Implant design and the maintenance of peri-implant tissue

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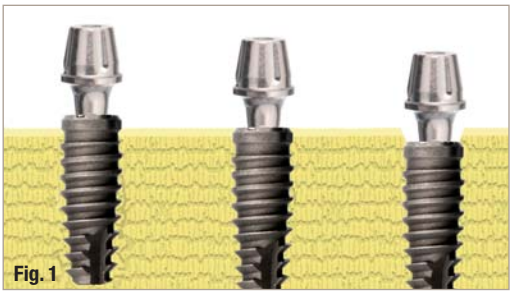
Fig. 1

_Introduction

The number of patients whose teeth are replaced with implants in aesthetic areas has increased greatly. Proportionately, so have the requirements regarding the outcome of treatment. Unlike the early years of implant osseointegration, many are placed in the anterior maxilla and other aesthetically visible regions. Consequently, several studies have been published about implant treatment and its results in aesthetic regions (Belser et al. 2003).

Peri-implant bone loss causes retraction of soft tissue and makes aesthetic reconstruction a rather complicated task. Several factors are cited as possible causes of peri-implant bone loss, such as inter-implant distance (Novaes et al. 2006), periodontal disease (Kozlovsky et al. 2007), occlusal overload (Mangano et al. 2010), a gap in the implant-abutment interface (King et al. 2002), the quality of peri-implant soft tissue (Kim et al. 2009), the relation between crown and implant (Blanes et al. 2007), and the location of the implant-abutment junction (IAJ; Hermann et al. 1997). The integrity of the bone-implant interface results from local microbiological control (Mangano et al. 2010) and a continuous process of bone remodelling replacing fatigued bone.

The IAJ can be located in various positions with respect to the alveolar bone crest (supra-crestal, crestal or sub-crestal; Fig. 1). This location is of great importance for aesthetic restoration. Positioning the IAJ in the most apical position can create an emergence profile best suited for prosthetic reconstruction (Buser & Von Arx 2000).

The Morse taper connection implant has been extensively studied for its benefits with respect to peri-implant tissue biology (Weigl 2004). Among the main benefits are decreased bacterial colonisation in the implant–abutment interface and the reduction of micro-movement of placed implants. These factors are

Fig. 1_Position of the implant in relation to the alveolar bone crest (supra-crestal, crestal or sub-crestal).
Fig. 2_Initial radiographic **(a)** and clinical **(b)** findings.
Figs. 3a–c_Image after the alveolar extraction **(a)**, an illustration of an ideal position **(b)**, and the prepared site from a more palatal direction **(c)**.


Fig. 2a


Fig. 2b

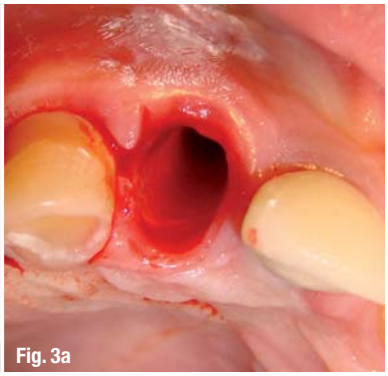
Fig. 3a


Fig. 3b

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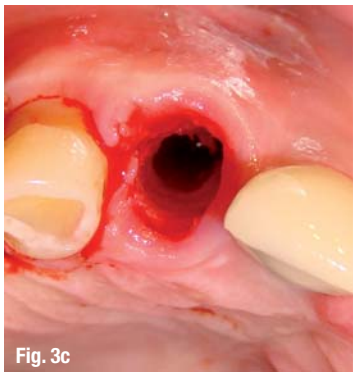
Fig. 3c


