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21

BONE GRAFTS AND IMPLANTOLOGY WITH IMMEDIATE PROSTHETIC RESTORATION IN AREAS OF HIGH AESTHETIC VALUE

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MAKING IMPLANTOLOGY SIMPLE

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1. INTRODUCTION

Loss of teeth leads to bone resorption which can be vestibular or palatal, depending on the area within the jaw from which the teeth are lost. The edentulous maxillary bone was classified based on the study of 300 craniums. Reduced differences were noted in the shape and resorption of the basal bones, while sharp variations were seen in the edentulous alveolar processes. Generally speaking, changes in shape follow a foreseeable pattern and resorption also varies depending on where it actually occurs:

- In the intraforaminal region of the mandible, the bone resorption is almost entirely vestibular with horizontal development.
- Posterior to the mental foramina, it is predominately vertical.
- In the upper maxillary, it is horizontal along the vestibular side of the entire arch (1).

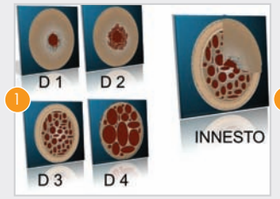
This indicates that a vestibular bone deficit is very likely to occur with the loss of a tooth in the upper arch or the intraforaminal lower arch. To reliably position an implant, the bone tissue must envelop the implant along its entire length and have acceptable vascularisation, so that the supporting bone structure is maintained (2).

In cases of edentulism, when there is insufficient bone tissue, surgical techniques must be applied to modify the bone shape (3). There are numerous techniques for increasing bone volume, including bone regeneration, grafts and split crest. In 1992, Gottlow (4) presented 88 instances in which the Guided Tissue Regeneration (GTR) technique was applied, and had obtained an average increase of approximately 2 mm. In 1994, Simion et al (5) demonstrated that it is possible to achieve vertical regeneration of approximately 7 mm; however, this also resulted in substantial contractions of the graft material. Therefore, when carrying out these interventions, extra graft should be carefully planned to obtain the required volumes.
In recent years, the split crest technique has also undergone significant development, as a result of the use of piezoelectrical instruments. These ensure improved incision linearity, as well as a reduction in the breadth of the cutting instruments when compared to traditional drills (6)(7)(8). The split crest technique involves the creation of a vertical incision, enabling the dilation of the bone section and expander-aided implant insertion.
In certain cases it may not be possible to apply the split crest technique, particularly if the residual bone tissue is extremely thin, and necessitates a block graft. This entails the removal of a block of bone from a donor site, which is then attached to the host bone site using osteosynthesis screws(9).
Romanos (10) demonstrated that it is possible to carry out bone grafts and obtain a similar tissue response to the traditional technique in the implantation phase, including immediate prosthetic restoration of the implants.
The purpose of this study is to assess the percentage of success in implants placed on an alveolar ridge, augmented using the block bone graft technique; also whether this surgical approach is compatible in areas of high aesthetic value.
One of the more significant points to consider regarding the aesthetic assessment of an anterior element, is the presence (or absence) of papilla. The position of the papilla is determined by the distance from the interproximal bone crest at the point of contact with the elements. It is possible to use papilla in 98% of cases, up to 5 mm. If the distance increases by even as little as 1 mm, the possibility of using papilla is reduced to 56% (11). It is therefore necessary to consider the effect that the implant will have on the surrounding tissue and more importantly, whether it could cause an increase in the distance between the point of contact and the papillary bone crest. In particular, the position of the junction between abutment and implant creates a micro gap, which causes some form of biological implant elasticity, at approximately 1.5 – 2 mm vertically and 1.4 mm horizontally. This should always be a significant consideration, to enable the implants to be positioned correctly (12).
A further issue that was noted was that when a bone graft is carried out, a tissue of different density is created (see Fig. 1). Lekholm and Zarb (13) have classified four different types of bone (types 1-4) progressing from the most compact to the most trabeculated, depending on the qualitative ratio between the cortical and medullary bones. As a consequence of this regenerative treatment in the maxilla, the positioning of the implant often creates insertion problems, since the host bone tissue is "softer" than the graft from the mandible. This affects the drills, pulling them towards the areas of lower density. Consequently, there is a risk that the implant alveolus will be positioned in an area near the site receiving the graft, which could cause potential aesthetic and functional problems. The use of piezoelectrical instruments is not affected by the differences in bone density, enabling a surgically correct alveolus to be created. This demonstrates that Piezosurgery overcomes the limits of traditional drills and ensures a very high degree of precision, enabling total control of the tissue, with an increased recovery response and improved positioning of the implant (14).

