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REVIEW ARTICLE

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MAIN CONSIDERATIONS OF CLINICAL USE OF BONE GRAFTS: A REVIEW

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ABSTRACT

Introduction: Após extrações dentárias o osso alveolar reabsorve devido à falta de carga mecânica da mastigação. Tal reabsorção dificulta a reabilitação dos pacientes edêntulos devido a possíveis não adaptação das próteses e falta de altura para implantes, causando diversos danos a saúde. Para minizar a reabsorção enxertos podem ser utilizados no momento da extração, no alveolo. Estes enxertos podem ser autógenos, retirados, principalmente, da região mentoniana do paciente, ou alógenos, extraidos da matriz ossea bovina desvitalizada.
Objective: Aimed to bring together the literary findings on allogeneic and xenogenic grafts with the use of biomaterials and their correlations with dental and esthetic implants.
Methods: A search protocol was developed to identify the evidence related to determinants for autologous and xenogene grafts. Thus, the mesh terms were included "Dental Implantation," "Dental Implant", "Bone Graft", "Autogenous Graft" and "Xenogenous graft". For further specification, the "anterior maxilla" description for refinement was added during searches. The literature search was conducted through online databases: Pubmed, Periodicos.com and Google Scholar. It was stipulated deadline, and the related search covering all available literature on virtual libraries.
Conclusion: It can be concluded that autogenous grafts are still the first option in the treatment of alveolar bone loss. However, its disadvantages related mainly to the morbidity of the procedure and the small amount of possible donation material limits its use.

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INTRODUCTION

According to the literature one of the tissues that most remodels is the bone tissue. This tissue is specialized, vascularized and dynamic connective tissue, which changes throughout the individual's life (Souza, 2016 and Rinaldi, 2015). One of the most common traumas, ie, dental extraction results in loss of alveolar bone due to atrophy of the edentulous ridge. In many circumstances, this is a limiting factor for rehabilitation with dental implants due to insufficient bone volume for its execution, and the use of grafts may be indicated (Rinaldi, 2015; Abreu, 2014 and Cabral, 2014). In the area of buccomaxillofacial surgery and traumatology, bone is the most commonly required tissue in pre-prosthetic surgeries, in the treatment of congenital defects and dentofacial deformities. Although autogenous bone grafts are widely accepted as a standard for the treatment of bone defects, homogenous and heterogenous implants, and synthetic bone substitutes have been widely studied as an alternative to grafts (Paiva, 2014 and Okuhara, 2014). Patients are increasingly demanding regarding dental treatments. Treatment as Total Prosthesis are no longer accepted (Fardin, 2010). The scientific and technological advance that implantology is currently undergoing has been responsible for improving the quality of life of total or partial edentulous patients. However, some patients, this treatment becomes impracticable, because they do not have sufficient alveolar bone. For this reason, several studies involving autogenous bone grafts and biomaterials have been developed (Fardin, 2010 and Ferreira, 2001). The autogenous graft is still considered the best graft for alveolar bone defects, and it can be removed from intrabuccal regions (Ferreira, 2001 and Florian, 2012). The choice of donor area depends on the preference of the dental surgeon, size of the defect to be filled and morbidity associated with the surgical procedure. The most used places with donors are: Mento, Tuber da Maxila and Retromolar. When the autogenous graft is not sufficient or the patient is resistant in accepting surgeries, the biomaterials are excellent options (Gallerani, 2013). Thus, the present work aimed to bring together the literary findings on allogeneic and xenogenic grafts with the use of biomaterials and their correlations with dental and esthetic implants.

MATERIALS AND METHODS

A search protocol was developed to identify the evidence related to determinants for autologous and xenogene grafts. Thus, the study included should relate different aspects and may involve different tissues (bone), surgical techniques, materials and expectations of the patient and relate them with getting a nice aesthetic when rehabilitation involved previous regions. Experimental and clinical studies were included (retrospective, prospective and randomized) with qualitative and / or quantitative analysis. Initially, the key words were determined by searching the DeCS tool (Descriptors in Health Sciences, BIREME base) and later verified and validated by MeSh system (Medical Subject Headings, the US National Library of Medicine) in order to achieve consistent search.

