Orthodontic treatment of a mandibular incisor fenestration resulting from a broken retainer

Marcel M. Farret,[a] Milton M. B. Farret,[b] Gustavo da Luz Vieira,[c] Jamal Hassan Assaf,[a] and Eduardo Martinelli S. de Lima[d]
Santa Maria and Porto Alegre, Rio Grande do Sul, and Florianópolis, Santa Catarina, Brazil

This article describes the orthodontic relapse with mandibular incisor fenestration in a 36-year-old man who had undergone orthodontic treatment 21 years previously. The patient reported that his mandibular 3 × 3 bonded retainer had been partially debonded and broken 4 years earlier. The mandibular left lateral incisor remained bonded to the retainer and received the entire load of the incisors; consequently, there was extreme labial movement of the root, resulting in dental avulsion. As part of the treatment, the root was repositioned lingually using a titanium-molybdenum segmented archwire for 8 months, followed by endodontic treatment, an apicoectomy, and 4 months of alignment and leveling of both arches. The treatment outcomes were excellent, and the tooth remained stable, with good integrity of the mesial, distal, and lingual alveolar bones and periodontal ligament. The 1-year follow-up showed good stability of the results. (Am J Orthod Dentofacial Orthop 2015;148:332-7)

Orthodontic relapse in the anterior region of the mandibular arch is not uncommon.[1] This is predominantly caused by constriction of the transverse distance of the canines,[2] late growth of the mandible,[3] and mesial direction of the occlusal forces.[4] The best available option for avoiding mandibular arch relapse is the use of 3 × 3 bonded retainers, which can be worn for indefinite periods after orthodontic treatment.[5] However, when the flexible wire retainers become activated, crown displacement or torque movements of the roots of the incisors or canines can make retreatment necessary.[1]

Pazera et al[6] reported a case in which the root of the mandibular right canine had moved buccally as a result of a broken 3 × 3 bonded retainer, and they considered it the result of wire deflection during the bonding process or even a mechanical deformation in the posttreatment period. However, since the root did not perforate the soft tissue and also retained its vitality, the authors were able to successfully reposition the root.

Here, we report on a patient who had completed orthodontic treatment 21 years previously but had been wearing a broken mandibular 3 × 3 bonded retainer for 4 years, resulting in accentuated gingival recession and tooth avulsion.

CASE REPORT

The patient was a 36-year-old man who had been diagnosed with both skeletal and dental Class II malocclusion and had been treated in our clinic in Santa Maria, RS, Brazil, with cervical headgear and standard edgewise fixed appliances. The treatment began 24 years previously and had been completed 21 years before this report. Thereafter, the patient had received a maxillary removable retainer and a mandibular 3 × 3 retainer bonded to the 6 anterior teeth. He remained under the orthodontist's observation, with annual posttreatment follow-up examinations for up to 10 years; thereafter, he had no examinations for 11 years. At this point, he returned to the clinic with the complaint of extreme gingival recession on the labial surface of his mandibular left lateral incisor accompanied by pain in the affected tooth under certain conditions.

The clinical examination showed that the bonded retainer was broken between the mandibular right lateral incisor and the canine. Furthermore, the right lateral incisor and the right central incisor had moved lingually; consequently, the left canine had moved labially. In the initial clinical examination, we verified that the

[a]Private practice, Santa Maria, Rio Grande do Sul, Brazil.
[b]Professor and chairman, Department of Orthodontics, Federal University of Santa Maria, Santa Maria, Rio Grande do Sul, Brazil.
[c]Private practice, Florianópolis, Santa Catarina, Brazil.
[d]Professor, Department of Orthodontics, Pontifical Catholic University of Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil.
All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and none were reported.
Address correspondence to: Marcel M. Farret, Floriano Peixoto St. 1000/113, Santa Maria, RS, Brazil 97015-370; e-mail, marcelfarret@yahoo.com.br.
Submitted, August 2014; revised and accepted, April 2015.
0889-5406/$36.00

http://dx.doi.org/10.1016/j.ajodo.2015.04.027

Fig 1. Initial intraoral photographs.

