Treatment of Complications Associated with Lower Fixed Retainers

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Bonded retainers are often used to maintain orthodontic treatment results, especially for an increasing number of practitioners advocating long-term or even lifelong retention. Although fixed retainers have been described as effective, safe and predictable, and compatible with periodontal health, long-term retention is not without risks. Failures of fixed retainers, as evidenced by debonding or fatigue wire fracture, are relatively common. Long-term use of fixed retainers is associated with increased calculus and plaque accumulation, with a consequent risk of gingival recession and increased probing depths.

Unexpected complications from fixed retainers, even without wire fractures or debonding, have also been described in the literature. These issues take one of two distinct forms: a torque change of two adjacent upper or lower incisors (X-effect), or an opposite inclination of the contralateral lower canines, occasionally accompanied by twisting of the whole anterior segment and canting of the occlusal plane (twist-effect). Development of small spaces between the anterior teeth has also been noted.

The prevalence of these unexpected complications is estimated to be between 2.7% and 5% of all cases, but the etiology is not well understood. Possible factors include forces of relapse, bonding mistakes such as inadequate passivity of the wire, instability of flexible spiral wires, and wire straightening or activation by mechanical trauma.

The clinical impact of such unforeseen incidents can be significant. One-half of these patients have been reported to require retreatment, depending on the severity of the complication and the amount of unexpected tooth movement. Severe cases may entail serious periodontal involvement, gingival recession, or positioning of the roots outside the skeletal envelope. Improving the root position relative to the surrounding bone has been found beneficial in reducing the extent of bone dehiscences and gingival recession, which can be particularly advantageous prior to reconstructive periodontal therapy. Root-coverage procedures include connective tissue grafts (CTGs), laterally or coronally positioned flap techniques, or a combination of both. Minimally invasive approaches such as envelope or modified tunneling techniques have also been recommended.

This article describes the interdisciplinary treatment of gingival recession resulting from an unexpected complication of a lower bonded retainer, illustrating the difficulties accompanying orthodontic treatment in these relatively rare cases.

Case Report
A healthy 28-year-old female was referred by a periodontist for treatment of gingival recession on her lower right lateral incisor. The patient had previously received orthodontic treatment twice—once for crowding and once for an anterior open bite. Two upper first premolars and one lower cen-
central incisor had been extracted before the first treatment, which used removable appliances. Another lower central incisor was extracted before the second treatment, involving two years of fixed appliances followed by removable and 3-3 bonded retainers in both arches.

After debonding, six years before presenting in our office, the patient was monitored for an additional two years by her orthodontist before she stopped attending recall visits and wearing the removable retainers. The patient reported no rebonding or repair of the fixed retainers, but had observed gradual worsening of her condition, especially at the lower left canine.

Intraoral examination indicated an anterior open bite with canting of the lower occlusal plane and a significant difference in inclination of the contralateral lower canines and incisors (Fig. 1). The left canine and incisor were inclined buccally, while the right canine and incisor were inclined buccally.

![Fig. 1 28-year-old female presenting for retreatment with buccally inclined lower left canine and lateral incisor and lingually inclined lower right canine and lateral incisor (twist-effect).]
lingually (twist-effect),\textsuperscript{11} with a pronounced root prominence and a gingival recession of 4mm at the lower right incisor. The retainer, which appeared to be an .0155” three-stranded twisted wire, had detached from the lower left incisor. The patient displayed frequent bleeding on periodontal probing and an intermediary (thick-scalloped) gingival biotype as described by De Rouck and colleagues.\textsuperscript{19}

A panoramic radiograph revealed mesial inclination of the lower left incisor and canine, poor endodontic treatment of the lower right first molar, and a failing restoration on the lower left first molar; all third molars were absent. Cephalometric analysis showed an excessive mandibular plane angle with a skeletal open bite, a skeletal Class II malocclusion, and retroclined upper and lower incisors. A long and narrow lower anterior alveolar process was also apparent on the cephalogram.

Two treatment plans were proposed. The first consisted of comprehensive orthodontic treatment of both arches, using vertical elastics to close the anterior open bite. The second option was limited to the mandibular arch. Because the patient had already undergone two orthodontic treatments and the aesthetics of the upper teeth were satisfactory, she chose the limited treatment plan. The primary aim was to improve the torque and inclination of all anterior teeth and achieve a more favorable position of the roots in the center of the alveolar bone.\textsuperscript{15} Reconstructive periodontal surgery was planned to cover the exposed root surface of the lower right incisor.

