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**Research study**

# "One-piece" immediate-load post-extraction implants in labial bone deficient upper jaws

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**Abstract**

**Introduction**

Contusive trauma or malocclusion-related periodontal disease can severely compromise the upper anterior teeth, leading to labial bone resorption and ultimately loss of function and unsightly root exposure. To resolve these issues, we propose the replacement of compromised teeth using one-piece immediate-load post-extraction implants. These can be implanted and fitted with customized temporary crowns in a single surgical procedure, restoring function and aesthetics and consenting recovery of the bone deficit with reduced healing times and limited patient discomfort.

**Materials and Methods.**

One-piece wide-diameter titanium screw implants with thread measurements of 3,5 and 4,5 mm with one abutment of 2,5 mm respectively, were positioned and splinted by intraoral welding.

**Results and Conclusions.**

These implants yielded satisfactory functional and aesthetic outcome in bone-deficient upper anterior sectors, without invasive regenerative procedures. The low invasiveness of this approach also consents rapid healing, reduced biological burden and greater patient benefit.

**Conflict of interest:**

The authors declare no conflict of interest.

***INTRODUCTION***

Root fracture and, more often, occlusal trauma-related periodontal disease (1, 2 and 3) can severely compromise the teeth in the upper anterior sector, leading to labial bone deficit, root exposure, loss of function and poor aesthetics.

The front teeth, i.e. the central and lateral incisors and the canines, are particularly susceptible to these problems. This is due to their natural inclination, which causes them to develop transversal forces upon contact, unlike the vertical forces like in molars and in premolars, in which occlusal forces are dispersed along the long axis of the root and are therefore well tolerated. Hence, in physiological static occlusion, the anterior teeth should barely touch their antagonists if these damaging forces are to be avoided (4). Indeed, where centric pre-contacts occur in these teeth, stable static mandibular support is compromised, disturbing both swallowing and chewing mechanisms and the harmony of the neuromuscular system. In order to counteract this occlusal instability, the lower jaw, unable to rotate, moves forwards and/or to the side (prochoresis) in the search for replacement static contacts and a new equilibrium. Although this compensatory position consents mastication and swallowing, it is in fact pathological, because it is based on traumatic non-centric contacts. Indeed, during swallowing, the dysfunctional occlusal loads and transversal forces are mainly dispersed into the portion of bone labial to the front teeth, leading to ischaemia and gradual atrophy of the alveolar ridge (5, 6, 7, 8, 9, 10, 11, 12). If this condition is left untreated, it can severely compromise the integrity of the entire periodontium, and consequently the stability of the teeth, ultimately leading to their loss and the consequent functional and aesthetic damage.

In order to restore both function and aesthetics in such cases of bone deficit, multiple surgical procedures are routine. As well as being burdensome and uncomfortable for the patient, these procedures do not consent immediate loading of implants, and the healing times before first temporary and then definitive fixed prosthetics can be fitted are considerable.

Hence, as a less invasive alternative we propose the use of one-piece immediate-load screw implants, which consent rapid resolution of functional and aesthetic issues by means of a single surgical procedure (13, 14, 15, 16, 17, 18).

***MATERIALS AND METHODS***

One-piece titanium single-structure fixtures featuring with abutment of 2,5 mm and with thread diameters of 3,5 and 4,5 mm, respectively, were implanted. The wide diameter of the thread is the prime component of the proposed protocol, as it confers good primary stability. Different implant lengths can be chosen on a case-by-case basis so that the cortex of the nasal fossae is engaged (bicortical anchorage), as good anchorage, the second component of the protocol, is also indispensable for primary stability. Splinting of the implants, the third component of the protocol, is performed by means of Mondani intraoral welding to a cylindrical supporter bar of 1.2 mm diameter resting on the palatal mucosa (19, 20, 21, 22, and 23). The implantation site is prepared with Pasqualini self-centring drills (24, 25) of diameters increasing progressively up to 2.6 mm, starting with a 1.1-millimetre-diameter probe drill, which is initially used to penetrate the cortex of the nasal fossae. After x-ray confirmation of the correct depth, the other self-centring drills are measured accordingly in order to complete the osteotomy, whose precision and minimal invasiveness is guaranteed by the pyramidal cutting tip and bevelled triangular shank of the drills in question.

Bone deficit filling is performed using porcine bone putty and the heterologous implant is protected by placement of a lyophilized bovine pericardial membrane.

The implants are immediately loaded with acrylic resin crowns, prior to the fixture of definitive metal ceramic prostheses.