Mesh Terms

The mesh terms were included "Dental Implant", "Bone Graft", “Autogenous Graft” and “Xenogenous graft”. For further specification, the "anterior maxilla" description for refinement was added during searches. The literature search was conducted through online databases: Pubmed, Periodicos.com and Google Scholar. It was stipulated deadline, and the related search covering all available literature on virtual libraries.

Series of Articles And Eligibility

A total of 250 articles were found involving implantation, anterior and aesthetics. Initially, it was held the exclusion existing title and duplications in accordance with the interest described this work. After this process, the summaries were evaluated and a new exclusion was held. A total of 30 articles were evaluated in full, and 24 were included and discussed in this study.

Main Predictors

In order to clarify the main points related to aesthetics in implantology, the articles were categorized according to the topics discussed, and these: 1) Diagnosis and Planning; 2) Reverse Planning; 3) Handling of Soft and Hard Tissue; 4) Fabric perimplantar; 5) Prosthetic Resources; and 6) Psychological factors associated with Aesthetics.

Literature Review

Materials for bone grafting can be classified as osteogenic, osteoinductive and osteoconductive. Osteogens refer to organic materials capable of stimulating bone formation directly from osteoblasts (Souza, 2016 and Rinaldi, 2015 and Abreu, 2014). Osteoinducers are those capable of inducing the differentiation of undifferentiated mesenchymal cells into osteoblasts or chondroblasts, increasing bone formation at the site or even stimulating the formation of bone at a heterotopic site. Osteoconductive materials (usually inorganic) allow the apposition of a new bone tissue on its surface, requiring the presence of preexisting bone tissue as a source of osteoprogenitor cells (Cabral, 2014). The ideal graft material should meet the following requirements: 1) unlimited supply without compromising the donor area; 2) promote osteogenesis; 3) does not present host immune response; 4) revascularize rapidly; 5) stimulate osteoinduction; 6) promote osteoconduction; 7) to be completely replaced by bone in quantity and quality similar to that of the host [7,8]. There is no such ideal grafting material, but the autogenous bone is enshrined in world literature as one that can bring features closer to the ideal. It has as main advantage its potential of integration to the receptor site with bone formation mechanisms of osteogenesis, osteoinduction and osteoconduction. As a disadvantage, there is a need for a donor area, potential for resorption and difficulty of adaptation in the recipient area. The main donor extraoral areas are the iliac bones and the calvaria. The body, chin, branch and mandible coronoid regions can also be used, although they provide less bone quantity (Florian, 2012 and Gallerani, 2013). Autogenous grafts have been widely used by implantology (Lima, 2009: Xavier, 2011 and Yildirim, 2001). It is essential to emphasize that the success of the technique is based on the foundation of biological principles, clinical experience and results obtained make it the technique of choice in small oral rehabilitations (Hising, 2001; Slotte; 2003 and Schlegel, 2003). Thus, the autogenous graft was chosen for the clinical case presented since the amount of bone required for subsequent rehabilitation of the patient was compatible with the donor area, oblique line, besides the numerous advantages previously mentioned, besides being surgery performed in session Single, requiring no prior hospitalization and general anesthesia (Valentini, 2003; John, 2004 and Crespi, 2007). Predictability is the main factor in the choice of this type of bone reconstruction material, since this is the only technique that provides the receptor bed cells with capacity for bone neoformation, growth factors and a bone framework similar to the receptor (Crespi, 2007).

