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Implant-Supported Fixed Prosthesis in the Anterior Maxilla: Aesthetic Challenges

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Abstract **Case Report**

The implant-supported prosthesis is considered as an alternative to conventional techniques. This technique provides patients with a fixed solution; aesthetic and comfortable to replace one or more teeth and to preserve the adjacent teeth in their integrity. The placement of implant-supported prostheses in the anterior maxillary area requires a great deal of rigor and precision due to the optimal aesthetic requirements. However, environmental morphology is often affected by the amount of bone available as well as a thin periodontal biotype. Early identification of problems, careful analysis of treatment possibilities while respecting the biological imperatives associated with an adequate treatment sequence will make it possible to obtain an optimal functional and aesthetic result.

Keywords: "implant-supported prosthesis", "anterior sector", "guided bone regeneration".

INTRODUCTION

In the maxillary anterior sector, the placement of implant-supported prostheses is more complicated with little margin for error due to optimal aesthetic requirements [1].

It will therefore be necessary not only to ensure a good choice of the shape; the three-dimensional positioning of the implant and the quality of the prosthesis, but also of the hard and soft pre-implant tissues, such as a thickness and a position appropriate keratinized tissue, a convex contour of the alveolar process, a harmonious gingival contour around implants and adjacent teeth, the size and shape of the papillae [2, 3]. Indeed, post-extraction bone healing is accompanied by bone loss as well vertical than vestibulo-lingual (VL), dimensional changes in bone architecture, occur mainly during the first 12 months [4]. Overall, the reduction in ridge width can be more than 50%, with two-thirds of this resorption occurring within the first 3 months after extraction with more pronounced vestibular loss [5]. So, in this situation, the preservation of bone and gingival volumes seems to be crucial [6].

Currently thanks to the techniques of preservation of the alveoli as well as the technique of immediate extraction-implantation technique [7], it is possible to preserve the volume of the edentulous ridge as well as the harmony and the soft tissue architecture [8]. The Socket Shield Technique (SST) is a good alternative to the two previous techniques [9, 10]. In some cases, it is necessary to use bone augmentation techniques during implant treatment [11, 12]. Whatever the moment chosen, different types of grafts as well as different techniques are then possible such as: guided bone regeneration (GBR), transverse expansion and apposition grafts [13, 14].

CLINICAL CASE

A 23-year-old patient, without any particular pathology, with good oral hygiene, presented to the dental department at the military hospital in Tunis for the replacement of teeth 11 and 12 lost at the age of 15. following a trauma, the patient has since been wearing a removable prosthesis

Clinical examination revealed sufficient ridge height, average periodontal biotype with pronounced horizontal resorption making it difficult to place an implant in this site (Figure 1).

A cone beam has objectified on coronal reconstructions an increased vestibular concavity at the level of the implant site, essentially at the apical level, which could compromise the placement of the implant in a prophetically favorable axis.

Therapeutic decision:

Based on all of these clinical and radiological data, we opted for a sealed implant-supported rehabilitation replacing 11 and 12, a GBR in order to optimize the bone architecture and more precisely the bone volume in vestibular. This technique allowed a gain of 2 mm in width of the ridge, justifying the simultaneous placement of an implant (3.75/13) along the predefined prosthetic axis without fenestration or fracture of the vestibular table.

A supracrestal incision offset lingually was performed, completed by an intrasulcular incision on the distal side and a relieving incision on the mesial side, followed by full-thickness flap lifting (Figure 1).

To provide optimal osteo-mucous support, intraoperatively guided bone regeneration was performed using: granular bone of bovine origin mixed with blood and placed on the vestibular table then covered with a resorbable collagen membrane (Figure 2 & 3).

The flap is then repositioned without tension so as to cover the entire membrane (Figure 4).

The follow-up 10 days after the intervention shows a favorable evolution with perfect closure of the surgical sites without exposure of the flap. Perfect closure of the surgical sites without exposing the flap.

A panoramic X-ray was taken after placement shows the parallelism of the implants and respect for the adjacent teeth: implant-tooth distance and implant-implant distance was respected (Figure 5).

Two healing screws were placed two months after placement, and the gingiva was sutured around the healing screws to create an emergence profile (Figure 6 & 7).

15 days after an open-air impression was made, which aims to record the position of the implant and its environment (Figure 8 & 9).

A validation in the mouth of the validation key was carried out, the absence of crack demonstrates the good precision of the master model (Figure 10).

Three months later, two definitive zirconia crowns were cemented with satisfactory aesthetic results.

