RECONSTRUCTION OF ALVEOLAR DEFECTS FOR IMPLANTS

Mihaela Cernușcă-Mițariu¹, V. Burlui², Daniela Trandafir³, D. Gogălniceanu⁴, Carmen Stadoleanu², Violeta Trandafir³, P. Gogălniceanu⁴

1. Lecturer, “Lucian Blaga” University of Sibiu
2. Prof.dr., “Apollonia” University of Iași
3. University assistant, “Gr.T.Popa” University of Iași
4. Dr, UCL, UK, member of the Royal College of Surgeons of England

Abstract

Resorption of the alveolar ridge after uni- or pluridental losses appears as a “norm” and not as an “exception”, when considering all morphological, functional and aesthetic modifications accompanying it. Repair of such disorders requires, in some cases, replacement of the lost teeth with endo-bone implants. When the width of the alveolar ridge is insufficient to support an implant, the defect should be completed with compatible materials. The study discusses the alveolar reconstruction performed on 22 patients with post-extractional bone atrophy in transversal direction, the alveolar deficit being completed with cortico-spongious and autogenic spongious graft, of enchondral or membranous origin, and also with deproteinized lyophilized bovine bone. When a correct technique has been applied, the results obtained with the autogenic membranous graft were very good, while those with the autogenic enchondral graft were only good. Reconstruction with bio-bone was only 50% successful. 6 months after graft application, the resulting bony condensation was sufficient for assuring the stability, in time, of the applied implants. In the opinion of the authors, alveolar bone reconstruction is a surgical procedure sometimes necessary and possible, requiring, nevertheless, high competence and the most suitable technical means for such a difficult intervention.

Keywords : alveolar reconstruction, dental implant

INTRODUCTION

Oral rehabilitation through prosthetizing on an implanting support of some severe post-extractional alveolar resorptions in transversal direction involves complex surgical attitudes and material qualities with a reconstructive role of maximum morphological, functional and aesthetic requirements.

According to recent surveys on the literature in the field, bone post-extraction resorption has a value of 40-60% in the first three months, after which it decreases with 0.25-0.50% each year. In this way, reduction of the alveolar size occurs, in width, from 4.2 up to 0.48 mm. In 2010, Yldirim and Wessing(1) asserted that the process of postextractional resorption begins as early as 2 weeks after the tooth loss. 8 weeks later, it attains an average resorption level of 2 mm in height while, after 12 months, about 50% of the width is lost, which corresponds, approximately, to a level of almost 5 to 7 mm. The most significant dimensional decrease occurs in the first three months, according to Pietrokovski and Massler(2) - in 1967. The vestibular dental blade, 0.1 up to 1.9 mm thick, with an average of 0.6 mm at the level of canines and of the upper central teeth, is mostly resorbed as, through separation during the surgical interventions, its vascularization - of periostal, dismal and trabecular origin - is interrupted - as Matic wrote in 2005 (3).

Bradnemark, cited by Zerbib et al. in 1991(11), appreciated that application of an implant requires a minimum 8 mm high and 6 mm thick alveolar ridge. Gunaydin et al. (2004) (12) required a width of 5 mm and a height of 10 mm for the alveolar crest, while McGlumphy and Larsen(1993) (13) recommended a thickness of
the vestibular cortical of 0.5 mm, and of the lingual one of 1 mm, respectively.

Correction of the transversal dimension of the post-extraction remaining alveole for implanting purposes may be achieved by several methods, with different materials, such as:

- The split crest technique (Scipioni, Bruschi and Calesini-1994) (14), with or without filling of the space between corticals with biological or non-biological materials (Coatoam and Mariotti-2003) (15)
- Osteo-condensation (Abels et al. 1999) (16)
- Controlled bone regeneration (Raghoebbar-2009) (17).
- Reconstruction with an externally-applied autogene bone graft (onlay graft- Pelo et al.-2005) (18)
- Reconstruction with organic and anorganic bone substitution materials (Terheyden-2007) (19), etc.

MATERIALS AND METHOD

In view of employing, in the Oral Surgery examination room, some standardized techniques and materials used for correcting, through implants, some post-extraction alveolar defects in transversal direction, 22 patients with ages between 35 and 56 years were examined both pre- and post-surgery, clinically and radiographically. All patients, 7 women and 15 men, had dental extractions: 16 multidental and 6 unidental alveoloplastic ones, on the frontal and lateral zone, up to 2-5 years ago. In all patients, width of the remaining ridge ranged between 2 and 4 mm, which did not offer the conditions for any implant application. Ridge height was reduced with about 2 mm, according to the standards imposed by Branemark. Reconstruction made use of:

1) cortico-spongious graft of mandibular origin in 13 cases - 5 grafts taken over from the vestibular zone of the horizontal branch - 1/3 posterior, (a technique recommended by Soehardi et al. in 2009)(20) and 4 grafts by the technique used by Vincente and Stoelinga (2005) (21). In 2 patients, grafts were taken over from the simfisary area, as recommended by Misch-1997 (22).

