Dentistry

Clinical Sheet

BONE SUBSTITUTE AND THREE-DIMENSIONAL COLLAGEN MATRIX OF EQUINE ORIGIN IN POST-EXTRACTIVE REGENERATION

Ridge preservation by use of a heterologous bone graft and a three-dimensional collagen matrix.

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Alveolar ridge preservation (ARP) is the bone regeneration procedure to counteract horizontal and vertical bone resorption following the loss of a dental element. It can be successfully performed using bone substitutes, membranes, and matrices, following appropriate treatment protocols that take into account anatomy and implant *timing*, residual tissue, and esthetic demand.
The clinical goal of ARP is the preservation of crestal volume or, at least, slowing down the bone resorption process in all those conditions in which implant placement is temporarily not feasible for reasons related to the patient's clinical condition.
Among the factors to be considered in the implant-prosthetic treatment plan when performing *ridge preservation* is the choice of graft material, which must create an adequate condition to counteract ridge resorption.
The evaluation of biological effects resulting from partial remodeling of bone substitutes and the possible interference of residual particles in the intra-alveolar healing process, as in subsequent bone remodeling, represent topics still widely debated in the literature[1]. Thus, it is evident the need for further study of tissue parameters in regenerated sites, correlating histomorphometric values of bone regeneration with clinical and functional outcomes.

1. Canellas JVDS et al. Histomorphometric evaluation of different grafting materials used for alveolar ridge preservation: a systematic review and network meta-analysis. Int J Oral Maxillofac Surg, 49(6), 797-810 (2020).

Materials

The ARP of this clinical case was performed using a collagen-preserved cortico-cancellous granular bone graft of 0.25-1mm granulometry (OsteOXenon, Bioteck) and a collagen matrix (Xenomatrix, BCG-XC10, Bioteck) composed of a 20 x 10 x 4 mm octagonal portion and a Ø 14 x 4 mm circular portion. Both materials are equine-derived.
OsteOXenon granules are produced by the unique Zymo-Teck® low-temperature deantigenation process. Selective elimination of antigens preserves collagen in its native conformation and keeps the mineral component of bone intact.
Xenomatrix is a three-dimensional matrix derived from collagen extracted from tendons and it is an alternative to the use of autologous connective tissue. Xenomatrix supports soft tissue regeneration by promoting fibroblast adhesion. This results in faster healing, even in the presence of membrane exposure, which reduces patient discomfort and complications, allowing a better esthetic result.

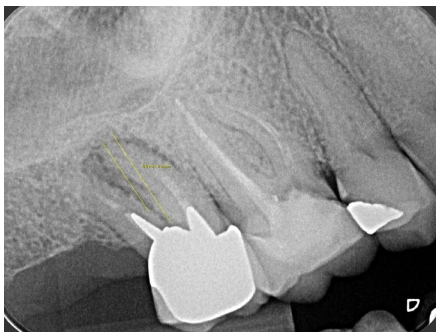

Fig. 1 *– Endodontic injury to the mesio-vestibular root, associated with vertical fracture, results in the need to extract element 17.*

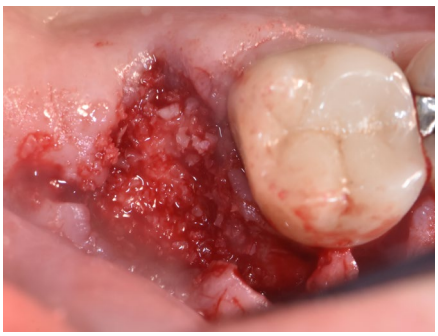

Fig. 2 *– After flapless extraction, the socket was filled with cortico-cancellous granules up to the maximum height of the bone wall, which was still most preserved.*

Fig. 3 *– Xenomatrix BCG-XC10 three-dimensional collagen matrix was chosen to protect the bone graft and promote soft tissue healing.*

Fig. 4 *– After matrix placement, the soft tissues were sutured with detached stitches, promoting healing by second intention.*

