Prevalence of gingival recession after orthodontic tooth movements

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Introduction: This study was designed to evaluate the long-term prevalence of gingival recession after orthodontic tooth movements, focusing on the effects of mandibular incisor proclination and expansion of maxillary posterior teeth. **Methods:** Records of 205 patients (162 female, 43 male) were obtained from 2 private practice orthodontists. Using pretreatment (age, 14.0 ± 5.9 years) and posttreatment (age, 16.5 ± 6.0 years) lateral cephalograms and dental models, mandibular incisor proclination and maxillary arch widths were measured. Gingival recession was measured based on posttreatment and postretention (age, 32.3 ± 8.5 years) intraoral photographs and models. Associations between tooth movements and gingival recession were evaluated statistically. **Results:** Only 5.8% of teeth exhibited recession at the end of orthodontic treatment (only 0.6% had recession >1 mm). After retention, 41.7% of the teeth showed recession, but the severity was limited (only 7.0% >1 mm). There was no relationship between mandibular incisor proclination during treatment and posttreatment gingival recession. Incisors that finished treatment angulated (IMPA) at 95° or greater did not show significantly more recession than did those that finished less than 95°. There were weak positive correlations ($r = 0.17$-0.41) between maxillary arch width increases during treatment and posttreatment recession. **Conclusions:** Orthodontic treatment is not a major risk factor for the development of gingival recession. Although greater amounts of maxillary expansion during treatment increase the risks of posttreatment recession, the effects are minimal. (Am J Orthod Dentofacial Orthop 2017;151:851-9)

Gingival recession refers to the exposure of the tooth's surface by an apical shift of the gingiva.[1] Recession is important because it can lead to poor esthetics,[2,3] tooth hypersensitivity,[4] loss of periodontal support,[5] difficulties in maintenance of oral hygiene,[6,7] and increased susceptibility to caries.[8-10] Although its etiology is not fully understood, periodontal disease[11-13] and mechanical trauma[11,14,15] are considered the primary factors in the pathogenesis of gingival recession.

Orthodontic treatment might also promote the development of gingival recessions.[16] It has been well established that orthodontic forces can move roots close to or through the alveolar cortical plates, leading to bone dehiscences.[17-19] Since areas of recession always exhibit dehiscences in the subjacent alveolar bone, it is reasonable to assume that the marginal gingiva, without proper alveolar bone support, might migrate apically and expose the root.[20] However, animal experiments have demonstrated little or no recession, over the short term, associated with excessively proclined teeth, despite the development of bony dehiscences.[17-19] This suggests that either more time may be necessary for recession to develop or recessions do not necessarily occur when dehiscences are created.

Clinically, the association between mandibular incisor proclination and recession remains unclear. Most studies evaluating recession shortly after treatment showed no relationship.[21-25] The few studies that investigated the long-term relationship between mandibular incisor proclination and recession are controversial; 2 showed no relationship,[24,26] and 1 did.[27] The study that showed a relationship had a relatively small sample compared with other studies. Only 1 long-term study of adolescents, who represent the typical orthodontic population, has been conducted.[24] It is also important to evaluate the association between recession and maxillary expansion. Expansion causes dental tipping and loss of buccal alveolar bone, which could increase the risk of recession.[17,19,28]

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The purpose of this study was to evaluate the long-term prevalence of gingival recession after orthodontic movement of the mandibular incisors, maxillary premolars, and maxillary first molars. It will be the first study to evaluate the long-term effects (approximately 16 years posttreatment at 32.3 years of age) effects of maxillary expansion on the buccal soft tissues. The specific aims were the following.

1. Determine the prevalence and extent of recession immediately after orthodontic treatment and after a long-term follow-up period.
2. Evaluate the relationships between mandibular incisor proclination during treatment and long-term recession.
3. Evaluate the relationship between maxillary expansion during treatment and long-term recession.