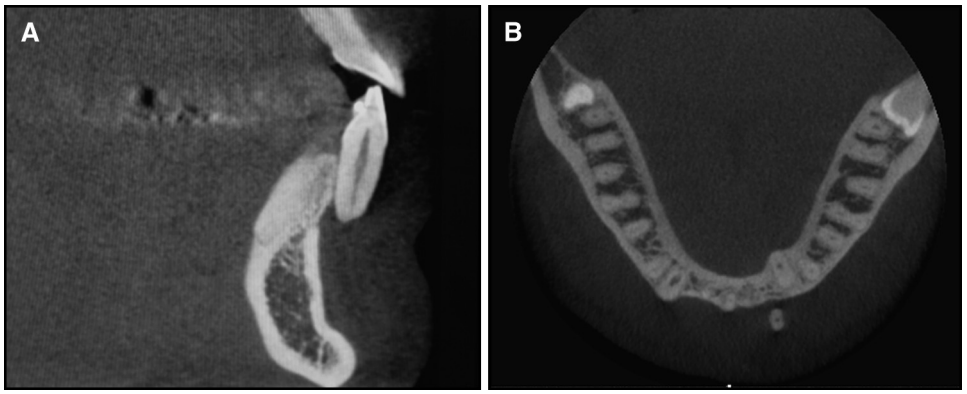

Fig 2. Initial CBCT images: **A,** mandibular left lateral incisor in the sagittal view; **B,** mandibular left lateral incisor in the occlusal view on the apical third of the root.

mandibular left lateral incisor received the complete load of the incisal guidance during mandibular movements. The retainer worked as a support, and the wire became debonded inside the resin of the mandibular left lateral incisor, working as a center of rotation. This system generated an extreme labial torque on the root, causing total fenestration of the root including the anterior contour of the apex (Figs 1 and 2). Unfortunately, the vitality test of this tooth was negative. Likewise, in the maxillary arch, there were accentuated recessions and root abrasions on the left lateral incisor and both canines. Therefore, the chosen line of treatment for the mandibular left lateral incisor involved calcium-hydroxide therapy in the pulp cavity with concomitant tooth repositioning, followed by obturation after tooth movement and an apicoectomy with deep cleaning of the apical region. The maxillary tooth would be aligned and leveled; then the roots of the left lateral incisor and the canines would be restored with compomer.

Fig 3. Segmented mechanics with 0.019 × 0.025-in titanium-molybdenum archwire connected only to the lateral incisor.

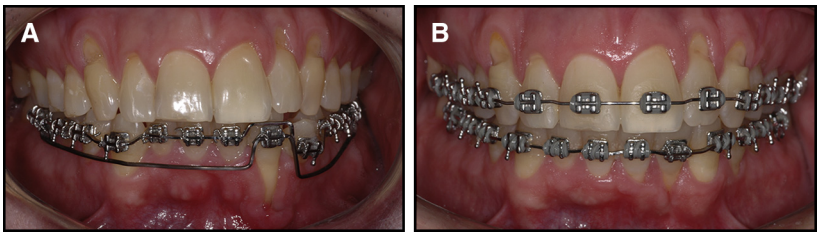

Fig 4. Progress of root lingual movement: **A,** 5 months; **B,** 12 months.

Fig 5. Posttreatment intraoral photographs.

