The Forsus Fatigue Resistant Device as a Fixed Functional Appliance

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When mandibular retrusion is a factor in Class II malocclusion,[1] a functional appliance is often used to advance the mandible.[2] To avoid the need for patient compliance in such therapy,[3] a number of fixed interarch appliances have been developed, including the Herbst.*[4,5] Disadvantages of the Herbst appliance include the rigidity of the mechanism, the tendency of the appliance or its support system to break, and the requirement for complex laboratory work.[6]

The Forsus Fatigue Resistant Device (FRD)** is an alternative interarch appliance for treating Class II malocclusion.[7,8] A mandibular push rod attaches directly to the lower archwire distal to the canines, and a telescoping spring attaches to the headgear tube with an L-pin or EZ module. Forces are unloaded when the patient's jaw opens, resulting in intrusive rather than extrusive force vectors. In contrast, Class II elastics load upon jaw opening, producing extrusive forces at their terminal ends and potentially undesirable side effects as the occlusal plane is rotated clockwise.[9] The Forsus FRD exerts a continuous force with more elasticity and flexibility than the Herbst, permitting a greater range of mandibular opening and lateral movements during speech, chewing, and swallowing.[9] Because muscular forces are distributed over a larger periodontal area, there is less inhibition of the jaw elevator muscles by the periodontal mechanoreceptors, allowing better stabilization of the mandible.

Although the Forsus FRD was not designed as a functional appliance, our clinical experience has shown that it works effectively as one when the mandible is advanced into a Class I position. In this configuration, the Forsus FRD functions much like the Herbst appliance, without its drawbacks.[9] We did find an increase in canine bracket breakage when the Forsus FRD was used as a functional appliance. To overcome this problem, we modified the .019" × .025" stainless steel mandibular archwire by incorporating a small, circular occlusal loop on each side, distal to the canines (Fig. 1). The mesial end of the mandibular push rod is placed over the archwire just distal to this

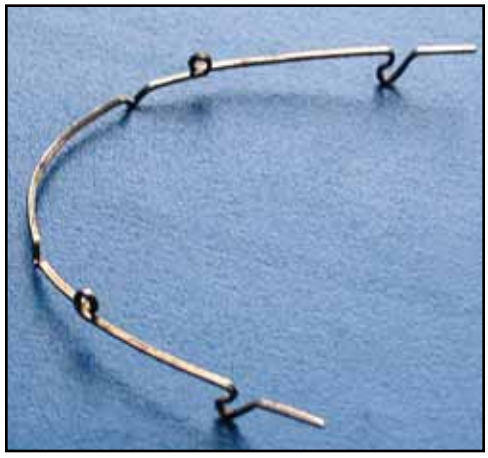

Fig. 1 Mandibular archwire modified with circular occlusal loop distal to canines.

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occlusal loop and crimped slightly to secure it (Fig. 2). The point of force application is thus shifted from the canine brackets to the rigid mandibular archwire, distributing the forces over a wider surface area. In cases where the interbracket span is too narrow to permit placement of the mandibular push rod distal to the occlusal loop, the mesial end of the push rod can be inserted directly into the loop and crimped in place (Fig. 3). This simple modification has allowed us to achieve treatment objectives in more than 10 patients without any further breakage.

Case Report

A 12-year-old female presented with a Class II malocclusion, a convex profile, and a 9mm overjet (Fig. 4). She exhibited an average growth pattern with no symptoms of neuromuscular or mandibular dysfunction. Cephalometric analysis showed a full Class II molar and canine relationship; the mandible was short (Co-Gn = 80mm) and retrusive (N⊥-Pg = –10.5mm).

A nonextraction treatment plan was chosen, with the goal of reducing the overjet and overbite and correcting the Class II occlusion by using a Forsus FRD as a fixed functional appliance.

Leveling and alignment were initiated with .022" brackets and .016" round nickel titanium archwires in both arches, and headgear tubes were soldered to the upper molar bands. After five weeks, upper and lower .016" round stainless steel wires were placed with appropriate bite-opening bends, followed five weeks later by upper and lower .017" × .025" stainless steel wires.

After 16 weeks of treatment, adequate leveling and alignment had been achieved for placement of the Forsus FRD. Upper and lower .019" × .025" stainless steel wires were placed, with lingual crown torque of 10-15° in the lower anterior segment to counteract the Class II corrective forces, and pigtail ligation was used in both arches from first molar to first molar. Both archwires were cinched back for reinforced anchorage. The mandible was advanced to a Class I molar relationship, and the Forsus FRD was inserted bilaterally (Fig. 5A).

One week after placement of the Forsus FRD, the patient returned with loose lower canine brackets on both sides (Fig. 5B). The brackets were rebonded and the appliance refitted, but the patient returned a week later with the same problem. After the mandibular wire design was modified to prevent direct contact of the mesial ends of the mandibular push rods with the canine brackets, neither bracket loosened during the subsequent six months of treatment with the Forsus appliance (Fig. 5C).

Final arch coordination and detailing were completed, and all objectives were met after 15 months of treatment (Fig. 6).

Fig. 2 Mandibular push rod inserted just distal to occlusal loop.

Fig. 3 Mandibular push rod inserted into occlusal loop.

Fig. 4 12-year-old female patient with Class II malocclusion before treatment.

Fig. 5 A. After four months of leveling and alignment, Forsus Fatigue Resistant Device inserted bilaterally, with mandibular ends of push rods placed distal to canine brackets. B. One week after placement, when patient returned with loosened lower canine brackets. C. Subsequent modification of mandibular archwire.

Fig. 6 Patient after 15 months of treatment.

Discussion

The Forsus FRD was not designed as a functional appliance. The manufacturer's instructions indicate that the device must be fitted in centric occlusion without reposturing the mandible. If the appliance is inserted with the mandible advanced, the spring can become fully compressed and "bottom out", resulting in a force that greatly exceeds the design limits. Pressure from mesially directed forces concentrated on the canine brackets caused repeated bond failures in our patient.

Ross and colleagues reported fracture of a Forsus FRD L-pin and shearing of a prewelded molar tube from the band with the use of a conventional Forsus FRD in one patient.[10] Perhaps because we solder the molar tubes to the bands, we have not experienced this difficulty, even when using the appliance as a fixed functional device. After modifying the mandibular archwire design, we have experienced no further canine bracket failures in our patients,[9] making this treatment modality efficient and predictable in our practice.

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