After an initial dental-hygiene appointment and removal of the lower retainer, a fixed appliance was bonded in the lower arch, using a Roth-prescription, preadjusted Victory\textsuperscript{®} appliance with .018” slots for the anterior teeth and .022” slots in the buccal segments and buccal molar tubes. Initial leveling and alignment were carried out on round, superelastic nickel titanium wires. Interproximal enamel reduction was also performed during this stage to eliminate black triangles. Stainless steel lacebacks were added to prevent unwanted flaring of the retroclined lower incisors. An .017” × .025” rectangular nickel titanium wire was then placed to improve the torque of both incisors, later enhanced by finishing bends in the lingual direction to reduce the root prominence of the lower right incisor (Fig. 2). Because the lower alveolar process was so narrow, extreme caution was required so as not to overcorrect the root position and create excessive prominence on the lingual side.

After nine months of orthodontic treatment, a modified tunneling technique with a subepithelial CTG was performed to cover the defect and augment the zone of keratinized gingiva from canine to canine\textsuperscript{18} (Fig. 3). Due to thin soft tissue, the tunnel was prepared full thickness instead of partial thickness, as described by Zuhr and colleagues.\textsuperscript{18} Periosteal and muscular insertions were cut in the depth of the tunnel with a microblade to enable coronal repositioning of the soft tissue. A single-incision technique was used to harvest CTG from the left side of the palate. Connective tissue was carefully placed into the prepared tunnel, and the soft tissues were closed with suspension sutures and positioned coronally with support from the fixed orthodontic appliance. The patient was ad-

![Fig. 2 After eight months of treatment (shortly before completion of orthodontic preparation), showing 1mm reduction of gingival recession.](image-url)
During the three-year retention period, even without occlusal equilibration.

Discussion

The need for retreatment of unexpected complications from a fixed orthodontic retainer depends on the severity of the case. If only minor changes are apparent, removal of the retainer may be sufficient, perhaps accompanied by a minor reduction of the interproximal enamel. When significant changes in tooth positions occur, however, a retreatment with fixed or removable appliances is often necessary. In the most severe cases, involving large bone dehiscences and gingival recessions—as in the patient shown here—an interdisciplinary approach will be required.
Dehiscences may be present when the thickness of a root approaches or even exceeds that of the crestal bone, even if no previous orthodontic treatment has been performed. The prevalence of dehiscences and bony fenestrations is higher in hyperdivergent patients, who usually exhibit longer and narrower alveolar bone than in normo- and hypodivergent patients. Further movement of the roots out of the bony envelope, in this case caused by the active retainer, can have deleterious effects on the cortical plate and increase the risk of gingival recession.

Various periodontal surgery techniques can be used to cover denuded root surfaces. Free gingival grafts have been reported to have inferior results compared to advanced techniques such as coronally advanced flaps, laterally positioned flaps, and a broad range of modifications. The coronally advanced flap, usually combined with a subepithelial CTG or enamel matrix derivative, is the most widely used and best-documented technique and is therefore considered the gold standard for maxillary anterior and premolar locations. More favorable results have recently been demonstrated without the use of releasing incisions.

Several clinicians have developed less invasive, though technically more demanding, approaches using envelope or tunneling techniques. These are reportedly more effective than epithelial grafts due to a higher success rate and better esthetic results, to the extent that the augmented tissue is barely discernible after healing. In more difficult anatomical situations such as those involving limited keratinized mucosa, a strong muscle pull from the lower lip, or a thin gingival biotype, these techniques can provide a decisive advantage in healing. In the case shown here, a modified tunneling technique allowed a small portion of the CTG to stay uncovered, promoting a thickening of the keratinized gingival tissue at the neighboring teeth. Thus, the need for coronal advancement of the gingival tissue was minimized, and healing of the CTG was supported by undamaged papillae.

**Fig. 5 Lower .0215" gold-plated, five-stranded Penta-One** retainer bonded from first premolar to first premolar.

**Fig. 6 Patient three years after debonding.**

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Conclusion

Repeated orthodontic treatment for fixed-retainer complications may take a considerable amount of time and, if an interdisciplinary approach is chosen, may also be expensive. When long-term retention with fixed retainers is prescribed, patients should be encouraged to come in for regular six-month recalls. These patients, as well as their dentists and hygienists, should be informed about the potential for complications and encouraged to take part in active monitoring to prevent them.

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REFERENCES