***RESULTS***

***CASE 1***

A male 62-year-old patient with visible exposure of anterior teeth roots, and bone loss confirmed by OPT (Figs. 1 and 2). Extraction of the teeth reveals severe alveolar bone deficit, particularly on the labial side. Insertion of the implants, without flap opening, was performed parallel and contiguous to the palatal cortical bone rather than following the natural direction of the alveolus (Fig. 3). Due to the reduced dimensions of the abutment, the labial mucosa will not be subject to tension; in fact, being no longer supported by the alveolar ridge it tends to collapse. It is therefore possible to introduce biomaterial filler and pericardial membrane without generating tension in the labial mucosa, an indispensable condition for complete aesthetic recovery (Fig. 4).

In the same sitting, the implanted fixtures are splinted by intraoral welding to a titanium supporter bar according to our protocol (26, 27, and 28). At the end of this surgical phase, temporary resin crowns are cemented in place, thereby achieving immediate loading in a single sitting (Fig. 5).

The lack of labial tension generated using the described technique (without flap opening) accelerates the healing process and aesthetic recovery of the tissues (Fig. 6), and consents porcelain-fused-to-metal permanent crowns to be fitted without lengthy delays (Figs. 7 and 8). Moreover, it is worth noting that the small size of the abutments (2.5 mm) does not compromise the precision of the prosthetic crowns in any way (Figs. 9 and 10).

***CASE 2***

A 45-year-old female patient with a fractured left upper lateral incisor root being used to support a gold/ceramic bridge. The prosthesis, still fixed with temporary cement, was removed, that manoeuvre permitted recovery of the crowns of teeth 11 and 12, which were not scheduled for replacement. After flap opening, extraction of the fractured root revealed a severe deficit of labial alveolar bone extending almost to its apex (Fig. 11).

Osteotomy was performed according to the protocol described, inserting the implant parallel and contiguous to the palatal cortical bone (Fig. 12, 13, 29 and 30) until the cortex of the nasal fossae was delicately engaged. Following the same procedure, a second implant was then inserted into the edentulous space corresponding to the left central incisor, and the two implants were subsequently splintated with a welded titanium bar.

The bone deficient labial area was filled with porcine bone putty (Fig. 14) and protected by means of a bovine pericardial membrane. At the end of surgery (Fig. 15) two temporary resin crowns were immediately cemented in place (Fig. 16).

Rapid tissue healing consented permanent gold/porcelain crowns to be fitted after 90 days (Figs. 17 and 18).

Six-year follow-up is shown in Figure 19.

## *DISCUSSION*

Due to the stress generated by transversal forces during swallowing, traumatic static occlusion of the upper anterior teeth can lead to progressive ischaemic atrophy of the labial portion of the alveolar bone. The treatment of choice for these dystrophic dysfunctional lesions consists of removing pre-contacts and restoring physiological occlusion. When the bone deficit is such that the natural tooth must be removed, however, this can be replaced by an implant. In alternative to the techniques most commonly described in the literature (31, 32, 33, 34, 35), one-piece implants can be positioned exploiting the post-extraction edentulous spaces, which are often unusable with other types of implant without resorting to more invasive surgical techniques and long healing times.

Indeed, should biphasic implants be positioned in the alveolus along the direction of the natural tooth root in cases of similar bone deficit, their threads would be exposed on the labial side, necessitating guided regeneration to be undertaken. This technique, despite its validity, non  means guarantees complete recovery of the lost bone. In fact dehiscence can often occur at the top threads of the fixture, leading to unsightly exposure of the implant. However, this problem is rare when using one-piece implants and an appropriate surgical technique: the fixture (threaded shank) is inserted to a depth below the natural apex of the missing tooth, into the compact bone of the nasal fossae, leaving the abutment, with a uniform diameter of 2.5 mm, exposed. This can be immediately loaded with a temporary prosthesis, to be replaced by a permanent crown upon complete healing of the tissues, without the need for advance planning.

One-piece implants are derived from Stefano Tramonte's titanium screws, which have been morphologically adapted for immediate loading (36). Recent studies have demonstrated that abutments of smaller diameter than the fixture itself (platform switching), as in one-piece screw implants, only rarely lead to crestal resorption.  Despite their suitability for immediate loading, the dazzling array of revolutionary implantation products entering the market has meant that one-piece screw implants have been rather overlooked. Nevertheless, we contend that, thanks to their width and versatility as regards insertion technique, these implants remain useful. Indeed, they guarantee good primary stability due to their insertion and parallelization contiguous to the palatal cortex, thereby allowing them to adapt to the residual bone and contrast transversal occlusal forces and micromovements of over 150 μ that may compromise osteointegration (37, 38). Moreover, during dynamic mastication contacts, little strain will develop in the marginal labial bone, thereby limiting resorption and favouring bone remodelling.

