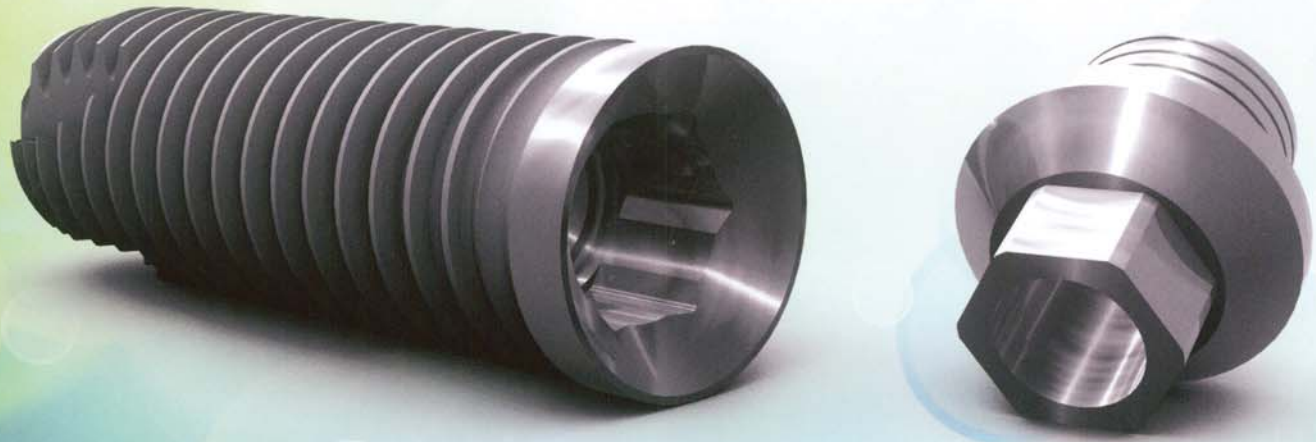
issn 1868-3207

Vol. 12 • Issue 3/2011

implants

international magazine of oral implantology

3 2011



case report

44 Roots—44 Implants

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"Paradigms are beginning to shift"

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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).

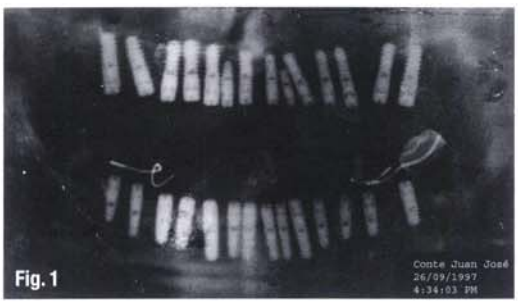

Fig. 1

_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

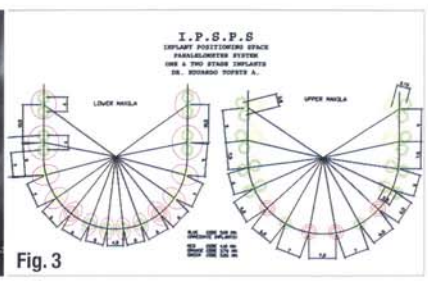

Fig. 3

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-

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).

