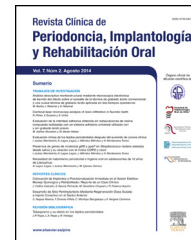




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REVIEW ARTICLE

Current considerations on bone substitutes in maxillary sinus lifting



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Abstract The procedure of maxillary sinus lifting using autogenous bone was considered the reference standard choice for oral rehabilitation in cases of severe atrophic maxilla. However, it is not always a viable option, due to the limitations or morbidity caused by grafting techniques. This has led to the development of bone substitutes, which have been elaborated and improved. Choosing the best biomaterial becomes difficult due to the wide variety of bone substitutes. The aim of this article is to present some of these materials that are reported in the current scientific literature for maxillary sinus lifting.

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PALABRAS CLAVE

Seno maxilar;
Sustitutos de huesos;
Materiales
biocompatibles

Consideraciones actuales sobre sustitutos óseos en elevación del seno maxilar

Resumen El procedimiento de elevación del seno maxilar utilizando hueso autógeno se consideraba la opción estándar de oro para la rehabilitación oral en casos de maxilar atrófico grave. Sin embargo, no siempre es una opción viable, debido a las limitaciones o a la morbilidad causada por técnicas de injerto, lo que justifica la existencia de sustitutos óseos que han sido elaborados y mejorados. En cuanto a la amplia variedad de sustitutos óseos, se hace difícil la mejor elección de biomaterial. El objetivo de este informe es presentar una variedad de

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sustitutos óseos respetados en la literatura científica actual, usados en la elevación del seno maxilar.

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Introduction

Over the past 40 years, the dental implant osseointegration has been considered the greatest scientific discovery for dentistry, since its first description by offering an alternative of oral rehabilitation.¹ However, there are some individual limitations including the bone insufficiency, which is common after tooth loss associated with absence of functional stimulus in the site.² After tooth extraction, the alveolar bone undergoes an additional atrophy as a result of natural remodeling process. This process begins immediately after extraction and may result up to 50% of ridge width resorption, within 3 months.³ Deficiency in bone volume in the posterior maxilla is one of the most common problems to the implantodontist to plan an implant supported prosthesis. This is because the maxillary sinus in the absence of teeth tends to pneumatized reducing the height of alveolar ridge, hindering the installation and/or initial stability of the implant required to the prosthetic support. Against this problem, authors have created a procedure to increase bone volume of atrophic jaws through the maxillary sinus lifting.^{3,4}

In the literature, the autogenous bone graft is considered as "gold standard", because it presents the characteristics considered ideal: osteogenesis, osteoinduction and osteoconduction.⁵ However, the techniques of bone grafting and partial reconstruction of the jaws are planned according to the degree of bone loss, surgical prosthetic planning, the patient's systemic condition and the viability of the donor area. The major limitation of intraoral autogenous bone is the need of more surgical intervention and the morbidity of the donor area, apart from the limited amount of autogenous bone. Extraoral donor areas also have some disadvantages or limitations such as the need for hospitalization, morbidity of the donor area, higher cost and, particularly, in the case of the Iliac crest, one post-operative riskier in relation to infections, injuries to nerves and functional disability.⁶ In addition, there are reports on significant levels of bone reabsorption when only the autogenous bone is used, requiring an alternative consideration of bone substitutes.^{7,8}

As a priority to minimize patient's morbidity, bone substitutes are becoming increasingly improved. On the wide variety of bone substitutes, it becomes difficult to choose the best product.^{9,10} The aim of this paper is to present to surgeon dentist the variety of bone substitutes applied in maxillary sinus lifting, enshrined in the current scientific literature.

Materials and methods

The proposal of this study was to inform the surgeon on suitable bone substitutes regarding the world scientific literature. The search was based on scientific researches published in English including systematic reviews and also animal and human studies. The exclusion criteria were case reports and discussion articles. The inclusion criteria assumed the studies published in English from 1980 to 2014 searched at Medline (Pubmed) and Bireme databases. The keywords "bone substitute," "bone repair", "bone modeling", "maxillary sinus lifting", "biomaterials" and "grafting" were used for searching.

Literature review

Fundamental considerations on bone substitutes

There are four main characteristics considered ideal in bone regeneration, those of which at least one bone substitute must present.^{8,9} The first main feature is the osteogenesis or osteogenic activity (ability of bone formation from viable osteoblasts or pre-osteoblasts derived from the graft donor area, which are capable of generating cellular proliferation and producing new bone).⁸⁻¹¹ The second property is the osteoconduction (the capacity of the graft for support or allow cell migration, formation of blood vessels and the bone growth in surface), and the osteoinductivity (refers to the ability of a graft to induce nondifferentiated stem cells or osteoprogenitor cells to differentiate into osteoblasts).^{8,9} Finally, the osseointegration, which is the ability of chemical contact between the bone surfaces without the fibrous tissue's presence.¹⁰ It is fundamental the presence of at least one of the characteristics described above and only autogenous bone presents them all.

Other characteristics considered ideal include: the remodeling of the bone initially formed in mature lamellar bone as a function of time passing, ability to stabilize implants when installed simultaneously to the grafting procedure, low risk of infection, good availability, low antigenicity and physiologically stable, not cause rejection and be ideally be absorbed after the regeneration.¹¹

Classification of bone substitutes

Considering the limitations, disadvantages and morbidities associated with use of autogenous bone in maxillary sinus lifting, bone substitutes were introduced as an alternative,

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