The Forsus Fatigue Resistant Device

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Devices commonly used for the correction of Class II malocclusions can be classified as extraoral (headgear), intra-arch, or interarch. The intra-arch devices are either removable (Cetlin or sagittal appliances) or fixed (Pendulum,* Distal Jet,** Jones Jig**). Fixed intra-arch appliances often depend on a Nance button for anchorage. Interarch devices, which use the mandibular arch for anchorage, can be removable (bionator, twin block) or fixed. They can pull (Class II elastics, SAIF springs***) or push (Fränkel, Herbst,† Jasper Jumper**).

While all these Class II appliances are capable of distalizing the maxillary molars, each type has different treatment effects. Headgear inhibits maxillary growth, but has little impact on the mandibular arch.[1-3] Intra-arch devices usually cause flaring of the maxillary incisors, tipping of the maxillary molars, and slight clockwise rotation of the mandible.[4] Interarch appliances tend to produce some slowing of maxillary growth, some acceleration of mandibular growth (which may not be clinically significant), and flaring of the mandibular incisors.

To determine the best Class II device for a particular patient, therefore, the orthodontist must consider such factors as whether the patient's profile is flat, concave, or convex; whether the face is long or short; whether the incisors are flared or upright; and whether the maxilla is prognathic or the mandible retrognathic. The severity of the problem and the anticipated patient cooperation also enter into the equation.

Forsus Appliance

The Forsus Fatigue Resistant Device‡ (FRD) is an interarch push spring that produces about 200g of force when fully compressed (Fig. 1). Since the Forsus springs are rarely fully compressed, however, they are comparable in force level to heavy Class II elastics. Unlike other push-spring appliances, such as the Herbst, the FRD can intrude the maxillary first molars and thus correct a Class II malocclusion without opening the bite. Even in severe cases, the FRD can be used as successfully as the Herbst, which appears to provide no long-term orthopedic benefits.[5-8]

The distal end of the FRD's push rod inserts into the telescoping cylinder (Fig. 2), and a hook on the mesial end is crimped directly to the archwire near the canine or premolar brackets. The telescoping cylinder consists of inner and outer sliding tubes surrounded by an open-coil spring. An eyelet at the distal end of the cylinder is connected to the maxillary molar headgear tube with an L-pin.

The push rod has a built-in stop that compresses the spring when the patient's mouth closes. The spring force is then transferred to the maxillary molars, using the mandibular arch as the

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**American Orthodontics, 1714 Cambridge Ave., Sheboygan, WI 53082.
***Pacific Coast Manufacturing, 15604 163rd Ave. N.E., Woodinville, WA 98072.
†Registered trademark of Dentaurum, Inc., 10 Pheasant Run, Newtown, PA 18940.
‡Trademark of 3M Unitek, 2724 S. Peck Road, Monrovia, CA 91016.

Fig. 1 Forsus Fatigue Resistant Device (FRD).

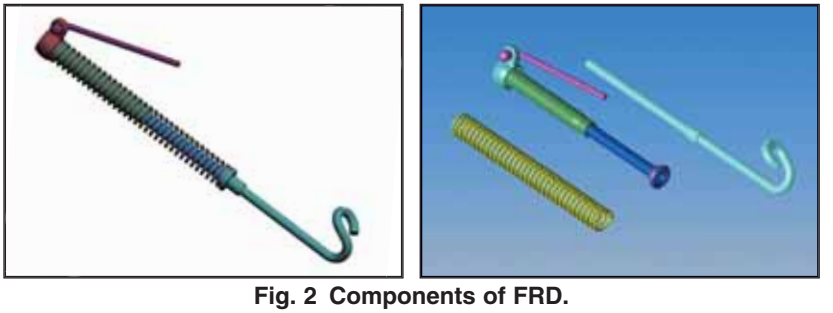

Fig. 2 Components of FRD.

anchorage unit. Since the appliance was introduced, a recurved portion has been added to the push rod adjacent to the crimpable hook. The new parts are called Direct Push Rods because they allow the appliance to be attached directly to the mandibular archwire instead of a bypass wire. The recurved portion prevents the push rod from rotating into the bite.

Installation

The first step is to insert an L-pin into the eyelet of the telescoping spring, making sure the ball of the L-pin is facing buccally. The L-pin is then threaded through the molar headgear tube from distal to mesial and cinched, leaving about 2mm of slack (Fig. 3).

The push rods come in four sizes, plus a customizable model that can be used for patients with extremely small or large mouths (Fig. 4). The clinician can thus select the push rod that will deliver the optimum force level, regardless of the size of the mouth. The push rod used on the right can be a different size from the one on the left, providing more flexibility in asymmetrical cases. A measuring device is included in the appliance kit.

