.

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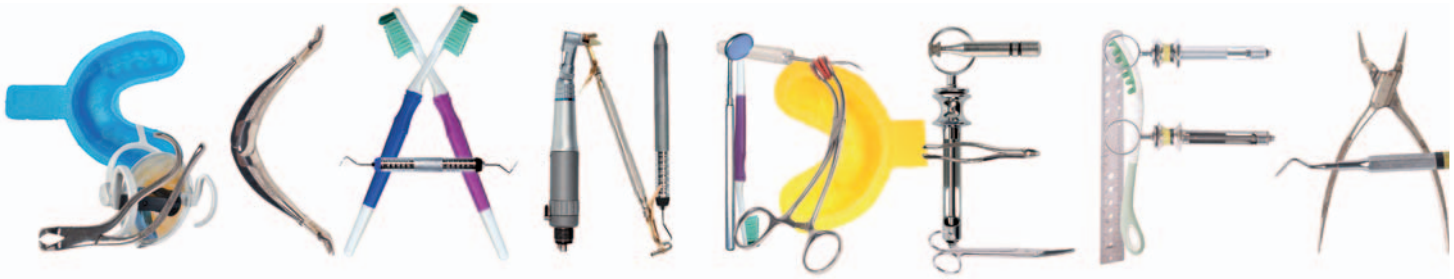
Bella Center
Copenhagen



APRIL 26- 28, 2012 • BELLA CENTER • **COPENHAGEN** • DENMARK

Welcome to the 45th Scandinavian Dental Fair
The leading annual dental fair in Scandinavia

scandefa 2012

The 45th SCANDEFA invites you to exquisitely meet the Scandinavian dental market and sales partners from all over the world in springtime in wonderful Copenhagen

SCANDEFA 2012
Is organized by Bella Center and is being held in conjunction with the Annual Scientific Meeting, organized by the Danish Dental Association (www.tandlaegeforeningen.dk).

175 exhibitors and 11.422 visitors participated at SCANDEFA 2011 on 14,220 m^2 of exhibition space.

Exhibit at Scandefa
Book online at www.scandefa.dk
Sales and Project Manager, Christian Olrik
col@bellacenter.dk, T +45 32 47 21 25

Travel information
Bella Center is located just a 10 minute taxi drive from Copenhagen Airport. A regional train runs from the airport to Orestad Station, only 15 minutes drive.

Check in at Bella Center's newly built hotel
Bella Sky Comwell is Scandinavia's largest design hotel. The hotel is an integral part of Bella Center and has direct access to Scandefa. Book your stay on www.bellasky.dk

Fotos from Bella Center, Wonderful Copenhagen

www.scandefa.dk

Official care provider
to the German Olympic teams
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GO FOR GOLD.

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