Bone Regeneration Material with a Potential in GuM Regeneration

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Biomaterials for bone regeneration techniques can preface rehabilitation implantation, may intervene in the same step with the implantation, or they can find the insertion in reconstructive periodontal therapy. This study aimed to quantify the contribution that different materials may bring for bone regeneration potential in gum regeneration in resizing bone structures affected, in order to establish oral rehabilitation.There were considered a total of five bone regeneration materials(Hidroxiapatite, Bio-Oss, OsteoGraf /N, Osteogen, Cerasorb), applied in similar clinical situations, radiological assessment of bone regeneration issues, made before the application, immediately after application and 6 months after application. Regarding the quality of bone neo formation, the bone structure was very dense when using Bio-oss and Cerasorb, relevant issues the X-ray that provides the necessary information. In terms of clinical results, they were very good for the other three biomaterials used for bone regeneration. When used properly, biomaterials for bone regeneration provide very good results in terms of maintaining bone volume to withstand the demands, offering also a high percentage of vitality, safety and lack of complications.

Key words: regeneration, biomaterials, augmentation, bone density

The materials most commonly used as a substitute for bone are ceramic materials, treated with bovine bone, synthetic ceramic calcium phosphate (hydroxyapatite, tricalcic phosphate TCP) and calcium carbonate (coraline)[1,2].

The mechanism of action of these ceramics are based on osteo conduction. These materials are used for the reconstruction of bone defects and resorbed alveolar ridge augmentation [3,4]. They have a good resistance to compression and poor tortional resistance, similar to the natural bone. Although there are different biological responses, all bioceramics are indicated for augmentations [5, 6].

In cases of minor bone resorption, getting a corresponding bone bed is mainly combined with alien materials or membranes [7].

Currently, two types are distinguished by a peri implant bone augmentation by a guided tissue regeneration:firstly, bone regeneration is initiated simultaneously with the implant placement, achieving significant time savings, in situations where the initial implant stability cannot be ensured due to an insufficient bone volume, a method that involves the gradual addition of marrow in the first stage and subsequently inserting the implant is considered [8,9].

This method gives an improved primary stability, facilitates implant placement in the mature bone and can thus be examined and considered apt for placing a dental implant at this level.

Indications of this method are the bone volume sufficient for an initial implant stability and providing a high success rate for achieving augmentation [10, 11]. When bone volume and configuration do not allow initial stability, we recommend a phased approach with the bone augmentation in the first stage [12,13].

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Experimental part

This study aimed to quantify the contribution that different materials may bring for bone regeneration potential in gum regeneration in resizing bone structures affected, in order to establish oral rehabilitation.

Material and method

There were considered a total of five bone regeneration materials, applied in similar clinical situations, radiological assessment of bone regeneration issues, made before the application, immediately after application and 6 months after application.

Bone regeneration materials analyzed were:

1. Hidroxiapatite- has an increased degree of biocompatibility, adhering easily to hard and soft tissues. Thus the last decade derived from bovine hydroxyapatite has received attention as a substitute for autogenous bone grafts. Calcium and phosphorus are the most abundant, but bicarbonates, citrates, Mg, K, Na, etc are also present. Through comprehensive studies based on X-ray diffraction (Roentgen) it was exhibited that P and Ca form crystals together.

2. Bio-Oss- is an inorganic bovine bone which has been treated chemically to the removal of the organic component. Thus it can be used in augmentations without causing the appearance of an immune response from the host.Bio-Oss is an osteo conductive material and it becomes incorporated into the physiological remodeling surrounding bone with the time passing.

3. OsteoGraf / N -is another porous hydroxyapatite-based material derived from bovine bone. This material is available in two variants, a version with small particles (OsteoGraf / N300) and a version of large dimension particles (OsteoGraf / N700).

4.Osteogen- is a bioactive synthetic graft, which can be resorbed. Augmentation is an osteo conductive material, non-ceramic, suitable for shaping and rebuilding the alveolar ridge defects (alveoli post extractional augmentation, augmentation defects around implants, restoring OASO marginal defects, periapical and periodontal alveolar).

5. Cerasorb -is Beta TCP and can be used for bone regeneration of the entire frame. The material is completely resorbed and replaced by bone over a period of time ranging between 3-24 months, depending on the type of bone.

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Although it is a highly porous material, Cerasorb is stable and highly resistant to abrasion.

Results and discussions

Evaluation of bone structures at 6 months showed positive results in terms of dimensional parameters for each type of regeneration biomaterial. Regarding the quality of bone neo formation, the bone structure was very dense when using Bio-oss and Cerasorb, relevant issues the X-ray that provides the necessary information. In terms of clinical results, they were very good for the other three biomaterials used for bone regeneration.