For repositioning the tooth, 0.022 × 0.028-in edgewise standard brackets were bonded only in the mandibular arch. First, a passive 0.021 × 0.025-in stainless steel archwire was inserted in all brackets except that of the mandibular left lateral incisor. Thereafter, the lingual torque of the root was corrected with a 0.019 × 0.025-in titanium-molybdenum wire connected only to the bracket of the mandibular left lateral incisor and activated in 10 g of force in the posterior region between the mandibular second premolars and the first molars on both sides (Fig 3). Because there was about 30 mm of distance between the lateral incisor and the point where the force was applied, a system with a moment of about 300 g of force per millimeter acting over the root was developed. The archwire for torque movement was activated every month for 5 months. By the fifth month, the apex was totally covered with soft tissue; consequently, the apicoectomy was performed (Fig 4). Thereafter, a maxillary orthodontic appliance was bonded, and alignment and leveling were performed for both arches from 0.014-in to 0.019 × 0.025-in stainless steel archwires, along with individual lingual root torque for the mandibular left lateral incisor and labial root torque for the mandibular left canine. After 13 months of treatment and after 1 month of stabilization without activation, the root was completely covered with gingival soft tissue, with only a small gingival defect visible on the labial surface of the root (Fig 5). The posttreatment cone-beam computed tomography (CBCT) image showed that the root was positioned over the alveolar bone and that no regeneration of the buccal wall of the alveolar bone could be achieved. However, some integrity of the mesial and partly of the distal wall surrounding the root was present. The wide alveolar ridge at the level of the mandibular left lateral incisor (Fig 2, *A*) was resorbed because of the lingual root movement, and only a small part of the lingual wall seemed to be present (Fig 6, *A*). However, periodontal probing showed a sulcus depth of only 1 mm labially (Fig 6). Finally, a 4 × 4 retainer of 0.016 × 0.022-in stainless steel wire was bonded to the mandibular arch, and the maxillary arch received a wraparound retainer. At the 1-year follow-up, the results

Fig 6. Posttreatment CBCT images of the mandibular left lateral incisor: **A,** the sagittal view; **B,** the occlusal view; **C,** the frontal view on the cervical third of the root showing the bone mainly in the lingual and mesial walls of the tooth.

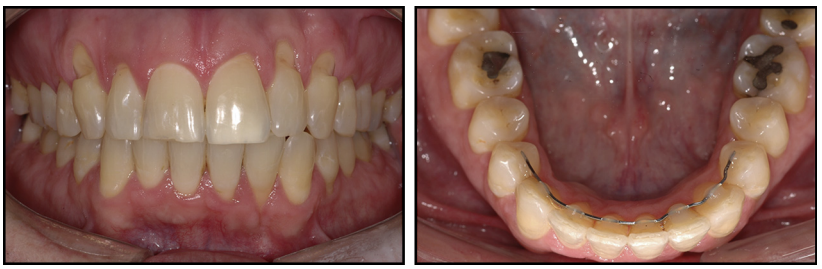

Fig 7. Intraoral 1-year posttreatment photographs.

obtained were totally stable in both clinical or tomographic analyses (Figs 7 and 8).

DISCUSSION

Mandibular anterior crowding has a high incidence of relapse.[4,5] The primary method of preventing relapse is to prevent the posttreatment reduction of the intercanine transverse distance using a 3 × 3 retainer.[5,7] However, this kind of retainer may have negative effects when it becomes totally or partially debonded, as observed in this case. A good practice for preventing these problems is to verify the patient's status at least once a year after treatment.

According to Sifakakis et al,[8] unexpected movements of the mandibular incisors after treatment can have many causes. Some movements may be considered relapse because they are toward the pretreatment position or caused by late craniofacial development, occlusal forces, or elastic fiber traction.[1,6,8] Some other movements may be provoked by an active component in the retainer caused either by the clinician during construction or bonding or by the masticatory forces deforming the wire.[8] Moreover, the fracture or

