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ORIGINAL ARTICLE

Alvelar ridge preservation: a systematic review

Preservação do rebordo alveolar: uma revisão sistemática

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ABSTRACT

Introduction: Periodontal disease, periapical pathology and mechanical trauma often result in increased bone loss prior to tooth extraction. In addition, traumatic extraction is also associated with additional bone loss. **Objective:** To verify by means of a systematic review the effect of preservation of the alveolar ridge compared to unassisted healing. **Methods:** The most relevant studies published originally in English during the last 5 years (October 2008 to September 2012) were analyzed, with reference to the MEDLINE (National Library of Medicine) databases. Aiming to select the studies with the highest scientific evidence, previous reviews were identified and their scope was updated and revised, in addition to systematic reviews with or without meta-analysis. The search strategy utilized the following keyword combinations: bone preservation regeneration AND dental implant. **Results:** We identified 247 articles. However, after applying the inclusion and exclusion criteria, 71 were selected for peer review. The selected articles were judged by two independent reviewers who used as reference the levels of evidence suggested by PUBMED, and 17 articles were eligible for analysis. **Conclusion:** Considering the similarity of the results found in the research, it is understood that there are substantial advantages regarding the adoption of assisted preservation techniques in relation to the unassisted preservation.

Keywords: tooth extraction AND bone resorption; implant site development; bonoe substitute; bone regeneration

RESUMO

Introdução: Doença periodontal, patologia periapical e traumatismo mecânico frequentemente resultam em aumento da perda óssea antes da extração dentária. Além disso, a extração traumática é também associada à perda óssea adicional. **Objetivo:** Verificar por meio de uma revisão sistemática o efeito da preservação do rebordo alveolar comparado à cicatrização não assistida. **Métodos:** Foram analisados os mais relevantes estudos publicados originalmente na língua inglesa, durante os últimos 5 anos (outubro de 2008 a setembro de 2012) , tendo como referência as bases de dados MEDLINE (National Library of Medicine). Objetivando selecionar os estudos de maior evidência científica, foram identificadas revisões anteriores, que tiveram seu escopo atualizado e revisado, além das revisões sistemáticas com ou sem meta-análise. A estratégia de busca utilizou as seguintes combinações de palavras-chave: bone preservation regeneration AND dental implant. **Resultados:** Foram identificados 247 artigos. Contudo, após aplicação dos critérios de inclusão e exclusão, 71 foram selecionados para revisão por pares. Os artigos selecionados, foram julgados por dois revisores independentes que, utilizaram como referência, os níveis de evidências sugeridos pelo PUBMED, sendo elegíveis para análise 17 artigos. **Conclusão:** Considerando a similaridade dos resultados encontrados na pesquisa, entende-se que há vantagens substanciais quanto à adoção das técnicas de preservação assistida em relação a não assistida.

Palavras-chave: Tooth extraction; Bone resorption; Implant site development; Bone substitute; Bone regeneration

INTRODUCTION

Periodontal disease, periapical pathology and mechanical trauma often result in increased bone loss prior to tooth extraction. In addition, traumatic extraction is also associated with additional bone loss. In the healing process after extraction, the alveolar bone immediately initiates additional atrophy as a result of the natural remodeling process, which can result in more than 50% resorption of the alveolar ridge in three months that may have an impact on the positioning of the osseointegrable implant, since it has adequate bone volume and residual alveolar bone dimensions at the time of implant insertion[21].

When the extraction is necessary and it is intended to maintain the height and thickness of the alveolar bone, the gains of performing an assisted cure are noteworthy[11]. However, it is known that the process of alveolar resorption post-extraction is unavoidable but that we can minimize this natural process when we use an assisted healing[5].

The great advantage of using post-extraction guided bone regeneration is that, in the future, it will be possible to implant larger diameter and desired platform implants, in addition to a better prosthetic position[4]. Unassisted healing can result in a severe alveolar bone resorption at a level that would make it impossible for the patient to undergo rehabilitation with osseointegratable implants. The survival rate of implants placed in preserved areas reaches 97%[14].

Therefore, the systematic review presented herein aimed to investigate the effect of preserving the dimensions of the alveolar ridge compared to unassisted healing.