When using hydroxyapatite, the higher porosity of the material is, it offers better support for new bone formed and is quickly resorbed. The more crystal clear the graft is, the smaller the graft resorption rate is.

One can conclude that amorphous grafts resorb faster than the crystal. Solid dense blocks of hydroxyapatite have resistance to compression but are brittle, so are not suitable for areas that will receive increased strength. Therefore, careful consideration is very important in terms of clinical and paraclinical area to be augmented, evaluation forces at this level is very important and evaluation of the type of occlusion as well. Due to physical and chemical properties of materials based on hydroxyapatite one can mention resorption rate and clinical applicability of these materials. Such large particles resorb in a long time and therefore remain longer in the augmentation site.

A drawback of porous ceramics is that the resistance is in an inversely proportion with the porous state. The most widely used for ridge augmentations are 1mm particles of hydroxyapatite, adhering well to the underlying bony structures.

Using particles instead of solid blocks minimizes the problem of brittleness, leading to the formation of a smaller amount compared to the use of bone blocks.

Regarding the use of Bio-Oss this type of bone mineral can be used alone or in combination with the membrane length, such as in periodontal defects, dehiscence and fenestration around the implant. If large alveolar deficiencies, bone mineral can be combined with bone autogenous. We can underline accuracy in the revascularization process, migration of osteoblasts, creating a network of fine bone induced by Bio-Oss (fig. 1).

By networking micro and macroprils the blood clot is stabilized, premise of an efficient remodeling when using this type of regeneration biomaterial. The radiological evaluation indicates a perfect integration of the new structure of bone associated with Bio-Oss® which was achieved after 6 months.

Graft dimensional stability when using this product that determines stabilization of graft both in volume and as architectural areas augmented structure, made Bio-oss a choice material in ridge augmentation in the areas of aesthetic importance at both the jaw and mandibular cavity.

In terms of using the regeneration osteograph type bone biomaterial, the variant with small particles has been successfully used to treat alveolar ridge defects. After a 4 months healing period from the augmented soft tissue, they had the same look as the neighboring tissues and the material had a smooth consistency and is able to detach from the underlying bone only by force.

When using Cerasorb as a bone regeneration material, after 6 months of intervention one can notice a very good structure of the bone around the implants (fig.2).

Relatively recently, restoring the alveolar ridge defects caused by atrophy or resorption was performed by using the addition of materials or allogenic or autologous or heterogenous bone graft implants maintained by osteosynthesis.

Supracrestal bone graft placement was followed by a bone resorption rate of about 50%. For this reason, it was preferable to apply the allogenic bone graft material by *sandwich* technique.

Lyophilized bone is often used but relatively low for restoring defects in combination with membrane. When using allogenic materials, there is an increased risk of wound infection and dehiscence of mucous. It is also found that the lyophilized bone shows o lower potential to revitalize than the autologous bone.

Guided bone regeneration expanded its indications regarding the addition of localized alveolar ridge preceding or simultaneous with the insertion of implants, treatment of bone defects and peri implantation additions.

Guided bone regeneration expanded its information with regard to the addition of localized bone reconstruction material (HA granules; P-TCP), treatment of bone defects and peri implantation addition.

Larger defects, accompanied by total atrophy alveolar ridge augmentation with autologous bone requires, the amount of bone required influencing the choice of the donor site (chin, jaw retro- region, or a transplant from the iliac crest).

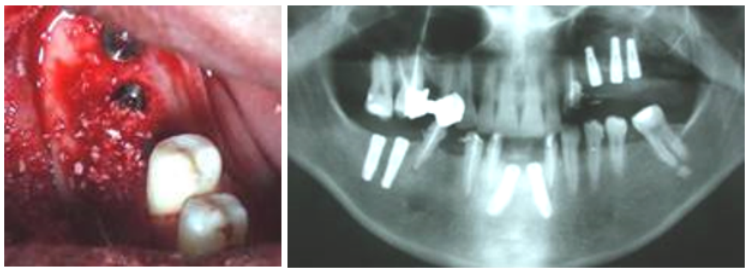

Fig. 1 Aspects of using bone regeneration material Bio-Oss type

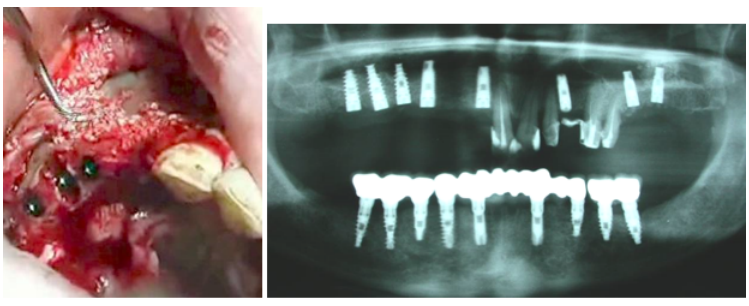

Fig. 2 Aspects of using bone regeneration material Cerasorb type

Conclusions

Biomaterials for bone regeneration potential in regenerative gum, because the two types of regeneration are to be regarded integrative successful content in a variety of therapeutic implant augmentations contributing to the success with thorough clinical and laboratory evaluation of the patient candidate for the implant and compliance with rigorous surgical protocols;

