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The impact of different activation protocols of rapid maxillary expansion on external root resorption: A systematic review and meta-analysis

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ADMINISTRATIVE INFORMATION

Support - N/A.

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

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202430057

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 14 March 2024 and was last updated on 14 March 2024.

INTRODUCTION

Review question / Objective This study aims to investigate the effect of RME on external root resorption through a comprehensive meta-analysis of relevant literature.

Condition being studied External root resorption (ERR) is an inflammatory reaction that usually occurs in orthodontic therapy, the reasons for which are complex. ERR is unfavorable since it might affect the long-term viability of the dentition. The etiologic factors of ERR are complex and multifactorial, including individual biological variability, genetic predisposition, and the effect of mechanical factors. ERR is a highly complex sterile inflammatory process involving various components such as forces, tooth roots, bone, cells, surrounding matrix, and certain known biological messengers. ERR could be further

catalogued into surface, inflammatory, and replacement RR. The progression and clinical prominence differ among the categories of RR. ERR possibly leads to widespread tooth devastation, causing tooth loss. Though ERR might happen in any tooth, it frequently implicates the maxillary incisors.

Rapid maxillary expansion (RME), also known as rapid palatal expansion (RPE), was primarily depicted by Angell et al. and remains an intrinsic part of orthodontic healing methods till now. RME has been employed as a regular medical technique, with the principal purpose of routinely divorcing the palatine suture with maxilla crosswise contraction, profound palatal arch, and posterior crossbite. At present, the main types of RME are tooth-borne (TB), tooth-tissue-borne (TTB), and bone-borne (BB). Hyrax is the most used TB RME, and Haas is the most used TTB RME in the clinic. BB RME is seldom used in clinics because of its

severe trauma. Tooth-bone-borne (TBB) is a modified RME with microscrew implant anchorage to achieve the therapeutic effect of BB. Compared with traditional RME, TBB and BB are considered to have more osseous development effects and less dental development effects. However, the studies need comparative data on root resorption after RME with TB and BB expanders.

Thus, this review aims to explore the root resorption of patients treated with RME and compare the root resorption of patients treated with different RME to provide a more scientific basis for clinical practice.

METHODS

Participant or population In patients with narrow upper dental arch and transverse underdevelopment, the first premolars and first molars have erupted in mixed or permanent dentition.

Intervention N/A.

Comparator N/A.

Study designs to be included The protocol was settled based on the Cochrane Handbook¹⁶ for systematic review [14] and Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) declaration.

Eligibility criteria N/A.

Information sources Electronic databases, including the Cochrane Library, EMBASE, LILACS, MEDLINE, PubMed, and the Web of Science, were retrieved for relevant articles.

Main outcome(s) This meta-analysis systematically reviewed the literature on the relationship between RME and root resorption. The results showed that evident root resorption occurred after TB support, TTB support, and BB RME treatment. Compared with TB support RME, BB support did not significantly reduce root resorption.

Additional outcome(s) N/A.

Quality assessment / Risk of bias analysis Studies were assessed for quality using the Cochrane Bias Risk Assessment Tool for randomized controlled trials (RCTs) and the methodological index for non-randomized studies (MINORS) for other study designs.

Strategy of data synthesis Two investigators individually assessed the literature quality and extracted data from the included articles. If there is a disagreement, the supervisor might determine the puzzle and reach a final resolution. Data extraction included first author, publication year, country, study region, objects of research, interventions, outcome indicators, and measuring time. The Cochrane Bias Risk Assessment Tool was used to assess the bias of RCTs, while the methodological index for non-randomized studies (MINORS) was used for other studies. Articles of poor quality would be eliminated from this meta-analysis.

Subgroup analysis Subgroup analyses comparing different types of RME also revealed significant differences in root resorption.

Sensitivity analysis The sensitivity analysis was conducted to recognize influential cases with apparent heterogeneity. The funnel plot was created to investigate the potential publication bias of the meta-analysis.

Country(ies) involved China.

Keywords Rapid maxillary expansion; External root resorption; Meta-analysis, Orthodontic treatment.

Contributions of each author

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