## *CONCLUSIONS*

In cases of severely receding labial bone tissue in the upper anterior zones, the insertion of one-piece post-extraction implants may be performed without the need to adhere to the direction of the root of the extracted tooth. Instead, according to the protocol proposed herein, insertion can be performed parallel and contiguous to the palatal cortical bone so as to engage the cortex of the nasal fossae. Inserted in this fashion, with the threaded shank completely embedded in the cortical bone, the implant is extremely stable and can therefore be immediately loaded without precluding bone regeneration procedures that exploit the lack of tension in the labial mucosa.

Using this protocol, extraction of compromised teeth, positioning of the implants, application of biomaterial and fixing of temporary crowns can be performed in one sitting, by means of a single surgical procedure, thereby substantially reducing the biological burden and patient discomfort. After a relatively short healing period, the permanent crowns can be fitted without further ado.

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## FIGURE LEGENDS

### CASE 1

Fig. 1 Bone loss, mucosal retraction and root exposure consequent to occlusal trauma.

Fig. 2 Enlarged detail of upper jaw OPT. Vertical and horizontal resorption is evident.

Fig. 3 Direct implant parallel insertion technique.

Fig. 4 Three post-extraction implants were inserted. After their parallelization, deficient bone was replaced using porcine bone putty and a protective bovine pericardial membrane.

Fig. 5 Immediate loading with temporary resin crowns; occlusal harmony upon completion of surgery.

Fig. 6 Mucosal healing after 4 months, without removing temporary crowns, and restored function and aesthetics.

Fig. 7 Permanent metal/porcelain prosthesis.

Fig. 8 Final OPT. Bone tissue healing is evident.

Fig. 9 Detail of final OPT. The reduced abutment dimensions do not preclude precise crown fitting.

Fig. 10 5-year follow-up. The “orange-peel” appearance of the mucosa.

### CASE 2

Fig. 11 Evident severe labial bone loss.

Fig. 12 Osteotomy exploits the inclination of the palate rather than following the natural direction of the alveolus.

Fig. 13 Insertion of the post-extraction implant along the palatal cortex.

Fig. 14 Lost bone replaced with porcine bone putty.

Fig. 15 Implants upon insertion, before immediate loading. Note welding to titanium supporter bar.

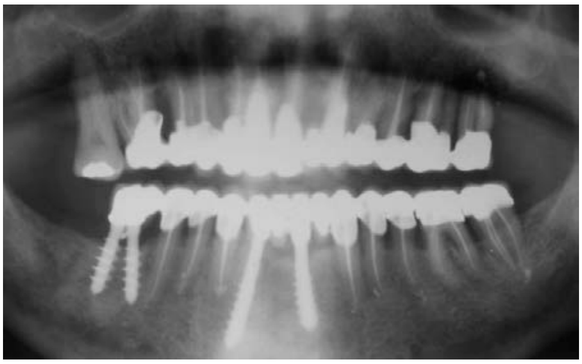
Fig. 16 Loading with temporary resin crowns immediately after surgery.

Fig. 17 Definitive porcelain-fused-to metal prosthesis.

Fig. 18 Final OPT.

Fig. 19 6-year follow-up before scale and polish. Note the good appearance of the mucosa. Maintenance of occlusal harmony conditioned the spontaneous aesthetic recovery of the gingival border of the contiguous central incisor.

Fig.1



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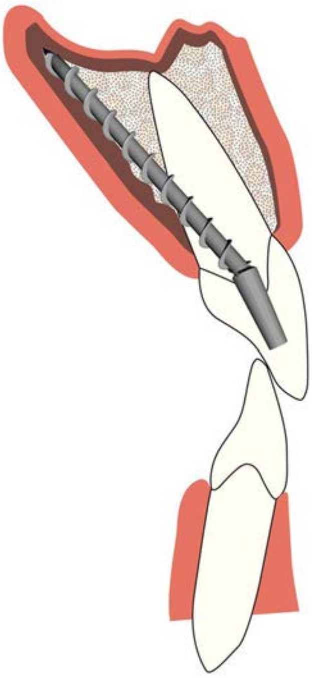

