Effect of orthodontic treatment with 4 premolar extractions compared with nonextraction treatment on the vertical dimension of the face: A systematic review

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Introduction: Our aim was to assess the available evidence for the effects of orthodontic treatment with 4 premolar extractions on the skeletal vertical dimension of the face compared with nonextraction treatment. **Methods:** Electronic database searches (MEDLINE, EMBASE, Cochrane Oral Health Group's Trials Register, and CENTRAL) of published and unpublished literature and hand searches of eligible studies were performed, with no language or publication date restrictions. Two authors performed data extraction independently and in duplicate. Risk of bias was assessed. **Results:** After application of the eligibility criteria, 14 studies were included in this systematic review. All were retrospective. Risk of bias ranged from moderate to critical. Ten studies investigated patients with various skeletal vertical patterns and classes of malocclusion and found no difference between extraction (Ex) and nonextraction (Nonex) treatment in regard to the vertical dimension. Only 2 studies found statistically significant increases in the nonextraction groups, one in N-Me (Ex: +1.5 mm; Nonex: +5.5 mm; P <0.05) and one in SN-GoGn (Ex: −0.9°; Nonex: +0.8°; P <0.05), but without a concurrent significant change in other vertical measurements such as FMA. Two other studies showed opposite findings regarding N-Me (Ex: +2.3 mm; Nonex: +0.9 mm; P <0.05) and FMA (Ex: +0.3°; Nonex: −2.0°; P <0.05). **Conclusions:** Although the quality of evidence ranged from moderate to low, there was considerable agreement among these studies, suggesting that orthodontic treatment with 4 premolar extractions has no specific effect on the skeletal vertical dimension. Thus, an extraction treatment protocol aiming to reduce or control the vertical dimension does not seem to be an evidence-based clinical approach. (Am J Orthod Dentofacial Orthop 2018;154:175-87)

Extractions for orthodontic purposes have always been a controversial issue in contemporary treatment planning. When linked to the control of the vertical dimension during orthodontic treatment, this may be an additional major disputation. It has been advocated that changes in vertical dimension during growth may also influence the anteroposterior position of the mandible and the establishment of the permanent occlusion.[1]

For many years, posterior tooth extractions have been suggested, especially in long-face patients to control the vertical dimension.[2] It has been recommended that extracting permanent teeth may correct an open bite or reduce the vertical dimension of the face by counterclockwise rotation of the mandible, through the forward movement of the posterior teeth: the wedge-type effect.[3-5] According to various authors, extractions lead to reduction of the vertical dimension not only in hyperdivergent patients, but also in those with skeletal open bite.[6,7] On the other hand, other studies reported no distinct effects of extraction treatment on the facial vertical dimension.[8,9]

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All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and none were reported.
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Submitted, January 2018; revised and accepted, March 2018.
0889-5406/$36.00
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https://doi.org/10.1016/j.ajodo.2018.03.007

Hyperdivergent patients comprise a significant part (22%) of the orthodontic patients treated worldwide.[10] Thus, the selection of an extraction vs a nonextraction treatment protocol in regard to effects in the vertical dimension is a common decision made in every practice. The contradictory findings of previous studies, however, do not allow for evidence-based decision making, leading, in turn, to extremely different strategies applied to patients by various clinicians.

Therefore, the aim of this review was to systematically search the literature to evaluate the effects of 4 premolar extractions compared with nonextraction treatment on the skeletal vertical dimension of the face.

MATERIAL AND METHODS

Protocol and registration

The protocol was not registered prior to the study.

Selection criteria applied for the review

Any study design was considered eligible for inclusion in this review, including randomized clinical trials, nonrandomized or quasi-randomized controlled trials, and prospective and retrospective studies with a treated comparison or control group.

Patients of any age having orthodontic treatment with full fixed appliances in the maxilla and mandible were eligible.

Orthodontic therapy with fixed appliances including 4 premolar extractions (1 in each quadrant) were eligible.

For the control or comparison group, we chose orthodontic therapy with fixed appliances, but without tooth extractions.

The outcome was the effects on the vertical dimension of skeletal craniofacial structures, quantitatively assessed on radiographic images.

The follow-ups included before and after orthodontic treatment evaluations.

Exclusion criteria were animal and in-vitro studies, studies involving orthognathic surgery, and case reports or studies reporting outcomes from fewer than 10 patients.

Search strategy for identification of studies

Detailed search strategies were developed and appropriately revised for each data base, considering the differences in controlled vocabulary and syntax rules. The following electronic databases were searched: MEDLINE (via Ovid and PubMed, from 1946 to August 2, 2017; Appendix), EMBASE (via Ovid), Cochrane Oral Health Group's Trials Register, and CENTRAL.

Unpublished literature was searched on ClinicalTrials.gov, the National Research Register, and Pro-Quest Dissertation Abstracts and Thesis database. We attempted to identify all relevant studies irrespective of language. The reference lists of all eligible studies were hand searched for additional studies.

Selection of studies

Studies were selected independently and in duplicate by 2 authors (G.K., K.D.) who were not blinded to the identity of the authors of the studies, their institutions, or the results of their research. Study selection procedures comprised reading of titles, abstracts, and full texts. After they excluded noneligible studies, the full report of publications considered eligible for inclusion by either author was obtained and assessed independently. Disagreements were resolved by discussion and consultations with other authors (I.D., N.G.). A record of all decisions on study identification was kept.

Data extraction and management

Data extraction was performed independently and in duplicate by the first 2 authors (G.K., K.D.). To record the desired information, customized data collection forms were used. Disagreements were resolved in reevaluations of the original studies by both authors and discussions with the last author until consensus was reached.

Measures of treatment effect

For continuous outcomes, mean differences and standard deviations were used to summarize the data from each study.

Unit of analysis

In all cases, the unit of analysis was the patient.

Missing data

We contacted the authors via e-mail to request information that was missing. In case of no response, only the available data were reported and analyzed. For missing standard deviations, data could be retrieved if t statistics or P values were reported. When P values were reported as $P=0.000$, we considered them rounded values and made a worst case scenario hypothesis, imputing the value to be 0.0004 instead.

Assessment of heterogeneity

Heterogeneity can be divided into 3 forms: clinical, methodological, and statistical.[11] We assessed clinical heterogeneity by examining the characteristics of the studies, the similarities between the participants, the

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