When used properly, biomaterials for bone regeneration provide very good results in terms of maintaining bone volume to withstand the demands, offering also a high percentage of vitality, safety and lack of complications;

Radiological assessments accurately type CT, MRI provides a clear picture of the new formed in the bone and gingival structures.

References

1. BECKER, J., AL-NAWAS, B., KLEIN, M.O., SCHLIEPHAKE, H., TERHEYDEN, H., SCHWARZ, F.,: Use of a new cross-linked collagen membrane for the treatment of dehiscence-type defects at titanium implants: a prospective, randomized-controlled double-blinded clinical multicenter study. Clin Oral Implants Res , **20**(3), 2007, pg.742.

2. BECKER, W., DAHLIN, C., BECKER, B.E., et al.: The use of e-PTFE barrier membranes for bone promotion around titanium implants placed into extraction sockets: a prospective multicenter study. Int J Oral Maxillofac Implants, **9**(1),1994, pg.31.

3. BEITLITUM, I., ARTZI, Z., NEMCOVSKY, CE.,: Clinical evaluation of particulate allogeneic with and without autogenous bone grafts and resorbable collagen membranes for bone augmentation of atrophic alveolar ridges. Clin Oral Implants Res , **21**(4), 2010, pg. 1242.

4. CALVO-GUIRADO, J.L., ORTIZ-RUIZ, A.J., NEGRI, B., LÓPEZ-MARÍ, L., RODRIGUEZ-BARBA, C., SCHLOTTIG ,F.: Histological and histomorphometric evaluation of immediate implant placement on a dog model with a new implant surface treatment. Clin Oral Implants Res , **21**, 2010,pg. 308.

5.CHETRUS, V.,ROMAN, I.,:Gingival recession, Diagnostic methods, Romanian J.of Oral Rehab., **(6)**3, 2014, pg.38

6. CHIAPASCO, M., ZANIBONI, M.: Clinical outcomes of GBR procedures to correct peri-implant dehiscences and fenestrations: a systematic review. Clin Oral Implants Res , **20**(4), 2009, pg.113.

7. FRIEDMANN, A., GISSEL, K., SOUDAN, M., KLEBER, B.M., PITARU ,S., DIETRICH, T.,: Randomized controlled trial on lateral augmentation using two collagen membranes: morphometric results on mineralized tissue compound. J Clin Periodontol , **38**, 2011pg.677.

8. JENSEN, SS., TERHEYDEN, H.,: Bone augmentation procedures in localized defects in the alveolar ridge: clinical results with different bone grafts and bone-substitute materials. Int J Oral Maxillofac Implants, **24**(2), 2009, pg.218.

9.JUNG, RE., HaLG, GA., THOMA, DS., HaMMERLE ,CH.: A randomized, controlled clinical trial to evaluate a new membrane for guided bone regeneration around dental implants. Clin Oral Implants Res ,**20**(2), 2009, pg.162.

10. MALONEY ,WJ., WEINBERG, MA.,: Implementation of the American Society of Anesthesiologists Physical Status classification system in periodontal practice. J Periodontol , **79**(2), 2008, pg.1124.

11. MERLI ,M., LOMBARDINI ,F., ESPOSITO, M.,: Vertical ridge augmentation with autogenous bone grafts 3 years after loading: resorbable barriers versus titanium-reinforced barriers. A randomized controlled clinical trial. Int J Oral Maxillofac Implants, **25**(1), 2010, pg.801.

12 SCHWARZ, F., SAGER, M., KADELKA, I., FERRARI, D., BECKER, J.,: Influence of titanium implant surface characteristics on bone regeneration in dehiscence-type defects: an experimental study in dogs. J Clin Periodontol , **37**, 2010, pg.466;

13. SCHWARZ, F.,, HERTEN, M., FERRARI, D., et al.: Guided bone regeneration at dehiscence-type defects using biphasic hydroxyapatite + beta tricalcium phosphate (Bone Ceramic) or a collagen-coated natural bone mineral (Bio-Oss Collagen): an immunohistochemical study in dogs. Int J Oral Maxillofac Surg , **36**(7), 2007, pg.1198.

14.SOLOMON , S., et all.: The assessment of renal biochemical markers and their role in periodontal disease, Romanian J. of Oral Rehab., **(7)**3, 2015, pg.97

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