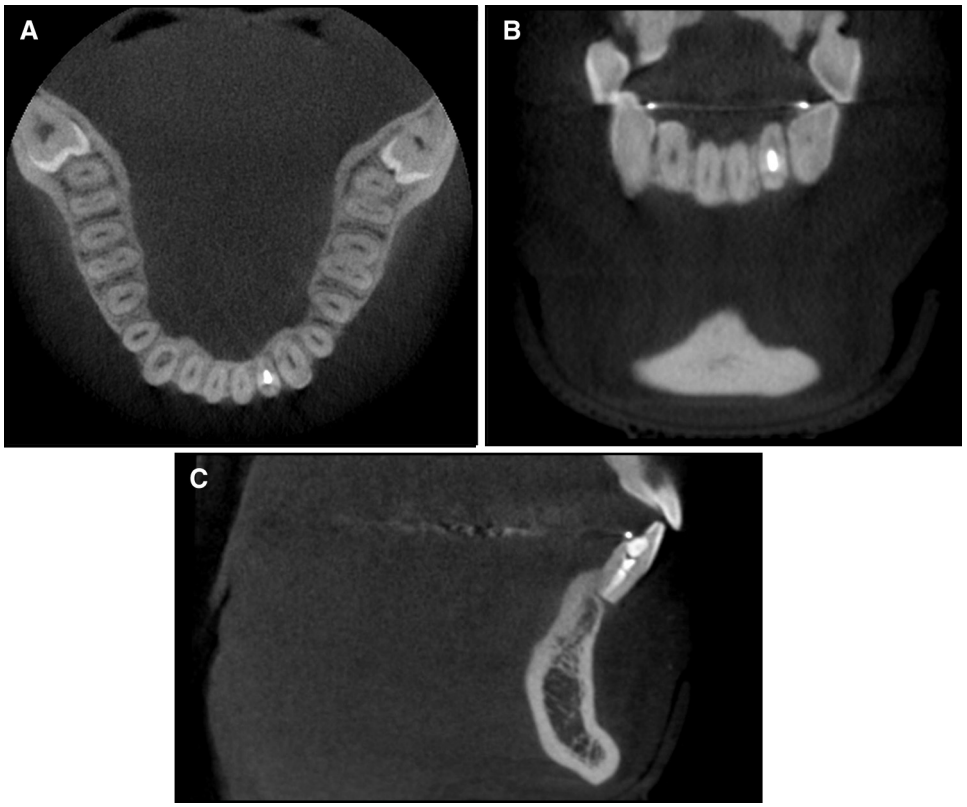

Fig 8. CBCT images at 1 year posttreatment of the mandibular left lateral incisor: **A,** the sagittal view; **B,** the occlusal view; **C,** the frontal view on the cervical third of the root showing a similar pattern as the posttreatment images.

debonding of the mandibular retainers may introduce another unwanted force that can cause large buccal or lingual movements of the mandibular incisors.[6]

Pizzaro and Jones[9] observed some unexpected movements after treatment in patients who used 3×3 flexible wires as a retainer in the maxillary arch; however, because the movements were toward the pretreatment inclination, it could be called a relapse. In the patient described in this article, it was impossible to classify the movements as a relapse because the retainer broke, thus delivering different forces than the forces from relapse. Pazera et al[6] also reported a similar case in which a mandibular bonded retainer broke near the mandibular right canine, resulting in extreme buccal torque on the tooth. The root was then repositioned lingually with good results, and only a minor gingival recession remained. The tomographic images showed that the apex had been successfully relocated into the alveolar bone; however, the remaining buccal surface of the root had no bone coverage except for the lower third of the root. What differentiates the case described by Pazera et al from our patient is that in our patient, the apex and the root did not completely perforate the buccal cortical bone and therefore resulted in minor gingival recession only. According to Chen et al,[10] when the apex perforates the soft tissue and is exposed to the intraoral environment, it worsens the prognosis of the tooth because of the contamination; consequently, the strategy of treatment also changes. In our patient, orthodontic treatment with both endodontic and surgical procedures was necessary to improve the treatment outcome.

For this patient, when evaluating the treatment options we considered alternatives.[2] The first alternative involved extraction of the affected mandibular left lateral incisor and movement of the mandibular left dentition mesially, thus closing the space. However, because it would result in the loss of the tooth, this option was to be used only in case of failure to recover the affected incisor. The second option involved extraction of the affected incisor, followed by implant-prosthetic rehabilitation. However, because this option was more invasive and radical, it was to be considered only if all other options failed.

Machado et al[11] used a continuous archwire to move an incisor root lingually to reduce a moderate recession. To increase the interbracket distance, they did not bond the adjacent teeth and used a continuous archwire of a titanium-molybdenum alloy, creating a more flexible system. In the patient described here, we chose a segmented mechanism rather than a continuous arch because we needed complete control of the force used to torque the root. With a continuous rectangular arch, it would have been impossible to quantify the force used during the activation, whereas the segmented arch allowed precise measurement of the force. Because the patient reported a constantly increasing recession and this labial movement was caused by the incisor guidance, we may consider that this was similar to a system delivering a constant force. Based on that, the option was the segmented titanium-molybdenum arch that can deliver a continuous force over a long time, compared with a continuous arch that delivers an interrupted force.

