Prevalence of extraction space reopening in different orthodontic treatment protocols

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Introduction: In this study, we aimed to compare the amount and frequency of extraction space reopening after 2- and 4-premolar extraction treatments in Class II and 4-premolar extractions in Class I malocclusion patients. **Methods:** The sample comprised 105 subjects with full-cusp Class II and Class I malocclusions, divided into 3 groups. Group 1 consisted of 33 full-cusp Class II malocclusion patients treated with a 2-premolar extraction protocol. Group 2 had 34 full-cusp Class II malocclusion patients treated with 4-premolar extractions, and group 3 included 38 Class I malocclusion patients treated with 4-premolar extractions. The Peer Assessment Rating index was used to assess initial malocclusion severity and quality of the occlusal outcome, measured on dental casts. The amounts of extraction spaces were measured with a digital caliper on the final and long-term posttreatment dental casts, after an average of 9.79 years posttreatment. Intergroup comparisons were performed by analysis of variance, followed by Tukey tests and chi-square tests. **Results:** There were no significant differences regarding the amount and frequency of extraction space reopening among the groups. **Conclusions:** Two- and 4-premolar extractions in Class II and 4-premolar extraction treatment in Class I malocclusion patients show similar reopening of extraction spaces in the long term. (Am J Orthod Dentofacial Orthop 2017;152:320-6)

The goals of orthodontic treatment are not only correction of the malocclusion and the tooth alignment, but also stability of the results.[1] Generally, dental extractions are included in orthodontic treatment to meet the patient's functional and esthetic demands, and also to improve stability of the corrections.[2] Nevertheless, reopening of extraction spaces is commonly observed.[3-7]

Although the etiology of dental extraction space reopening has not yet been explained in the literature, some factors may influence this type of relapse, such as inadequate dental interdigitation, lack of root parallelism, imbalance between intraoral and extraoral forces, lack of a proper retention protocol, and distortion of the periodontal fibers.[2,8]

Typically, Class I malocclusions can be treated without or with extraction of 4 premolars to obtain space for correct tooth positioning and to provide good facial esthetics. With Class II malocclusions, treatment can be carried out without extractions, with extraction of 4 premolars, or extraction of only 2 maxillary premolars. When 2 maxillary premolars are extracted, the molar relationship is not corrected, and there is only retraction of the maxillary anterior teeth. These treatment mechanics are occlusally more efficient than nonextraction and 4-premolar extraction protocols.[9-12] However, there is speculation that there may be more extraction space reopening in the 2-maxillary premolar extraction protocol compared with the others.[13,14]

Therefore, to investigate this speculation, the objective of this study was to compare the frequency and amount of extraction space reopening of Class II malocclusions treated with 4-premolar and 2-maxillary premolar extractions and Class I malocclusions treated with 4-premolar extractions.

MATERIAL AND METHODS

This study was approved by the ethics in research committee of the Bauru Dental School at the University of São Paulo, Brazil.

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The sample size was calculated based on an alpha significance level of 0.05 and a beta of 0.2 to achieve 80% test power to detect a mean difference of 0.27 mm with a standard deviation of 0.39 mm in extraction-site reopening between the groups.[15] The results showed that 33 patients per group were needed. To increase the power even more, the groups included 33, 34, and 38 patients.

The sample was selected from the files of the Department of Orthodontics at Bauru Dental School, University of São Paulo. Group 1 consisted of 33 patients with complete bilateral Class II malocclusions (19 boys, 14 girls), with an initial mean age of 13.44 years, treated with 2 maxillary first premolar extractions, during a mean time of 2.21 years. This group was evaluated after a mean long-term posttreatment time of 9.59 years. Group 2 consisted of 34 patients with complete bilateral Class II malocclusions (19 boys, 15 girls) with an initial mean age of 13.07 years, treated with 4 first premolar extractions, during a mean time of 2.42 years. This group was evaluated after a mean long-term posttreatment time of 9.89 years. Group 3 consisted of 38 patients with Class I malocclusions (17 boys, 21 girls), with an initial mean age of 13.53 years, treated with 4 first premolar extractions, during a mean time of 2.26 years. This group was evaluated after a mean long-term posttreatment time of 9.89 years. The additional inclusion criteria were all permanent teeth up to the first molars, no supranumerary or impacted teeth, no tooth shape or size anomalies, no periodontal surgeries at the extraction sites, complete orthodontic records, and a minimum of 3 years posttreatment follow-up. The maxillary retention protocol of all patients consisted of a removable Hawley plate used continuously, except during meals, for 6 months and only during sleeping for an additional 6 months. The mandibular retainer consisted of a bonded canine-to-canine lingual wire used during a mean period of 3 years.

In the Class II malocclusions, the mechanics used with the standard fixed edgewise appliances included 0.022 × 0.028-in conventional brackets, associated with extraoral headgear and lip bumpers to reinforce anchorage for the maxillary and mandibular teeth, respectively, when necessary. Class II elastics were also used when applicable, especially in the 4-premolar extraction protocol, to aid in correcting the Class II anteroposterior relationship. There was no anchorage preparation. The usual wire sequence began with a 0.015-in Twist Flex or a 0.016-in Nitinol wire, followed by 0.016, 0.018, 0.020, and 0.019 × 0.025 or 0.018 × 0.025-in stainless steel wires (3M Unitek, Monrovia, Calif). In extraction treatment, the canines are initially retracted a small amount to allow space for leveling and alignment of the anterior teeth. The anterior teeth were retracted en masse with the rectangular wire, after leveling and aligning, with elastic chains. There was only maxillary anterior retraction in the 2 maxillary premolar extraction group. Deep overbites were usually corrected by reversing and accentuating the curve of Spee of the stainless steel archwires until obtaining overcorrection. This overcorrection was maintained by accentuating and reversing the curve of Spee in the rectangular wire as well.

The Class I malocclusions had similar mechanics except for the mechanics to correct the Class II anteroposterior discrepancy.

The initial mandibular crowding was measured using Little's irregularity index.[16] The initial maxillary crowding was also measured using a method similar to Little's irregularity index.[17,18]

The peer assessment rating (PAR) index[19] was calculated on the pretreatment and posttreatment dental study models of each patient, according to the American weightings suggested by DeGuzman et al,[20] by an examiner (D.P.V.). Initial and final occlusal characteristics were ranked by scores for molar and premolar anteroposterior relationships, overjet, overbite, midline, crossbite, and crowding to quantify the initial malocclusion severity and the occlusal treatment results.

The frequency and the amount of extraction space reopening were assessed on the posttreatment and long-term posttreatment dental casts of the 3 groups by the same calibrated examiner. The amounts of extraction space reopening were measured with a 0.01-mm precision digital caliper (Mitutoyo America, Aurora, Ill). The extraction spaces were measured in all quadrants; in group 1, a zero value was attributed to both mandibular quadrants where no extractions were performed. The following variables were measured or calculated.

1. Space between the maxillary right canine and second premolar proximal surfaces at the end of treatment.
2. Space between the maxillary right canine and second premolar proximal surfaces at the long-term posttreatment stage.
3. Space between the maxillary left canine and second premolar proximal surfaces at the end of treatment.
4. Space between the maxillary left canine and second premolar proximal surfaces at the long-term posttreatment stage.
5. Space between the mandibular right canine and second premolar proximal surfaces at the end of treatment.
6. Space between the mandibular right canine and second premolar proximal surfaces at the long-term posttreatment stage.
7. Space between the mandibular left canine and second premolar proximal surfaces at the end of treatment.