Fig. 4a

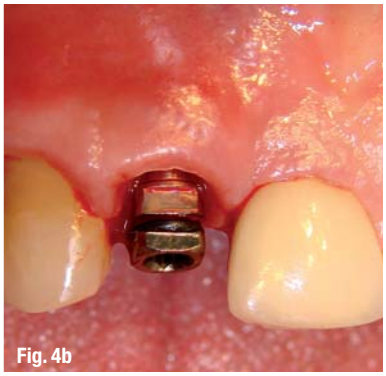
Fig. 4b

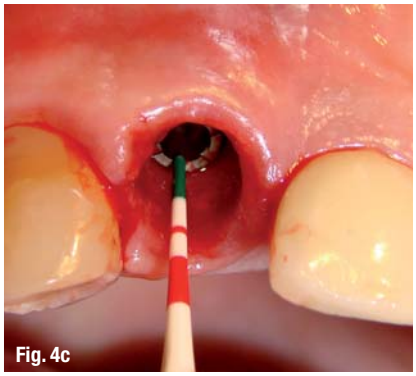
Fig. 4c

Figs. 4a–c_Image of implant being placed in the implant bed **(a)**, its final position **(b)**, and the probe marking about 2 mm below the level of the central alveolar bone crest of the tooth **(c)**.

essential for the prevention of peri-implant cervical bone loss (Cochran et al. 2009; Mangano et al. 2009; Schwarz et al. 2008) because these micro-movements between the implant and the abutment could lead to the formation of a micro-gap (Rack et al. 2010), resulting in internal contamination of the implant (Jansen et al. 1997; Steinebrunner et al. 2005).

This case report is aimed at demonstrating the advantages of the design of the Morse taper implant (Implacil De Bortoli) for maintenance of the anatomy of the peri-implant tissue.

_Case presentation

A 53-year-old male patient requested treatment of a coronal fracture of the right maxillary lateral incisor, which had been endodontically treated with a metal-ceramic crown with a metal core (Fig. 2). During surgical planning, factors essential to treatment success were observed, among which was the maintenance of the proximal bone crest, which is essential in determining the prognosis of the interproximal papilla of the implants (Rack et al. 2010) and future difficulties rising from the adjacent tooth, the central incisor, which was a prosthesis supported by an implant.

During drilling, it was observed that the pocket depth was less than 4 mm, since the fracture was fresh. After evaluating the patient's need for immediate aesthetics and his general condition, we chose to extract the remaining root and immediate placement of the implant and of the provisional. After anaesthesia, appropriate syndesmotomy was performed without displacement of the incision or tissue, in order not to disrupt the gingival line and to keep the papilla in position in seeking to prevent bone loss. This was achieved by performing an atraumatic extraction of the tooth (Fig. 3a).

An osteotomy was then performed in order to ensure the ideal position of the implant with regard to the future position of the prosthesis (Fig. 3b). The surgical sequence of the perforations followed the standard protocol specified for the placement of tapered implants, paying attention to the mesiodistal and buccolingual positioning of the implant, which should be around 1 to 2 mm for the buccal palate in relation to neighbouring teeth. The osteotomy started with super sharp drill launches in the predetermined position towards the palatal wall of the socket, preserving the labial plate. Subsequently, we used a 2 mm drill to the planned depth with a direction indicator to verify the need for adjustments in the orientation of the implant. This was followed by conical drills of 3.5 mm and 4 mm (Fig. 3c). The selected implant was a tapered Morse cone implant of 4 mm in diameter and 13 mm in length (Implacil De Bortoli).

The implant was placed in the implant bed (Fig. 4a) manually using with a torque meter (Fig. 4b), positioning the implant approximately 2 mm below the level of the central bone crest of the alveolar bone (Fig. 4c). The crash was performed at a torque of 50 N cm. An abutment (3.5 x 4.5 x 4 mm) was immediately placed (Fig. 5a).

Figs. 5a–c_The positioned abutment **(a)**, diagram showing the dimensions of the measured values **(b)**, and the seated provisional **(c)**.