At the end of the treatment, even without a graft positioned over the root, an excellent gingival pattern was obtained, with minor recession on the buccal surface not accompanied by inflammation. The absence of periodontal pockets was verified by probing after treatment and at 1 year after treatment, also increasing the good prognosis in the long term. This periodontal result after treatment may also result from good gingival width on the buccal surface of the mandibular anterior teeth and good hygiene, without inflammation during and after treatment. Tomographic images in the occlusal view showed bone formation on the mesial, distal, and lingual surfaces of the root of the lateral incisor, thus improving the prognosis of the tooth. The sagittal tomographic image showed a bone defect below the apex, probably caused by the movement of the root through the cortical bone that carried the cortical wall lingually. The mandibular left canine was also repositioned with the apex within the alveolar bone, as seen in the sagittal tomographic image. After debonding, a 4 × 4 retainer made of 0.016 × 0.022-in stainless steel wire was bonded to the 8 anterior teeth, to be used indefinitely as rigid fixation for stabilization of the lateral incisor. Usually, the use of semirigid fixation is recommended after traumatic avulsion of teeth to allow periodontal stimulation during function, but it should be used temporarily for up to 14 days.[12] After the repositioning of the root with torque, the mandibular left lateral incisor was stabilized for 1 month before debonding; after debonding, the use of a rigid retainer with a rectangular wire was considered to be more reliable in terms of stability and greater resistance against fracture compared with a flexible spiral wire, according to Katsaros et al,[1] who had already proposed this type of retainer after a similar treatment. The patient was clinically examined at 3-month intervals to verify the gingival condition of the lateral incisor and the stability of the retainer. At 1 year, the stability of the results was confirmed. The patient will continue to be under close observation through regular follow-up examinations.

REFERENCES

1. Katsaros C, Livas C, Renkema AM. Unexpected complications of bonded mandibular lingual retainers. Am J Orthod Dentofacial Orthop 2007;132:838-41.
2. Rossouw PE, Preston CB, Lombard CJ, Truter JW. A longitudinal evaluation of the anterior border of the dentition. Am J Orthod Dentofacial Orthop 1993;104:146-52.
3. Freitas KM, de Freitas MR, Henriques JF, Pinzan A, Janson G. Post-retention relapse of mandibular anterior crowding in patients treated without mandibular premolar extraction. Am J Orthod Dentofacial Orthop 2004;125:480-7.
4. Richardson ME, Gormley JS. Lower arch crowding in the third decade. Eur J Orthod 1998;20:597-607.
5. Renkema AM, Renkema A, Bronkhorst E, Katsaros C. Long-term effectiveness of canine-to-canine bonded flexible spiral wire lingual retainers. Am J Orthod Dentofacial Orthop 2011;139:614-21.
6. Pazera P, Fudalej P, Katsaros C. Severe complication of a bonded mandibular lingual retainer. Am J Orthod Dentofacial Orthop 2012;142:406-9.
7. Renkema AM, Al-Assad S, Bronkhorst E, Weindel S, Katsaros C, Lisson JA. Effectiveness of lingual retainers bonded to the canines in preventing mandibular incisor relapse. Am J Orthod Dentofacial Orthop 2008;134:179.e1-8.
8. Sifakakis I, Pandis N, Eliades T, Makou M, Katsaroz C, Bourauel C. In-vitro assessment of the forces generated by lingual fixed retainers. Am J Orthod Dentofacial Orthop 2011;139:44-8.
9. Pizzaro K, Jones ML. Crown inclination relapse with multiflex retainers. J Clin Orthod 1992;26:780-2.
10. Chen G, Fang CT, Tong C. The management of mucosal fenestration: a report of two cases. Int Endod J 2009;42:156-64.
11. Machado AM, MacGinnis M, Damis L, Moon W. Spontaneous improvement of gingival recession after correction of tooth positioning. Am J Orthod Dentofacial Orthop 2014;145:828-35.
12. Cengiz SB, Atac AS, Cehreli ZC. Biomechanical effects of splint types on traumatized tooth: a photoelastic stress analysis. Dent Traumatol 2006;22:133-8.