

Inadvertent tooth movement with fixed lingual retainers

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Fixed retainers are effective in maintaining the alignment of the anterior teeth more than 90% of the time, but they can produce inadvertent tooth movement that in the most severe instances requires orthodontic retreatment managed with a periodontist. This is different from relapse into crowding when a fixed retainer is lost. These problems arise when the retainer breaks but remains bonded to some or all teeth, or when an intact retainer is distorted by function or was not passive when bonded. In both instances, torque of the affected teeth is the predominant outcome. A fixed retainer made with dead soft wire is the least likely to create torque problems but is the most likely to break. Highly flexible twist wires bonded to all the teeth appear to be the most likely to produce inadvertent tooth movement, but this also can occur with stiffer wires bonded only to the canines. Orthodontists, general dentists, and patients should be aware of possible problems with fixed retainers, especially those with all teeth bonded, because the patient might not notice partial debonding. Regular observations of patients wearing fixed retainers by orthodontists in the short term and family dentists in the long term are needed. (Am J Orthod Dentofacial Orthop 2016;149:277-86)

The stability of orthodontic treatment is a major concern to both orthodontists and patients. Several long-term studies have demonstrated a strong tendency for relapse of anterior alignment after orthodontic treatment and retention.¹ For this reason, many orthodontists believe that permanent retention with a fixed retainer is the only way to maintain ideal dental alignment after treatment. Examining patients on 20-year recall, Booth et al² found that periodontal health was better in those whose mandibular fixed retainers bonded only to the canines were still in place than in those whose retainers had been lost or removed, so it appears that permanent retainers are not a risk factor for periodontal problems.

It has been shown that a higher percentage of patients with fixed retainers secured only to the canines will have incisor irregularity at 5 years after treatment than if the retainer wire is bonded to the incisors as

well.^{3,4} This has led to increased use of bonding to all teeth, but problems can arise when this is done. Bonding 6 teeth rather than 2 increases the chance of a bond failure within the first 5 years from approximately 20% to 30%.⁵ A more serious problem is major inadvertent tooth movement created by a lingual retainer, which has been the subject of previous case reports but has been considered highly unusual.^{6,7}

Tooth movement produced by a fixed retainer is different from the mild relapse seen occasionally despite the presence of a retainer, especially since it is almost never in the direction of the pretreatment position of the tooth and therefore is not relapse. This article was inspired by a patient who was referred to the office of the senior author (T.G.S.) in 2013 with surprising and unexpected mandibular anterior tooth movement and periodontal damage despite an intact small-diameter fixed retainer wire bonded to each tooth. Her coordinated periodontic-orthodontic treatment is discussed below. Through word of mouth among a few colleagues, a dozen or so other examples of tooth movement created by a fixed lingual retainer were collected, providing an impression of the unrecognized extent of the problem.

Our objectives in this article were to illustrate examples of inadvertent tooth movement created by fixed lingual retainers, discuss the most likely causes, make recommendations for prevention and retention management, and discuss the periodontist-orthodontist interactions in retreatment to correct severe problems.

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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, March 2015; revised and accepted, October 2015.

0889-5406/\$36.00

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<http://dx.doi.org/10.1016/j.ajodo.2015.10.015>

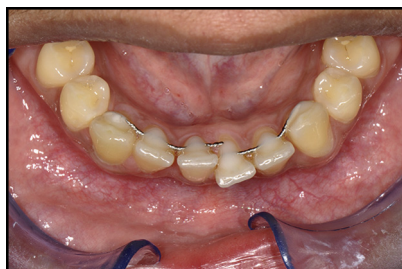


Fig 1. Dead soft wire with breakage between the central incisors, resulting in movement of 2 segments of teeth. Note the torque of the left canine and left central incisor in opposite directions.



Fig 2. Dead soft wire, half missing, with space opening and tooth movement. It is likely that the teeth on the right side were moved by the wire segment on that side before it was ultimately lost.

Examples of retainer-created inadvertent tooth movement

No single fixed retainer type appears to be immune to unexpected and unwanted tooth movement, although tooth movement is more likely when more flexible wires are used.

However, different types of tooth movement and problems are specific to the various retainer designs and wire sizes. This is discussed below relative to the most common fixed retainer types: (1) canine-to-canine plain steel wire (0.025-0.032 in) retained with bonding only to the canines, (2) more flexible 0.032-in spiral wire bonded only to the canines,⁸ (3) smaller diameter (0.0195-0.0215 in) and increasingly flexible spiral wire bonded to each anterior tooth, and (4) dead soft wire of various dimensions bonded to each anterior tooth.

Loss of alignment from inadvertent tooth movement is more likely when wires break. This appears to be most likely with smaller diameter dead soft wires (Fig 1), but it also occurs with small flexible spiral wires bonded to each tooth. Breakage can lead to no retention at all when a wire segment is missing or can lead to independent tooth movement produced by a remaining wire segment (Fig 2).

Transverse changes in the position of one or both canines can occur with small wires bonded to each tooth and are seen with both dead soft wires (Fig 3) and flexible spiral wires (Fig 4). Different types of transverse changes occur with larger diameter wires. A stiffer wire produces a more dependent relationship between the canines than does a smaller wire. Twisting of the wire can result in reciprocal movement of the canines and skewing of the arch form (Fig 5). Downward deflection of a relatively stiff wire can produce expansion across the canines (Fig 6).

Torque discrepancies between adjacent incisors are most likely with smaller diameter flexible spiral wires (Fig 7), but these can also occur with dead soft wires

(Fig 8). In some cases, tooth movement is severe enough to cause periodontal damage (Fig 9). We observed no examples of torque discrepancies between adjacent incisors with larger diameter canine-to-canine wires secured to the canines only.

Fixed lingual retainers to prevent reopening of a maxillary central diastema typically have a flexible wire between these teeth only. Both torque and tipping effects can occur over time (Fig 10). It has been suggested that it would be safer to bond across the diastema from the maxillary lateral incisors, but if a problem arises, the extended flexible wire can displace both the central and lateral incisors (Fig 11).⁹

Causes of inadvertent tooth movement

Wire distortion is one of several possible reasons for retainer-caused tooth movement. If the fixed retainer wire is not passive when placed, it introduces an active force when bonded. It is also possible that a truly passive wire could be deformed during bonding. This could happen when pushing on the wire with a hand instrument to adapt it. The use of a carrier for placement should prevent this, but perfect adaptation is less certain.

Wire deformation could occur in the posttreatment period from biting on hard foods or trauma, which would essentially activate the wire as if the orthodontist had bent it. It also is possible that the patient could distort the retainer wire while flossing the teeth; enough force to do that could be generated with dental floss under the wire. Tongue habits probably do not play a role in deforming retainer wires because of the short duration of tongue pressure.¹⁰ Also, resting tongue pressure against the incisors probably does not play a role because the magnitude of resting tongue pressure is far below the pressure needed to bend a wire.¹¹ Fortunately, a force heavy enough to distort a retainer wire usually leads to bonding failure or breakage; wire

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