Fig. 5a

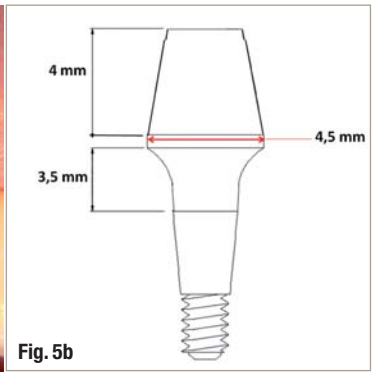

Fig. 5b

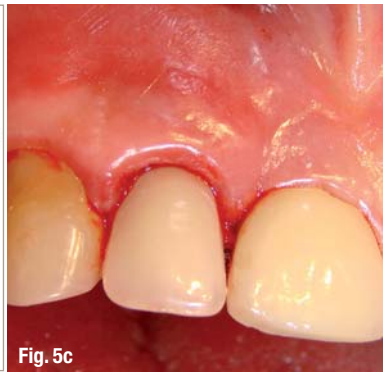
Fig. 5c

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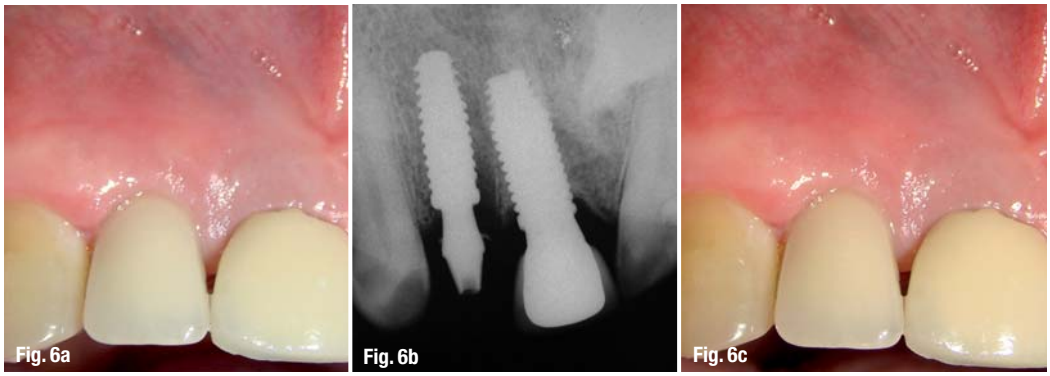

Fig. 6_Clinical appearance **(a)** and radiograph **(b)** after 30 days.

Figure 5b shows the dimensions of the abutment, on which a provisional (Fig. 5c) was fitted with a prefabricated acrylic tooth.

The follow-up radiograph and clinical follow-up demonstrated the good condition of the tissue, which facilitated subsequent rehabilitation procedures (Figs. 6 and 7).

_Discussion

The placement of single implants immediately after extraction has been proven to be a treatment modality with predictable success (Lazzara 1989). However, certain precautions should be taken, such as the positioning of the implant, the presence of bone tissue to obtain the initial implant stability and the presence of alveolar bone without great resorption of the walls, as these are essential to the restoration of function and aesthetics (Tarnow & Eskow 1995). An important consideration in the placement of implants immediately after tooth extraction is the behaviour of adjacent soft tissue during the healing period because, according to Schropp et al. 2003 who studied the changes in tissue (bone and gingiva) for 12 months after tooth extraction, early implant placement is favourable, thus increasing the preservation of bone anatomy and demonstrating the effectiveness of the technique.

The 3-D position of the implant is important for the development of the emergence profile of the tooth crown, especially the location of the implant in the apical direction. Therefore, the position of the IAJ influences the long-term outcomes. Placement at 1 to 3 mm sub-crestally can improve the aesthetics. A healing cap with an emergence profile could be used. The replacement of the prosthetic component in the event of tissue recession can help to maintain the texture and tone of the peri-implant mucosa, contributing also to the restoration of the marginal tissue architecture (Bridges et al. 2008).

In a clinical and radiographic study in dogs, in which implants with reduced platform were positioned at the crest and 1.5 mm below the crest, Novaes et al. (2006) found that the implants showed better results sub-crestally, compared with implants placed at the level of the bone crest. Positioning the implants sub-crestally resulted in a location above the bone joining the implant and abutment and bone formation above the implant shoulder.

Degidi et al. (2011) reported in their retrospective histological study on nine patients whose implants were placed at different levels with respect to the bone crest. In the sub-crestal implants, pre-existing bone formation was found on the implant shoulder and no bone resorption was found when the implant had been inserted to a depth of 3 mm, but bone formation contacting the surface of the abutment. Thus, placing the implant at a sub-crestal level seems to be a good alternative for achieving an aesthetic result; however, further studies are necessary.

_Conclusion

The placement of an implant immediately after extraction and placement of the provisional, in most cases, is a suitable alternative because it helps to preserve bone structure and gingiva. Additionally, it provides the patient with immediate psychological benefit, aesthetically and functionally. With the new design concepts and relation between the abutment and the implant regarding position, implants such as Morse taper implants can help maintain a larger amount of peri-implant tissue, thus improving the aesthetic condition._

_contact implants

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