Figure 1: Ridge height + Average periodontal biotype

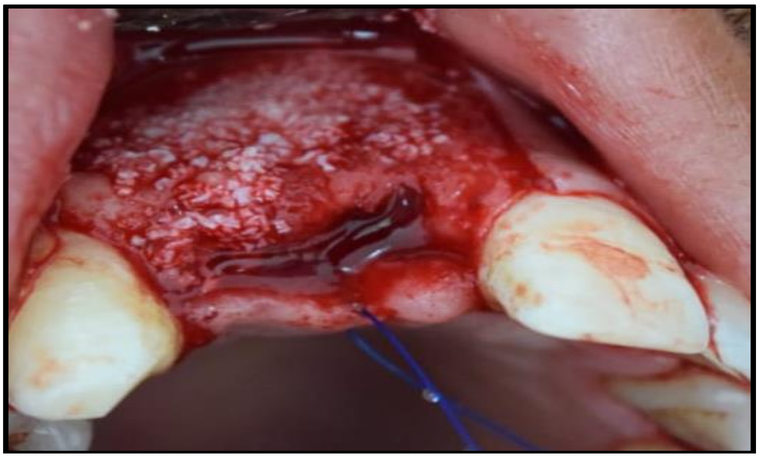

Figure 2: Granular bone of bovine origin mixed with blood and affixed to the vestibular table

Figure 3: A collagen membrane has been well applied

Figure 4: Hermetic closure of the site

Figure 5: Insertion of healing screws

Figure 6: Emergence profile after 15 days

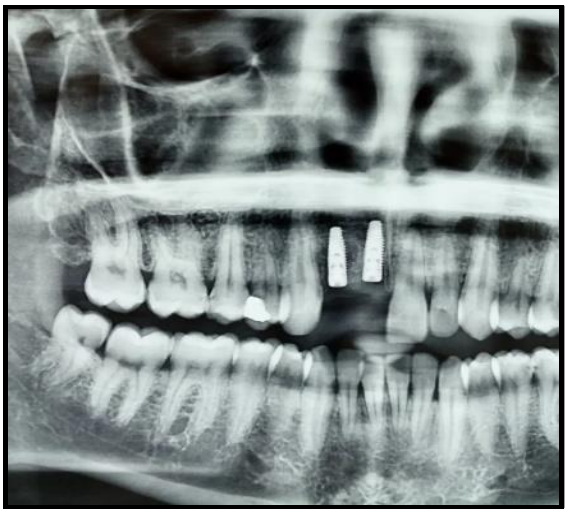

Figure 7: Panoramic X-ray of the control

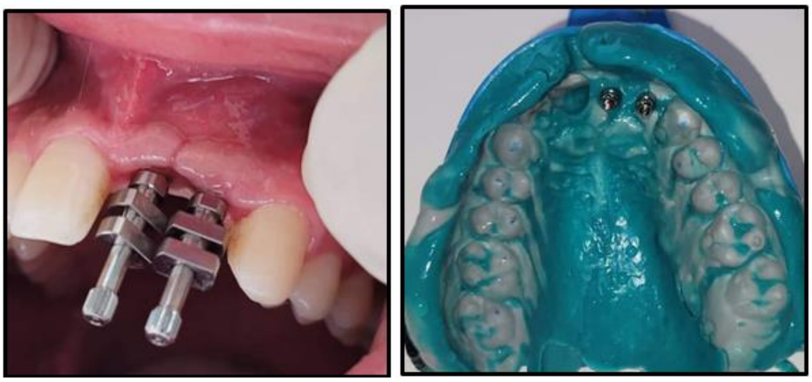

Figure 8: Silicone impression with the transfers embedded in the mass of the impression

Figure 9: Validation key

Figure 10: Prosthesis with satisfactory aesthetic rendering

DISCUSSION

The placement of a single tooth implant-supported restoration in the maxillary anterior area still presents a difficult challenge. This procedure requires preoperative diagnosis and careful treatment planning [4]. It is very important for a lasting esthetic result that the size and orientation of the implant are correct in the three dimensions of space [2, 5]. The implant should therefore not be too vestibular, but slightly shifted in the palatal direction with cingulate emergence allowing the realization of a screwed prosthesis [5]; this justifies the drilling at the expense of the palatal wall for our patient, the vestibular bone table should ideally have a thickness of 2 mm. In the mesio-distal direction, a minimum distance of 2 mm has been respected between the implant and the neighboring teeth, while being careful not to compress the interdental bone peaks which support the papillae the neck of the implant must be be located at a maximum distance of 4.5 mm from the point of contact, otherwise the papilla may disappear [15, 16]. The prosthetic part is just as important to obtain an optimal aesthetic result. Immediate temporization positively influences the aesthetic result, it allows to shape the peri-implant mucosa by compression and to sculpt the prosthetic emergence profile [17, 18].

Also, the peri-implant tissue environment is one of the key elements not only guaranteeing the long-term durability of the implant, but also contributing to the aesthetic result of the implant the future prosthesis [19]. As a result, the gingival biotype must be evaluated in order to guarantee a harmonious and stable peri-implant gingival context [2]. the presence of a height and a thickness of at least 2 mm of keratinized tissue around the implants promotes better plaque control and reduces the risk of mucosal recessions [20], moreover a thin biotype (< 2 mm) is more at risk of causing marginal bone loss compared to a thick biotype (≥ 2 mm) [19, 20]. It is therefore advisable to plan for an increase in the keratinized mucosa around an implant in patients with a thin biotype [21].