2) Bone graft of illiac origin, in 5 cases: 2 spongious and 3 cortico-spongious.

3) Bio-bone mixed with blood, was used in 4 cases, for enlarging the transversal diameter of the alveolar ridge. The bio-bone (spongious, deproteinized, lyophilized bovine bone) was employed in lateral defects smaller than 5 mm, as recommended by about Yesim Kale in 2007.
(23). This bone substitute is preferred for its similitude with the trabecular structure of the host bone, as well as for its osteo-conductive properties and depositing capacity for the osteo-forming cells transported by the vascular buds of the host, which penetrate the alveoles of the deproteinized bone.

RESULTS

5 months after graft application, 15 patients showed optimum alveolar thickness and bone density, capable of supporting an implant. In one case, the graft of iliac origin was more than 60% resorbed, which did not create the right conditions for the implant, any more. The resorption extent of the bone grafts was, over this period, between 0 and 25% of the initially obtained thickness, being much more intense in the iliac grafts and less marked in the ones taken over form the horizontal branch of the mandible.

12 months after graft application, no significant differences were noticed in the transversal size of the 14 controlled cases, or between the ridges implanted in one stage and those in 2 stages. Out of the 18 grafts applied vestibularly, in order to substitute the bone alveolar defect in transversal direction, 2 cortico-spongiuous grafts were lost as a result of infection, sequestration and rejection. In 3 cases, dehiscence of wounds occurred, which required their resuturing while, in other 3 patients, the latero-mandibular donating zone got infected, so that the space between the soft parts and the donating area had to be drained, with a meche, for 4 days, after which the wounds showed a healing tendency.

The painful sensation present in the receiving and donating areas persisted, in all cases, for about a week, which required the administration of antalgic and anti-inflammatory medication.

In 2 of the 4 cases in which the deproteinized bovine bone was employed, wound dehiscence and elimination of the bone substitute were noticed. The other 2 cases had a favourable evolution, with a resorption degree much higher than the one obtained for bone grafts.

DISCUSSION

Reconstruction of alveolar defects in transversal directions, considered to exceed the limits of implant benefit, represents a surgical procedure of special technical responsibility and careful selection of the most suitable bone substitute.
Out of the large range of available reconstructive materials, the cortico-spongious autogenic graft appears to be the most advantageous alternative. The autogenic bone is the only material considered as the "golden standard of any bone maxillary reconstruction" (Alam and Nowzari-2007) (26) and Rodriguez (27).

The grafted autogenic bone acts as a substitute of the lost alveolar bone, having the same structure and subsequent evolution as the receiving bed. It possesses osteo-conductive, osteo-inductive and osteo-formative properties (Burchardt 1983 (28). More than that, the autogenic bone graft does not induce rejection reactions, usually evident in the case of allografts or xenografts (Hollinger et al. - 1996 (29). In 2007, Mc Allister et al. (30) was of the opinion that the autogenic bone graft is resorbed and completely substituted by the host bone, as a result of the "creeping substitution" phenomenon described by Phemister in 1914.

In the oro-maxilo-facial territory, resorption of the bone grafts of enchondral origin is much higher, while the substitution tendency is much lower than in the grafts of membranous origin, similarly with the maxillary bone. The results obtained support the above-mentioned findings. Resorption may be limited by covering the grafted material with membranous barriers which prevent the neosteogenic conjunctive invasion.

When no perfect graft-receiver congruence was obtained, a "spongious paste", taken over from the same donating area, was used. This spongious paste brings about a high amount of osteo-forming cells, inductive and growing factors, to which a major osteo-conduction capacity should be added (30). Nevertheless, the cortical has a higher mechanical force and a more reliable fixation capacity (Gelrich and Bormann - 2007) (31), even if its vascularization rate is slower. Thus, the cortical has the advantage of fixing the graft on one of the bone alveolar tables, while the accompanying spongious substance brings in the osteo-forming cells.

The reduced number of post-surgical complications and the favourable evolution of the implants, applied either concomitantly with the graft or 5-6 months later, encouraged the use of such materials. However, 2 failures - out of the 4 cases of enlargement with bio-bone, which was not integrated and was eliminated from the wound in the same granular from - made us give up the use of this material for a lateral completion of the large-sized defects. Nevertheless, in some cases, the high porosity bio-bone was employed (for facilitating vascularization) for filling the empty spaces in the graft-receiving bed incongruencies. Mixture with blood and the spongious part of the grafted bed increased the osteo-conductive value of the bio-bone and its integration capacity into a vascularized biological medium. After 6 months, the deproteinized bovine bone was resorbed up to 60%, being substituted by a repairing osteoid tissue, having - however - a much lower density than the autogenic bone grafts.

CONCLUSIONS

Reconstruction with cortico-spongious bone graft of membranous origin of the lateral wall of the alveole for maximizing the area of implant application is a preferable option in most cases, as its osteo-formative, osteo-conductive and osteo-inductive properties assure the desired bone restoration.

References


