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Changes of the alveolar bone ridge using bone mineral grafts and collagen membranes after tooth extraction: A systematic review with meta-analysis

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ADMINISTRATIVE INFORMATION

Support - None.

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 22 February 2024 and was last updated on 22 February 2024.

INTRODUCTION

Review question / Objective Are bone mineral grafts and collagen membranes effective in alveolar bone ridge preservation (ABRP)? The research question was posed according to the PICO format and included intervention studies in adult patients undergoing dental extractions (P) comparing treatment with bone mineral grafts and collagen membranes (I) with spontaneous healing of the alveolus or with other different graft materials (C) to observe the effects on clinical and radiographic parameters (O), with only randomized clinical studies (s) being considered.

Rationale The present review aimed to evaluate the efficacy of bone mineral grafts and collagen membranes in ABRP after tooth extraction.

Condition being studied Dental extraction causes resorption of the alveolar ridge, starting this process immediately after extraction and causing a decrease in the vertical and horizontal dimensions of the alveolar ridge during the first 24 months. To preserve the original dimensions of the ridge after extraction, either for esthetic or functional purposes or both, multiple techniques of grafting and bone substitutes in the empty socket, stabilized by resorbable or non-resorbable membranes, or simply by securing the blood clot with these membranes, have been proposed.

METHODS

Search strategy Two reviewers (NL-V, BMS) independently searched four electronic databases (MEDLINE/PubMed, Embase, Cochrane Central, Web of Science) through January 2024 using the terms Medical Subject Headings (MeSH): Oral

Surgery Procedures* OR Surgery, Oral* AND Alveolar Bone Loss* / prevention & control AND Alveolar Process / surgery AND Alveolar Ridge Augmentation* AND Biocompatible Materials AND Bone Transplantation AND Bone Regeneration AND Guided Tissue Regeneration AND Membranes OR Collagen Membranes AND Humans*. In addition, they performed a manual search and consultations in the gray literature, as well as consultations of the bibliographic references of the studies included in the review. All this in order to obtain as much information as possible and to avoid bibliographic bias.

Participant or population Adult subjects undergoing dental extractions.

Intervention Bone mineral grafts and Collagen membranes.

Comparator Spontaneous healing or other grafting materials.

Study designs to be included RCTs.

Eligibility criteria The original research studies were selected according to the following inclusion criteria: (i) randomized clinical trials (single or double blind) that included in the study more than 10 adult subjects (≥ 18 years); (ii) with alveolar bone preservation needs; (iii) that provided data on clinical and radiological measurements on width, height and volume of the alveolar bone crest; (iv) with statistical methods that included mean numerical values and standard deviation; (v) published in English. Studies that did not follow all the above criteria, with lack of relevant data, preclinical studies or in vitro studies, case series or clinical cases, literature reviews and irrelevant studies (letters to the Editor, congress abstracts...) were excluded.

Information sources MEDLINE/PubMed, Embase, Cochrane Central, Web of Science.

Main outcome(s) The electronic search found 561 results, which after eliminating duplicates constituted 65 unique citations. Twenty-two full-text publications were evaluated and 11 were excluded based on established criteria, resulting in 12 articles for evaluation.

Quality assessment / Risk of bias analysis The risk of bias assessment of included studies using the Cochrane Risk of Bias Tool (RoB2) found no studies scoring positively in all domains. Random sequence generation (selection bias), incomplete outcome data (attrition bias), and selective

reporting (reporting bias) were the domains with the highest compliance. Blinding of participants and staff and blinding in outcome assessment (performance and dropout biases, respectively) were unclear or noncompliant in the included studies.

Strategy of data synthesis Data were analyzed using Review Manager software (RevMan Software. Version 5.4.1, The Cochrane Collaboration, Copenhagen, Denmark; 2020). Due to the heterogeneity of the results, a random-effects meta-analysis was performed for studies that assessed BCW and for those that assessed BCH. CBV was reported by only one study. All were based on mean difference (MD) and standard deviation (SD) for estimating continuous data and for assessing categorical data, with 95% confidence intervals (CI). Heterogeneity was considered low with $I^2 = 0-30\%$; moderate, with $I^2 = 40-50\%$; substantial with $I^2 = 60-75\%$ and high with $I^2 \geq 75\%$. The threshold for statistical significance was set at $p < 0.05$. No meta-analysis of adverse effects was performed due to the scarcity of reports on the subject.

Subgroup analysis Meta-analyses were performed for pooled studies evaluating BCH and BCW and for those comparing bone mineral graft and collagen membranes with spontaneous healing of the postextraction alveolus.

Sensitivity analysis Not applicable.

Country(ies) involved Spain, Portugal.

Keywords socket preservation; bone regeneration; bone mineral graft; collagen membrane; Randomized Clinical Trial.

Contributions of each author

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