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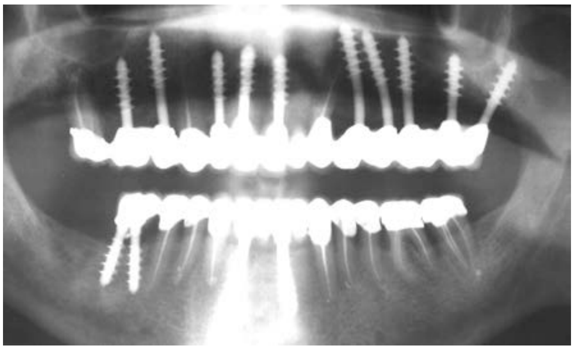
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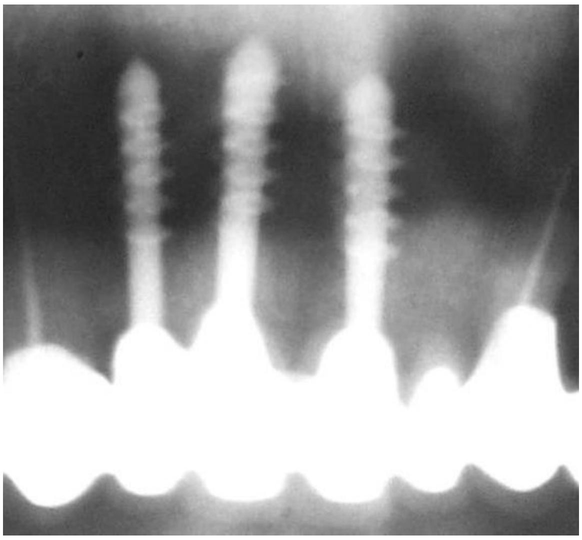
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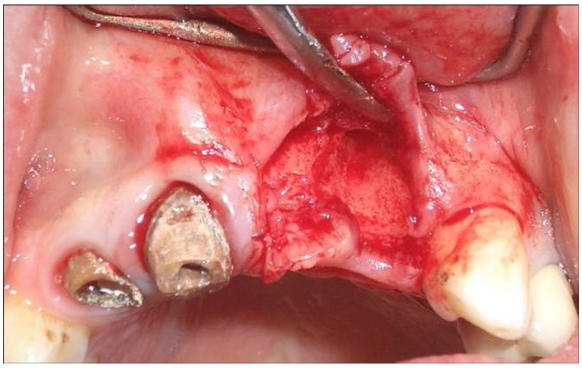
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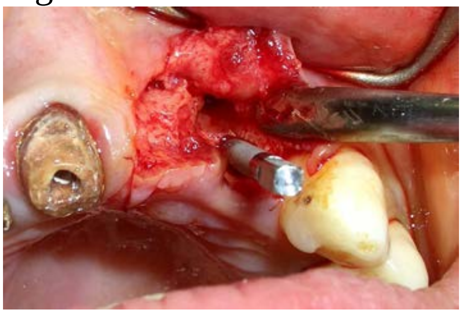
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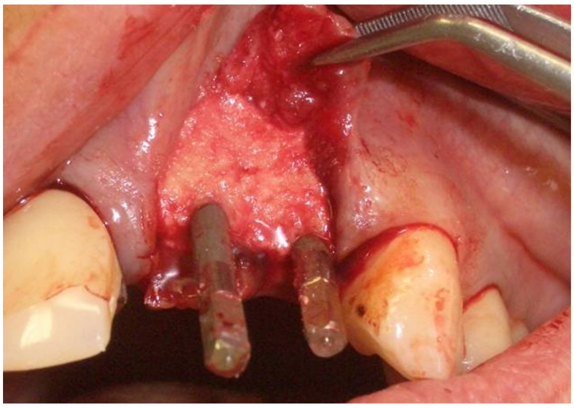
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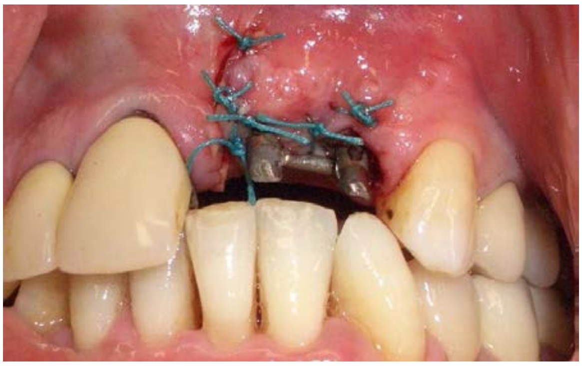
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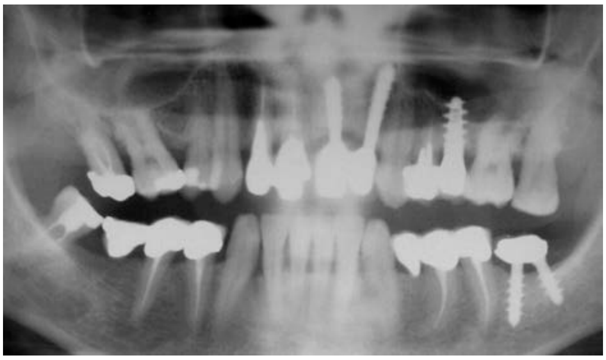
Fig.18

Fig19