METHODS

The most relevant studies published originally in English during the last 5 years (October 2008 to September 2012) were analyzed, with reference to the MEDLINE (National Library of Medicine) databases. Aiming to select the studies with the highest scientific evidence, previous reviews were identified and their scope were updated and revised, in addition to systematic reviews with or without meta-analysis. The search strategy used the following keyword combinations: bone preservation regeneration AND dental implant.

Inclusion and exclusion criteria were free and independently applied by two experienced reviewers and scholars, who judged the studies selected from the points raised in each item (Table 1).

RESULTS

We identified 247 articles. However, after applying the inclusion and exclusion criteria, 71 were selected for peer review. The selected articles were judged by two independent reviewers who used as reference the levels of evidence suggested by PUBMED being eligible for analysis 17 articles, as best described in table 1.

DISCUSSION

The present review evidenced that there are several alveolar preservation techniques used to minimize alveolar bone resorption both in height and in thickness after extraction, whether unitary or multiple.

All selected articles showed that there is no 100% preservation, or that is, 100% of the height and thickness of the alveolus after extraction is not preserved. However, a preservation of at least 85% of the alveolus[15] was observed, these preserved areas being more propitious to receive osseointegrable implants[2]. The use of membranes helps in preservation in relation to patients who did not receive membrane for recovery of alveolar filling/preservation, respectively 22% coronal to 36% apical and 35.2% coronal to 47% apical, both procedures being successful in alveolar preservation with bovine bone[1].

Fresh and frozen human bones were used for preservation as a method of sparing another donor area surgery, thus reducing operative time and risk of infection from another surgical area[3]. The alveolar preservation grafts with blocks of spongy bone, as well as bone conductor, have good compatibility and a high success rate in the variable of bone gain and the future placement of the implant in atrophic maxilla so that the result was 98.8% of success with regard to implant survival, and the follow-up time satisfied the inclusion criterion[16].

Although the best way to maintain the healthy alveolus is to preserve the natural tooth structure, whenever we use biomaterials to perform assisted preservation, we will always achieve a better result in relation to common healing[22].

Implants placed in an assisted and unassisted area were evaluated in relation to the clinical performance of the implants, presenting no significant difference. However, larger diameter implants could be inserted into preserved areas[6]. Patients who had even greater defects than 5mm and underwent alveolar preservation were evaluated for an assisted healing with hydroxyapatite in which an excellent horizontal bone regeneration was detected[7].

The survival of implants in grafted area with homologous tibial bone is also a good alternative to avoid a donor area. (8) The spongy bone, as well as the homologous bone, presented as a great alternative for bone gain in both thickness and height of alveolar bone maintenance. When performed, a better placement is allowed in the future[23].

Sections of incisors, canines and premolars preserved with Straumann and Bio Oss grafts showed in a very similar way the effectiveness of a reduction of bone resorption post-extraction[11]. Receptor sites have proved to be well tolerable for biomaterials and are resistant with enough bone to receive implants[13]. The ease of placing the implant after preservation with BMP has also been significantly noted[19]. In cases of anterior atrophic jaws where a block of *lyophilized*

Quadro 1. Critérios de inclusão e exclusão, e os principais resultados.

Inclusion criteria	
Design	• controlled and randomized clinical trials with follow-up of three months or more • review study • systematic reviews with meta-analysis
Patients	• Partially edentulous maxilla and mandible • Assisted healing • Unassisted healing • Previous single or multiple extraction • Immediate extraction before intervention • Male and female gender
Intervention	• Guided bone regeneration • Allograft • Xenograft • Autogenous graft • With or without membrane • Immediate Exodontia • Previous extraction • Bone bank
Language	• English only
Exclusion Criteria	
Design	• Randomization process unclear or poorly described • Articles out of the context of Alveolar Preservation
Patients	• Patients who did not complete the study
Intervention	• Unclear, poorly described or inadequate interventions
Type of publication	• Only in abstract

bone was used, there was a tendency for rehabilitation with implants in these areas, and it could be performed the implant immediately after grafting, reaching a success rate of 98%[16].

Several materials were used and regardless of the material, the gains were evaluated both in height and in the thickness of the alveolar bone. Most studies used membrane as a barrier in the grafted area. Regardless of the surgical technique used and the biomaterials, the studies were evaluated to obtain a success rate in the hard tissue gain as well as the success rate of the implants placed in the surgical areas.