2. OBJECTIVES

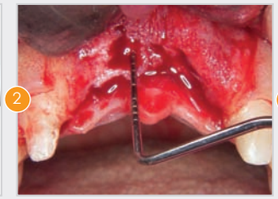
In the presence of a horizontal bone deficit, various surgical techniques can be selected, with the objective of restoring suitable bone volumes and correctly positioning the implant.
When the horizontal bone deficit has been reduced and the implant structure has acheived primary stability, a G.B.R. (guided bone regeneration) can be implemented, using a scaffold designed to support the new osteogenesis and a barrier required to reduce cellular competition.
A split crest can also be performed, when the remaining crest presents a thickness of at least 4 mm in the direction of the apex and tends to remain constant or increase its thickness. Using the piezoelectrical instrument, a crestal incision is made and enlarged to allow the implant to be positioned, using specific expanders.
When the thickness of the remaining tissue is less than 3 mm, the elective indication is that of autologous graft. A block of bone is taken from an intraoral donor region (lower retromolar area,

Combination of bone densities in the block graft



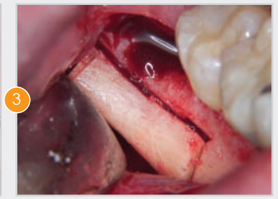
1

Assessment of the host site



2

Bone extraction in the retromolar region



3

Donor region

4

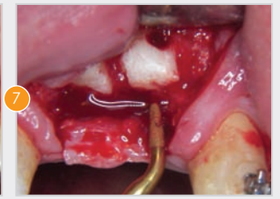
Stabilisation of the block on the host site

5

Maturation of the graft

6

Preparation of the surgical alveolus



7

Trauma in the anterior region

8

Bone defect in region 11-21

9

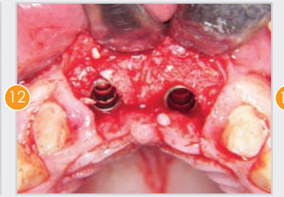
Immediate provisional in region 21

10

Immediate provisional in region 11-21

11

Three dimensional assessment of the implant positioning



12

Final reconstructions in porcelain

13

mandibular branch or symphysis menti) and is grafted into a host area by attaching it with osteosynthesis screws, to tightly connect the two interfaces and prevent micro movements.
The purpose of this is to apply the implant technique of immediate non-functional prosthetic restoration onto a bone site that has been reconstructed by means of a block graft taken from the mandible. This technique was decided upon to make the long waiting periods between the bone graft operation and the final prosthetic restoration more comfortable; also to use non-functional provisional prosthetics to try to condition the soft tissue, which is frequently altered in shape and appearance by the grafting procedure.