To deliver about 200g of force, the open-coil spring should be almost fully compressed when the push rod is inserted into the cylinder and the patient closes. If a push rod is too short, it may disengage from the cylinder when the patient opens wide. If it is too long, it will fully compress the spring, which will then reposition the mandible in a forward position, like a functional appliance. This may increase the load on the canine bracket to the point that it debonds.

Once the correct size is chosen, the push rod is inserted into the telescoping spring, and the mesial hook is looped over the mandibular archwire and crimped shut (Fig. 5). A nearly full-size rectangular mandibular archwire should be used, and it should be cinched or tied back to limit mandibular incisor flaring. Therefore, the mandibular anterior teeth must be aligned before placing the Forsus springs.

Because the open-coil spring can be compressed about 10mm, the FRD is capable of moving the maxillary molars a substantial distance over a long period of time. To keep the force level around 200g, the device can easily be reactivated by adding a crimpable stop distal to the built-in stop on the push rod (Fig. 6).

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Fig. 3 Attachment of L-pin from telescoping cylinder to maxillary molar tube.

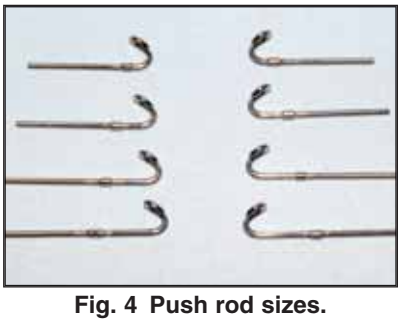

Fig. 4 Push rod sizes.

Fig. 5 Attachment of crimpable hook from push rod to mandibular archwire.

Fig. 6 Crimpable stop added to push rod, distal to built-in stop, for reactivation.

In a full Class II case, the Forsus springs should be continued until the incisors are edge-to-edge. They should not be overcorrected into crossbite, because there may not be enough subsequent relapse to achieve an ideal overjet. If the Class II relationship is a half-cusp or less, it should not be overcorrected past a Class I position, or Class III elastics may be required. On average, the FRD corrects a full Class II malocclusion in six months.

Case 1

A 12-year-old male presented with a Class II, division 1 malocclusion with mild maxillary and mandibular crowding (Fig. 7). His overjet measured 7mm, and his overbite was 100%. Cephalometric analysis revealed a brachyfacial growth pattern and mandibular retrognathia.

After seven months of leveling and alignment, FRDs were placed (Fig. 8). Although the malocclusion was corrected in six months (Fig. 9), the FRDs were left in place to prevent relapse and to supply anchorage for retraction of the maxillary anterior segment. After another three months, with the maxillary spaces almost closed and the bite a solid Class I, the Forsus springs were removed (Fig. 10).

Fixed appliances were debonded after 27 months of active treatment (Figs. 11,12).