Fig. 5 *– After 30 days, good soft tissue healing is observed.*

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Results

The clinical case involves a patient with element 17 judged unrecoverable due to an endodontic lesion at the mesio-vestibular root, associated with a vertical fracture, and therefore destined for extraction.
Avulsion was performed without flap lift and in an atraumatic manner, allowing almost complete preservation of the cortical bone wall. The socket was filled with OsteOXenon equine-derived granules to the maximum height of the residual bone wall. Graft protection was achieved by placing three-dimensional Xenomatrix collagen matrix in line with standard protocol, that is, by overlaying a double layer of collagen matrix on top of the graft.
The collagen matrix structure provides a favorable substrate for soft tissue regeneration and helps to stabilize and protect the bone graft. For this reason, we opted to stabilize the gingival margins and collagen matrix with a few detached sutures to achieve a safe healing by second intention, without the risk of infection.
Site healing was monitored at 30 days, 3 months, and 6 months after surgery. The evolution of the bone neoformation was monitored with radiographic checks by observing the increase in radiopacity at the regenerated site over time.
At 6 months, the bone formation was found to be suitable for implant placement. At the same time, a bone biopsy was taken to evaluate the effectiveness of the bone regeneration procedure from a histological and histomorphometric point of view.
Biopsy sections were stained with Masson's trichrome, which is particularly good for recognizing different connective cell types. Analysis of the sections under the light microscope allowed us to distinguish and quantify the areas occupied by new bone (40.84%), osteoid tissue (3.70%), residual graft (15.59%) and bone marrow area (24.61%).
The results show that treatment with OsteOXenon granules and Xenomatrix collagen matrix supports post-extractive socket healing and enables effective graft remodeling.

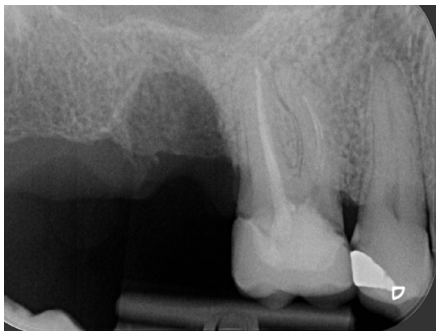

Fig. 6 *– Radiograph at 3 months after ARP. No volumetric loss is observed in the graft in the vertical direction although the graft is poorly radiopaque.*

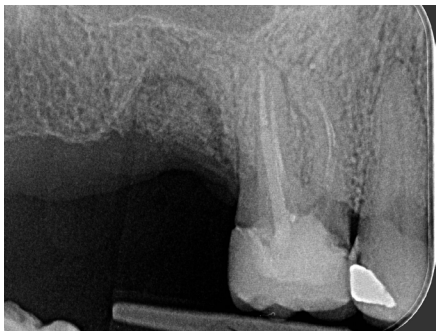

Fig. 7 *– Radiograph at 6 months after ARP. The bone graft appears more radiopaque, indicating that bone remodeling has occurred.*

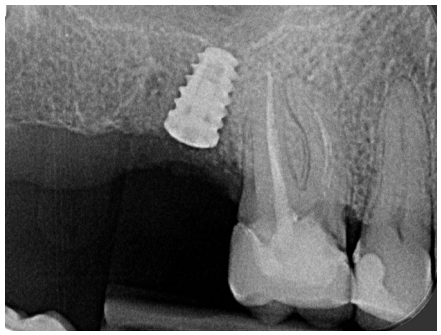

Fig. 8 *– Radiograph immediately after implant placement. Performing ARP allowed implant placement 6 months later.*

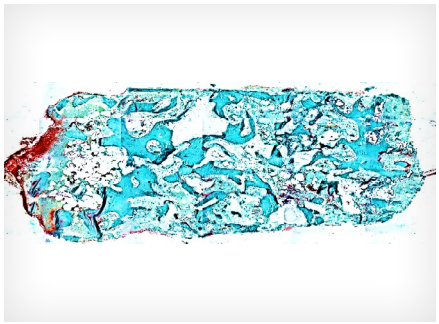

Fig. 9 *– Overall view of the section obtained from the bone biopsy taken from the regenerated site, stained with Masson's Trichrome (10x).*

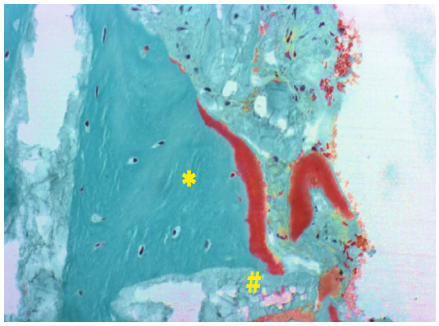

Fig. 10 *– Higher magnification view of the section (40x) makes it possible to distinguish a large area of newly formed bone (*), osteoid tissue (in red), and graft of equine origin (#).*

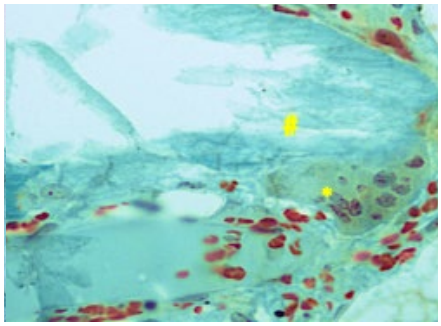

Fig. 11 *– Detail (120x) of the portion corresponding to the graft of equine origin (#). The remodeling phase is advanced but still ongoing, as evidenced by the presence of an active osteoclast (*).*

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