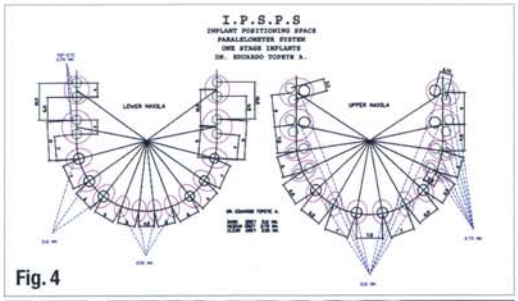

Fig. 4

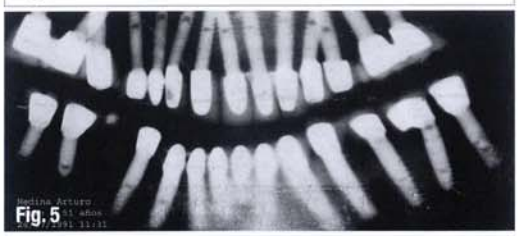
Fig. 5

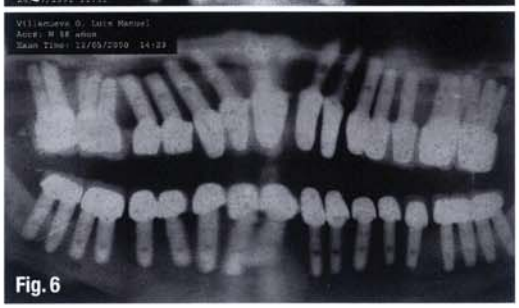
Fig. 6

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

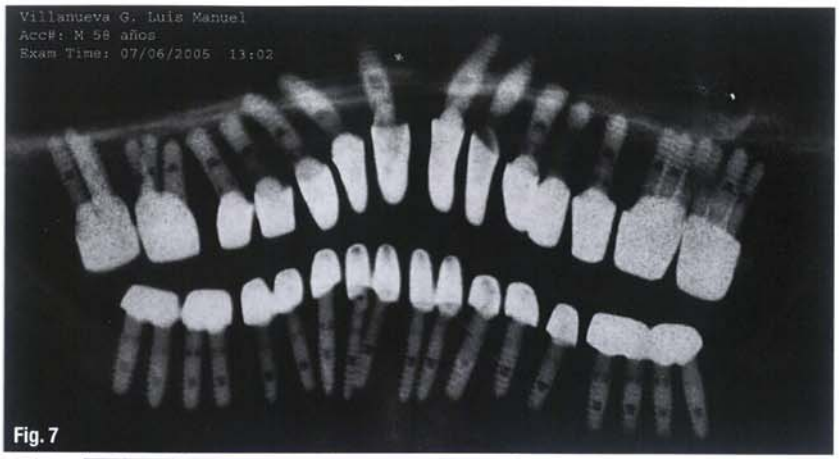

Fig. 7

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-

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).

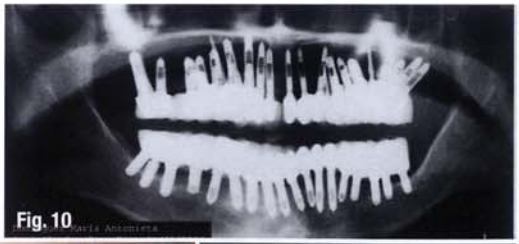
Fig. 10

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


Fig. 11

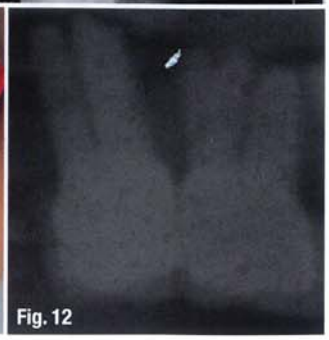
Fig. 12

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.

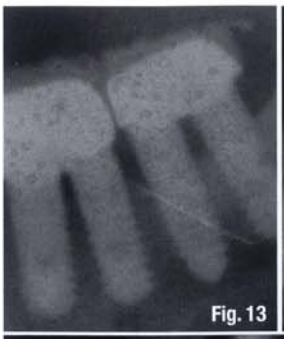
Fig. 13


Fig. 14

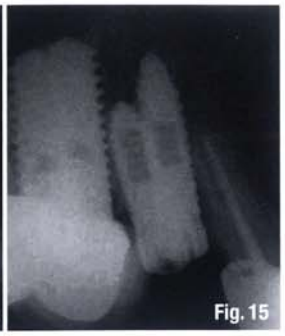
Fig. 15

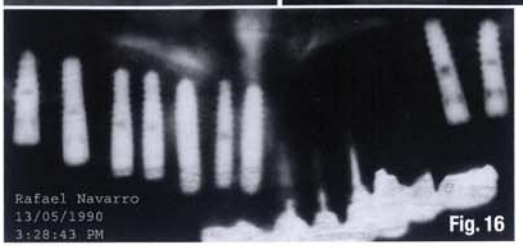

Fig. 16

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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