Autogenous Graft

There is a wide variety of grafting materials that can be safely and predictably used either alone or in combination: autografts, allografts, xenografts and alloplastic materials such as calcium phosphates, bioactive glass particles and hydroxyapatite. Bone grafts can produce bone formation by osteogenesis, osteoconduction or osteoinduction (Souza, 2016 and Rinaldi, 2015). While osteogenesis provides osteogenic cells and matrix directly from the graft, osteoinduction postulates that the grafted material is chemotactic to undifferentiated progenitor cells, inducing their differentiation into osteoblasts (Abreu, 2014). Osteoconduction is generally known as a three-dimensional process of capillaries, perivascular tissue and progenitor cells from the donor site into a porous structure of a graft. Autogenous bone is considered the gold standard for bone reconstruction. As a graft material, it is ideal because it does not cause an immune response during the remodeling process (Cabral, 2014).

Donor sites generally consist of the iliac crest, for bilateral and intraoral approaches, for unilateral approaches. Non-vascularized autogenous bone blocks may undergo partial necrosis and resorption due to prolonged ischemia and insufficient revascularization (Souza, 2006 and Cabral, 2014). Thus, the degree of osseointegration and implant stability in the graft may be limited. The use of particulate autogenous bone is an approach that facilitates cellular nutrition within the graft, initially by diffusion into the clot and subsequently by neoformed blood vessels (Paiva, 2014 and Okuhara, 2014). Bone crushing promotes the release of osteoinductive substances in the matrix, which increases bone neoformation. On the other hand, small bone particles that cannot be rigidly attached, undergo micromovements that may inhibit bone formation (Fardin, 2010 and Ferreira, 2001). Autogenous grafts are most commonly used because of their osteogenic, osteoinductive and osteoconductive properties. Thus, its biological activity combines the three properties, as well as the presence of a high number of viable cells and wealth of growth factors, providing the best results in the new bone formation, also by the promotion of neoangiogenesis, fundamental in the revascularization and remodeling process Osseous (Florian, 2012 and Gallerani, 2013).

The advantage of using autogenous bone as graft material is the rapid growth of vessels by their angiogenic potential from the surrounding native bone. This will revitalize parts of the graft and its cells, which will subsequently participate in local metabolism, ie, osteoclastic reabsorption and osteoblast-guided functional remodeling (Lima, 2009).The graft integration and osseointegration of the inserted implant are faster when autogenous bone is added than with the biomaterial only. Among the viable cells are osteoblasts, undifferentiated mesenchymal cells, monocytes and precursor cells of osteoclasts, which in turn participate in the remodeling and formation of new bone processes. Once autogenous bone is transplanted, the graft area is invaded by osteoinductive molecules, such as morphogenetic proteins (BMP), growth factors, and by osteogenic cells (Xavier, 2011). Thus, bone formation is considerably faster than when bone substitutes are used alone. It is important to note that the osteogenic potential of autografts can vary considerably with age, presence or absence of systemic diseases, the donor area as mandible, iliac crest, cortical / spongy bone and the technique of bone tissue collection, which will result in fragments With different sizes (Yildirim, 2001; Hising, 2001 and Slotte, 2003). In a study conducted in humans, other authors observed that the origin of the autogenous bone is not important, but rather the amount of cortical bone of the graft, which may imply a faster or slower resorption of the graft, that is, cortical bone behaves like Cortical bone, independent of its origin (Schlegel, 2003).

Xenogenic Graft - Bone Substitutes

Bone substitutes can be used when autogenous bone supply is limited (Valentini, 2003; John, 2004 and Crespi, 2007). Alternatives such as bone substitutes do not have the necessary elements for osteogenesis and are only osteoconductive - they are synthetic and most of their organic components are removed in the manufacturing process (Gutwald, 2010 and Jang, 2010). The use of bone substitutes in bone graft procedures can 1 - keep available space, avoiding tissue growth and barrier collapse; 2 - increase osteoconduction, allowing the growth of osteogenic cells from existing bone surfaces in the grafted material, stimulating osteoblasts to form new bone; 3- prevent contraction of the wound by stabilizing the subsequent clot of the provisional matrix (Cho-Lee, 2010 and Rickert, 2012).