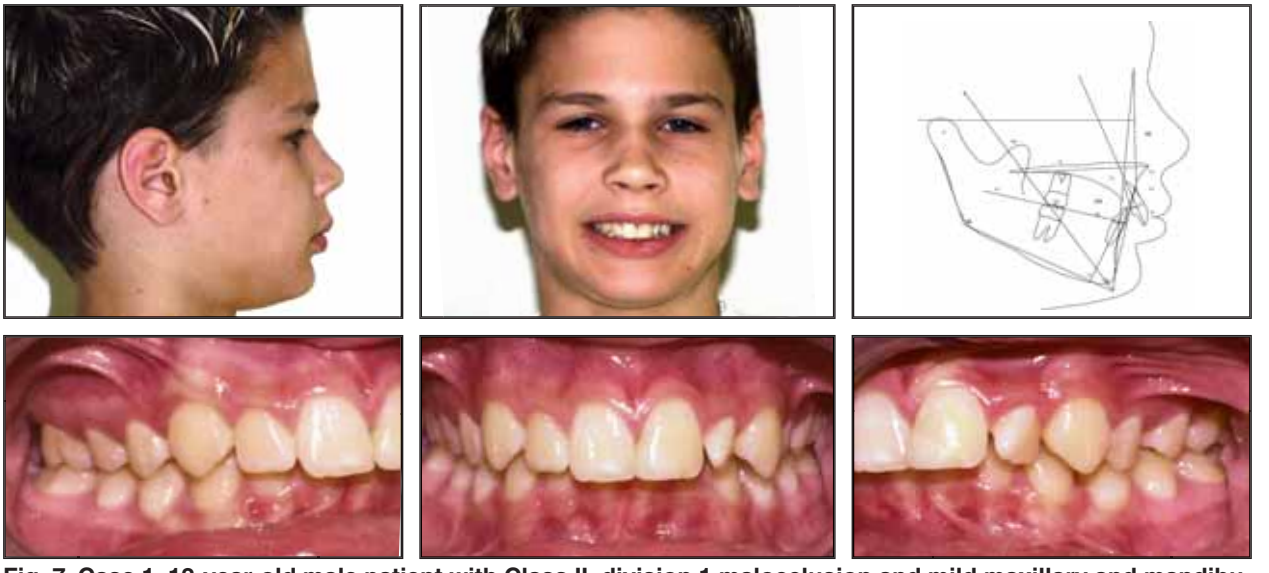

Fig. 7 Case 1. 12-year-old male patient with Class II, division 1 malocclusion and mild maxillary and mandibular crowding before treatment.

Fig. 8 Case 1. FRDs placed after seven months of leveling and alignment.

Fig. 9 Case 1. Patient after six months of FRD wear.

Fig. 10 Case 1. Patient after nine months of FRD wear.

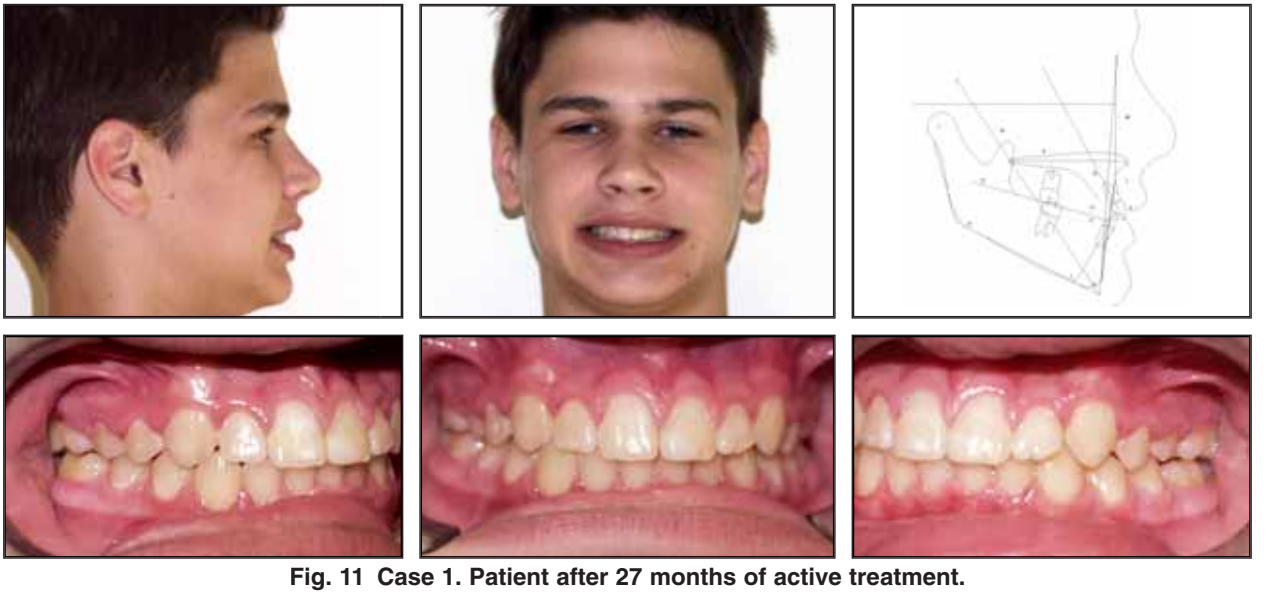

Fig. 11 Case 1. Patient after 27 months of active treatment.

Fig. 12 Case 1. Patient two years after treatment.