All studies have shown efficacy in post-extraction alveolar preservation. The aim of bone regeneration is directly linked to a better result of a better implant placement, giving better results in finishing the prosthetic phase, as well as minimizing the number of surgeries (donor area), and may even opt for a larger implant diameter[6,7,17].

CONCLUSION

This review confirmed the efficacy of alveolar preservation in relation to decreased alveolar bone resorption after extraction with biomaterials, regardless of the types used. Thus, it is feasible to use these materials to reduce alveolar bone resorption in order to avoid donor area surgery.

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Table 1. Summary of studies and their main results for the success rate with respect to bone gain or reduction of resorption (ANNEX)

			OUTCOMES				
Study	Patients	Intervention and Method	SUCCESSFUL INDEX	HIGHER BONE GAIN RATE	LOWER GAIN RATE	SUCCESSFUL RATE	FAILURE RATE
Perelman--Karmon et al. (2012)	2	Filling using bovine bone with membrane	—	35.2% coronal 47% apical	—	—	—
Borgonovo et al. (2012)	—	Frozen human fresh homolog bone provided by bone bank	Positive	Positive	—	—	—
Almasri et al. (2012)	3	DFDBM in mandible Respectively, imaplants 6,9,12 months after grafting Crown 3,3,5 resp.	100%	Positive	—	100%	—
Nissan et al. 2011	40	Spongy bone in atrophic maxilla Implants	98.8%	—	—	98.8%	—
Barone et al. 2012	40	"Test group: porcine bone graft Control group: unassisted healing Both received implants"	—	—	—	Success rate implants: 95%	Test group: lost 1 implant Control group: lost 1 implant
Sisti et al. (2012)	20	" Extraction of only one tooth in the maxilla in the premolars regions • Natural healing • Assisted healing (hydroxyapatite) • Implant"	—	Positive	—	Positive	—
Acocella et al. (2012)	16	Allogeneic tibial graft in atrophic maxilla	—	—	—	—	—
Baldini et al. (2011)	—	Deproteinized bovine bone	—	Deproteinized bovine bone has osteoconductive properties that can improve the bone regeneration of periodontal defects	—	—	—
Wallace et al. (2010)	—	Intra or extra oral autogenous bone. Cited: spongy bone	—	—	—	Presented positive	—
Mardas et al. (2010)	"• 27 • 1 paciente não concluiu o estudo"	"Exo: inc. Can. Pre Filling with • Straumann (ceramic bone) • Filling with Bio Oss (deproteinized) Both covered with collagen membrane"	Both groups had preservation of width and interproximal bone height of the alveolar ridge.	—	—	Positive	—
Horowitz et al. (2012)	—	Extraction and Alloplastic filling, composed of pure--phase beta-tricalcium phosphate (beta-TCP)) in the alveolus, covered with membrane barriers	All surgical areas had good preservation tolerance, with vital bone replaced by the biomaterial	—	—	Positive	—

Carinci et al. (2009)	21	· Grafting with fresh frozen bone in the mandible and 63 implants placed. Total edentulism (10 cap) Partial edentulism (11 cap) 63 totaled implants	__	__	__	97% of the implants	3% lost implants
Cardaropoli et al. (2008)	10	Single extraction in the posterior area received a bone substitute, with membrane	__	It was possible to maintain 85% of the initial vestibular alveolar and lingual dimensions	__	__	__
Nissan et al. (2011)	31	"• 63 implants were placed in the recipient areas (anterior atrophic maxilla) of block graft with lyophilized bone • 19 immediate implants • 46 spongy blocks"	Survival rates of the blocks were 95.6% Implant survival rate 98%	__	Ridge preservation processes are effective in limiting horizontal and vertical ridge changes in post-extraction sites	__	__
Darby et al. (2009)	37	Several techniques, methodologies, durations and materials were presented in the evaluation publications, making difficult a direct comparison	__	__	__	__	__
Levin et al. (2012)	6	Implants in preserved areas with rhBMP-2	100%	__	__	__	__
Vignoletti et al. (2012)	14	· Alveolar preservation after extraction · Not mentioned miscellaneous biomaterial	__	1.830 mm	1.47 mm	__	The advantage of preservation therapy has been shown to result in significantly less vertical and horizontal resorption of the alveolar bone ridge

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