A bone substitute evaluated in clinical and animal studies is Bio-oss® (Geistlich Pharma, Wolhusen, Switzerland), which is a deproteinized mineral bovine bone with a structure similar to human bone marrow, both in its structural morphology and composition Mineral (Souza, 2013). Bio-oss is one of the bone substitutes most widely used for its optimal osteoconductive potential (Souza, 2016 and Yildirim, 2001). It has a structure consisting of an ultraporous surface and an interconnected pore system, which acts as a microsponge, providing the entrance of blood cells, osteoblasts, osteoclasts and proteins into their particles. It has been argued that deproteinized bovine bone is resorbable, however, based on the available literature, it must be concluded that it will not be fully resorbed with time (Yildirim, 2001). As it has a relatively long reabsorption period, graft particles are still present after four years in humans. Some authors have suggested that the stability in terms of resistance to resorption is favorable as long as the volume of the grafted area is maintained for longer. In addition, the reinforcing effect of the Bio-oss particles on the newly formed bone may result in a positive effect on the biomechanical properties a in the ability of the bone to support the implant. In a study in humans, they observed that Bio-oss particles were incorporated by the newly formed bone, both in the group treated only with Bio-oss, and in that treated with Bio-oss and autogenous bone. Thus, osteoblast-osteoid formation lines were found in the newly formed bone. Bio-oss particles were found in close contact with neoformed bone (Yildirim, 2001).

DISCUSSION

The search for surrogates that had the same properties as the autogenous bone, with the objective of reducing the morbidity of surgical procedures, led to the research to develop synthetic materials, while bone banks became more reliable (Souza, 2016). Several materials were developed, among them: homogenous implants, xenogens, biological membranes, bioactive glasses and hydroxyapatite derivatives (Abreu, 2014). Vertical reabsorption of the maxilla is four times greater than that of the mandible. In the maxilla, an annual average bone resorption of 0.1 mm is estimated after tooth loss. Atrophy is more pronounced in the first year after the exodontia and becomes less intense in the subsequent years (Cabral, 2014). Horizontal resorption, in both arches, begins at the buccal surface and progresses in the lingual and palatal direction. During the resorption process it is common to check for insufficient bone (thickness and / or height) for the installation of osseointegrated implants in the anterior region of the maxilla, whereas in the posterior one, there is often sufficient bone thickness and insufficient height (Rinaldi, 2015 and Abreu, 2014). Autogenous bone grafting from intraocular donor sites presents good incorporation and low reabsorption, thus maintaining the grafted bone volume (Abreu, 2014 and Paiva, 2014). The buccal cavity emphasizes as sites the ment, the mandibular branch, the tuber, the coronoid process, the zygoma and the torus. These sites present an advantage in relation to the extraoral sites, since they allow better surgical access, absence of cutaneous scar, reduction of surgical time, accomplishment under local anesthesia, reduction of postoperative morbidity, lower financial cost, technique in dental practice, better technique Accepted by patients and bone volume maintained in a predictable way with minimal resorption. However, the disadvantage of the intra-buccal area is the limited amount of donor tissue (Paiva, 2014 and Okuhara, 2014). The homologous bone can be frozen, dried, demineralized or not and also lyophilized (Ferreira, 2001). Freeze-drying is the removal of moisture from the bone, previously defatted, allowing its storage for long periods. Currently, the most commonly used homogenous bone is dry frozen bone. This is readily available in large quantities, but revascularization takes longer compared to autogenous bone and has no potential osteoinductive (Florian, 2012). An alternative of homologous bone is fresh and frozen bone (Rinaldi, 2015). This is collected aseptically from living donors or from cadavers and then frozen. There is no further preparation, and the osteoinductive proteins are preserved. The demineralization process is used to expose the collagen from the organic matrix of the graft and, consequently, the BMP. Thus, the objective is to increase the osteoinductive potential of the graft (Cabral, 2014 and Paiva, 2014). In addition, the use of hydroxyapatite has been widely researched since its emergence as biomaterial in 1970. HA is a hydrated calcium phosphate, the main component (about 95.0%) of the mineral phase of human bones and teeth (Abreu, 2014 and Cabral, 2014). Hydroxyapatite is the material present in vertebrates, composing the bone skeleton and acting as a reserve of calcium and phosphorus. Among the indications of use is the repair of bone defects in dental and orthopedic applications; Increased alveolar ridge; Guided regeneration of bone tissues; Bucomaxillofacial reconstruction; Repair and replacement of orbital walls; And replacement of the eyeball (Paiva, 2014 and Okuhara, 2014). Hydroxyapatites of synthetic or natural origin have received special attention for their structural, chemical and physical similarity with the bone mineral matrix (Souza, 2016). In addition it does not induce any undesirable immune or toxic reaction, unlike some materials of organic origin. Perhaps the most important characteristic of HA is osteoconductivity, which induces bone growth within the graft, promoting stability and maintenance of implant volume (Rinaldi, 2015 and Abreu, 2014). The HA preparations have been presented in the form of ceramics, marketed as dense or porous forms, blocks and granules. The porous shape promotes more consistent osseointegration, resulting in strong bonding between the graft and adjacent bone. However its reabsorption is very slow, which may hinder bone remodeling (Abreu, 2014 and Cabral, 2014). As there are a large number of bone substitutes available with multiple results, the properties of these materials related to biocompatibility and function compared to autogenous bone should be considered by the surgeons during the planning of each patient (Paiva, 2014 and Okuhara, 2014). Some authors have observed that adequate bone formation in the space created can be achieved with a variety of materials, provided that a reasonable healing period is allowed - 5 to 6 months, and there is no clinical evidence of the superiority of the autogenous bone over the bone substitutes, when An adequate healing period is allowed (Fardin, 2010). When autograft is used separately as graft material, a comparable bone fraction is found in a shorter healing period - 3 to 4 months, justified by its high osteogenic potential (Fardin 2010). Autogenous bone of extra-oral origin increases expenditures, both in terms of time and financially, and is related to morbidity and functional limitations from the patient's point of view. Donor sites in the maxillofacial region are also used. According to Jang et al. (Fardin, 2010), the proportion of autogenous graft or other graft material used depends on the amount available from the former, a higher proportion of autogenous bone increases the osteogenic potential in the mixture. There are two main advantages in bone substitutes, whether used alone or mixed with bone of autogenous origin. First, the collection of autogenous bone at the second surgical site can be completely avoided or, at least, limited, thus reducing the pain and discomfort of the patient.