3. MATERIALS AND METHODS

The operational protocol proposes the use of SPI type Alpha-Bio Tec (Israel) implants, namely implants with a spiral structure that allow optimal primary stability with regards to a proper fit.
The patients were not selected according to any specific criteria; only those who presented absolute contraindications to the surgery were excluded.
Since this was an outpatient study, the assessment of the treatment's success relied exclusively on radiological findings, peri-implant probing and the clinical assessment, while acknowledging the greater evidence from invasive, instrumental techniques. Conversely, a clinically based definition was suggested by Zarb and Albrektsson:
"Osseointegration is a process whereby clinically asymptomatic rigid fixation of alloplastic materials is achieved and maintained in bone during functional loading."
The implants were inserted corresponding to fundamental surgical concepts, aimed at safeguarding the trophism of the bone tissue and simultaneously ensuring good primary stability.
Immediately after the implant was positioned, or within a maximum of 48 hours, the adjustment and functionality of the temporary prosthetics were applied, aiming to exclude lateral forces. The patients were also advised to eat soft foods during the first month, and then gradually increase the nature of their food intake. The final porcelain reconstructions are carried out according to standard healing times.
The first step in these operations has always been the opening of a trapezoidal flap at the host site and separation to the fullest extent, to allow the assessment and measurement of the size of the extraction (see Fig. 2). For the extraction, a flap of full thickness was raised in the retromolar mandibular region, with a distal crestal incision at the last dental intrasulcular element of the last two molars, using simple plexus anaesthesia. Once the flap was lifted, as conservative an approach as possible was adopted, moving the tissue only enough to allow the passage of the drilling instruments. The Surgybone (Silfradent, Italy) piezoelectrical instrument was used to perform the osteotomy, which helped avoid accidental lesions of the soft tissues, which can sometimes occur when using rotating instruments (see Figures 3 and 4).
Once mobilised, the bone volume was preserved in a physiologically sterile solution. The host site was treated using decortication to promote take up and is modified to create as compatible a receiving bed as possible. The block was then processed to eliminate any rough edges and attached with osteosynthesis screws (see Fig. 5).
Using the piezoelectrical instrument made the processing of the graft extremely simple, since the micro vibrations modified the block without impacting on its spatial position, unlike rotating instruments where the movements of the drills tend to affect the graft, running the risk of making it unstable. The flap was mobilised with periostal incisions and the marginal gaps were filled with mixed graft material of fragmented autologous bone tissue. The grafted material was protected with a resorbable membrane and the closure was made without pressure.
Upon the complete integration of the graft, roughly four months after the procedure (see Fig. 6), an access flap was fashioned, with paramarginal incisions approximately 2 mm away from the dental elements, in an attempt to respect the papilla. The flap was parted to its fullest width in the vestibule so that the osteosynthesis screws could be removed. The correct orientation of the implant alveolus was assessed using a diagnostic wax-up and the resulting guide mask. The alveolus was created using piezoelectrical inserts (see Fig. 7), as the spatial orientation of normal rotating instruments would be at risk of being compromised by the varying bone densities. Certainly in grafting the cortical tissue taken from the retromolar mandible region onto the anterior maxillary region, the bone tissue deriving from the host/donor combination would likely have two different densities: the D1 of the donor (formed almost entirely by cortical tissue) and the D3 of the host site (characteristic of the upper anterior maxillary region).

4. RESULTS AND CONCLUSIONS

Nineteen implants were placed in 13 patients in areas of high aesthetic value (see Figures 8-9). The aesthetic considerations, together with the explicit request for the least social discomfort possible, led us to consider immediate provisional prosthetic restoration (see Figures 10-11). The cases presented were all temporarily restored with a minimum follow up of 18 months. The use of the piezoelectrical instruments enabled the implants to be positioned and angled correctly, without being influenced by the various bone categories in the region (see Fig. 12). The use of the piezoelectrical instrument also ensured greater precision when assessing the biological elasticity and implant positioning, reducing the stress on the graft caused by the revolutions and vibrations of the rotating instruments. The shape of the SPI implants ensured remarkable implant stability and enabled immediate non-functional prosthetic restoration. Consequently, it was possible to condition the tissues, in an attempt to achieve the best aesthetic outcome, so that prosthetic restoration with "metal-free" prostheses (Fig.13) could be performed, following the integration period.
Harvey (15) also documented how it is possible to optimise the profile of the soft tissues in the aesthetic regions, after having inserted an implant with an immediate, non-functional provisional prosthesis. The level of the peri-implant tissue is maintained without resorption and with an implant success rate of 97.2%, even with the immediate prosthetic restoration implant technique. First Brunsk (16) and later Smuzler-Moncler (17), identified the existence of a range of tolerances to micro movements of between 50 and 150 microns at the bone implant interface. Remaining within this band ensures the maintenance of the primary stability and the osseointegration is not compromised; rather it is promoted. Beyond these movements, fibrous tissue is interposed and osseointegration is compromised. Immediate prosthetic restoration enables the control of the maturation of the soft tissue and helps achieve osseointegration (18).
These concepts are already prevalent in the existing literature regarding standard implants, and are also applicable to implants which are attached directly to block grafts.
This methodology provides a high degree of predictability of the aesthetic and functional outcome, when used in compliance with the guidelines suggested by the literature and the utilized instruments.

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