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One of the measures for obtaining adequate tissue integration and optimal aesthetic healing is the buried connective tissue graft [22, 23]. This technique has the advantage of guaranteeing a thickening of the gingiva, therefore an increased resistance, and an aesthetic result, because the graft is buried under a tissue that has the same appearance as the recipient site unlike the free epithelial connective graft [24, 25]. This technique is currently considered as a reference technique in mucogingival surgery. The graft will generally come either from a connective sample from the palate or from the maxillary tuberosity or from an edentulous crest and it will be fixed on the internal face of the flap [26, 27]. The intervention can be performed preoperatively, intraoperatively or postoperatively.

However, as for the soft tissues, the creation of a sufficient bone volume before or during the placement of the implants has become an unavoidable rule each time one is faced with a peri-implant bone defect ensuring optimal three-dimensional positioning of the implant implant [8, 28].

The morphology and nature of the bone defect determine whether bone augmentation procedures can be performed simultaneously or before implant placement [8]. Several techniques are to be compared such as: apposition grafts, interposition grafts, expansion, distraction or even guided bone regeneration (GBR) [1, 7, 29].

Although each surgical procedure has advantages and disadvantages [5], the choice of technique must be well evaluated based on precise parameters such as the anatomical site, morphology and type of bone defect [30]. First of all, the autogenous bone apposition graft is considered the gold standard [5], the graft can come from an extra-oral site or an intra-oral site [3, 31]. The autogenous graft has the advantage that it is well tolerated, osteogenic, osteoconductive and above all osteoinductive [1]. However, it requires a second surgical site and unfortunately has the highest resorption rate [8].

Transverse expansion is therefore a comparatively simple alternative because it does not require a 4 to 6 month waiting period for bone union [32] or a second harvesting site [5, 7]. The vestibular cortical bone fragment is dislocated laterally and the space created between the bony walls can be filled using bone substitute material, autogenous bone, or simply filled by the blood clot [33, [34].

This surgical procedure is applicable only if the bone height is sufficient [32, 35] with a residual thickness of 3mm including at least 1mm of spongy bone to allow an easy cleavage of the two bony tables [36, 37]. However, much finer cleavages are made possible by the use of piezotomes and by the complementary contribution of guided bone regeneration [33, 38, 39]. Guided bone regeneration used alone or with another surgical procedure is the most widely used method of augmenting localized alveolar defects [30, 40].

This technique relies on the use of a membrane to select and guide healing [29, 41]. These membranes prevent the colonization of the bone defect by connective and epithelial soft tissues and thus only allow cells with osteogenic potential to invade the scar space [42, 43]. So, the key element is the membrane that ensures the biological principles of Guided bone regeneration. This membrane maintains necessary space between the bone defect and the mucosa which will be the site of neo-ossification [44], it plays the role of a filter preventing the proliferation of cells from the covering mucosa and promoting the migration of osteogenic cells [42, 45]. Finally, this membrane has a stabilizing role of the blood clot, the very source of bone regeneration [30]. Therefore, the membrane must be: perfectly applied to the graft and perfectly stable. Osteosynthesis screws can also be used to create a tenting effect under the membrane. "Screw tenting" makes it possible to create and maintain the space necessary for regeneration and thus avoid membrane collapse [46].

The use of membrane alone in ROG is only indicated in the case of a bone defect less than 3 mm [7, 45], for defects greater than 3 mm the membrane alone is not sufficient to because of the risk of it collapsing [30]. The filling material is the second important element in the ROG [47]. The mechanism by which this material acts is determined by its origin as well as its composition, it can be osteogenic, osteoinductive and osteoconductive autogenous bone or allografts which have osteoconductive and possibly osteoinductive properties [30, 43]. Recently, several new bone substitutes of bovine, porcine, equine origin and synthetic bone have been developed. These alloplastic materials are usually just osteoconductive [42]. The Bio-Oss®, hydroxyapatite of bovine origin, is today one of the most widely used materials, with good clinical experience.

There are two approaches to ROG in implant therapy [48]: the simultaneous approach, if the bone deficiency is low and the stability of the implant can be achieved [6, 31] and the delayed before implant placement to increase the volume or improve the morphology of the alveolar ridge [45].

The predictability of GBR results can be affected by several factors [43], such as morphology and extent of bone defect [45], use of equipment and appropriate procedures, also mastery of manipulation, especially soft tissue to cover the membrane without tension, incision design and use of monofilament sutures are also key factors allowing flap closure without tension and can help reduce the risk of exposure and the rate of infection [31].

CONCLUSION

In the context of implant restorations located in an aesthetic zone, the key to aesthetic success lies in the right choice of shape, the placement of the implant in a very precise three-dimensional position. This often requires the use of hard and soft tissue preservation or reconstruction surgery. These techniques are not completely predictable and are not always able to guarantee the expected result, especially in the anterior maxilla. Therefore, it is necessary to discuss the possibility of complications with the patient from the beginning of therapy, especially with patients with high aesthetic demands and expectations.

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