Other authors found a rate of reabsorption of the grafted group with bone of higher autogenous origin, resulting in less bone formation and less graft volume, since volume maintenance was probably due to bovine bone, which protects reabsorption grafts (Chackartchi, 2011). An adequate elevation of the maxillary sinus should include elevation of the medial wall membrane. This provides a blood support to the graft, which comes from the bony walls of the sinus, allowing for a faster formation of vital bone and a reduced time necessary for graft maturation. The volume of graft is usually proportional to the size of the sinus. The time required for reabsorption of the graft and replacement by the new bone is greater in larger breasts. Thus, the high osteogenic potential of the autogenous bone is essential when maxillary sinus lift is performed in large maxillary sinuses (Cho-Lee, 2010). The contact between bone and implant was always greater in the remaining bone than in the grafted and that when an equal proportion of autogenous bone and Bio-oss was used, contact bone implant was increased during the initial healing period when compared to Bio-oss only. Thus, the addition of autogenous bone to the Bio-oss can accelerate not only bone regeneration, but also bone implant contact during the initial healing period (Yildirim, 2001).

Conclusion

It can be concluded that autogenous grafts are still the first option in the treatment of alveolar bone loss. However, its disadvantages related mainly to the morbidity of the procedure and the small amount of possible donation material limits its use. Thus xenogenous bone grafts have become commonplace so that the indication and choice of the various types available on the market are directly linked to the advantages and limitations of each, as well as the dentist's skill and personal preference.

Conflict of Interest: The authors declare no conflict of interest.

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