MATERIAL AND METHODS

A retrospective sample of 327 patients from 2 private orthodontic practices in Arlington and Dallas, Tx was evaluated. The selection criteria included records at the beginning of treatment (T1), the end of treatment (T2), and at long-term (at least 2 years after appliances removal) follow-up (T3). Treatments lasted an average of 2.5 years, starting at age 13.9 ± 5.9 years and ending at 16.5 ± 6.0 years. The long-term follow-up occurred at age 32.3 ± 8.5 years. A total of 205 patients were included in the study. Missing records or records taken too close to the appliance removal date were the reasons that all patients were not included in the study. Female subjects comprised the majority (78.7%) of the sample. Approximately 59.9% of the sample was treated with premolar extractions; approximately 6% had second premolar extractions. The sample included 92 (44.5%) Class I subjects, 109 (52.7%) Class II subjects, and 6 (2.9%) Class III subjects. Most patients were retained for 3 years. Some had their retainer removed by their general dentist before 3 years. To eliminate the possibility of inflamed gingiva obscuring the gingival recession, patients were excluded if the final treatment models and intraoral photographs were taken less than 2 weeks after debonding of the appliance. The T2 records of patients in this study were taken 4 to 8 weeks after debonding. Two patients had congenitally missing mandibular incisors.

For each subject, the frontal and buccal intraoral photographs taken at T2 and T3 were evaluated. In addition, their cephalometric radiographs were evaluated at T1 and T2. The intraoral photographs and cephalometric radiographs were scanned (300 pixels/in). Five standardized photographs (maxillary occlusal, maxillary frontal, maxillary right buccal, maxillary left buccal, and mandibular frontal) of the models, along with a millimeter ruler used for calibration, were taken at T1, T2, and T3. Information pertaining to ethnicity, Angle classification, expansion type (rapid palatal expansion or archwire), extractions, retention type, retention duration, and dates were obtained from the patients' charts.

Recession was measured bilaterally on the mandibular incisors, the maxillary premolars, and the maxillary first molars at T2 and T3. A score of 0 was recorded if the CEJ was not visible. Recession on the mandibular incisors was defined as the distance between the gingival margin and the cementoenamel junction on the midfacial surface.[21,22,26,28,29] Due to measurement variability, recession on the facial aspect of the maxillary first molars was defined as the maximum distance from the gingival margin to the cementoenamel junction anywhere on the maxillary first molars. When possible, intraoral photographs were used to measure recession because they are more reliable than dental models.[22]

All images were imported into Viewbox cephalometric software (version 4; dHAL Software, Kifissia, Greece). The intraoral photographs were calibrated based on the ratio of the mesiodistal width of the maxillary central incisor at its broadest point, as measured on the dental model, to the same width measurement on the intraoral photographs with the following formula.

Mandibular incisor recession = photographic measured recession × (mesiodistal width of maxillary central incisor measured on model ÷ mesiodistal width of maxillary central incisor measured on photograph).

To measure recession at the maxillary premolars and first molars, a ratio was established based on the distance from the gingival margin to the cusp tip of the maxillary posterior teeth taken on both the models and on the intraoral photographs with the following formula.

Maxillary posterior recession = photographic measured recession × (distance from gingival margin to cusp tip of premolar or molar measured on model ÷ distance from gingival margin to cusp tip of premolar or molar measured on photograph).

When intraoral photographs were not available or their quality was poor (approximately 20% of the time), recession was measured on the scanned models with the Viewbox cephalometric software. Using models to measure recession has been shown to be both valid[29] and reliable.[22]

Technical errors were based on randomly selected sets of replicates: 20 replicate intraoral photographs and 20 casts and associated intraoral photographs. The systematic error for intraoral photographs was not statistically significant, and the intraclass correlations ranged from 0.962 to 0.981. Systematic differences showed slightly (0.026 mm) larger measurements on the casts than the intraoral photograph measurements for the maxillary first