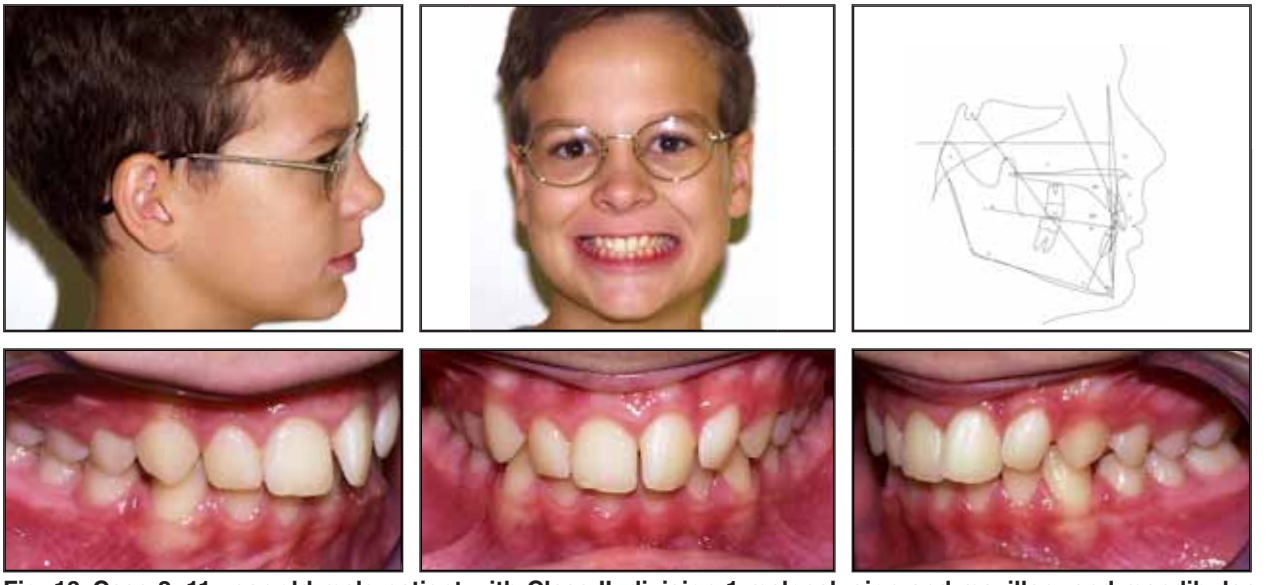

Fig. 13 Case 2. 11-year-old male patient with Class II, division 1 malocclusion and maxillary and mandibular spacing before treatment.

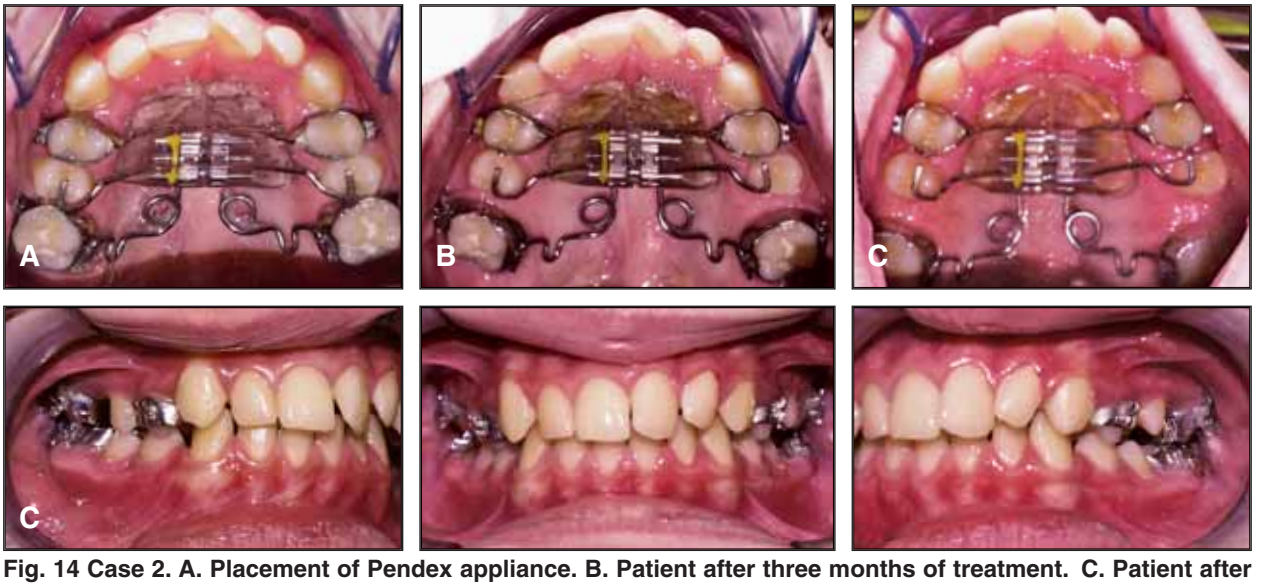

Fig. 14 Case 2. A. Placement of Pendex appliance. B. Patient after three months of treatment. C. Patient after five months of treatment.

Fig. 15 Case 2. FRD placement.

Case 2

An 11-year-old male presented with a Class II, division 1 malocclusion with maxillary and mandibular spacing (Fig. 13). He had a 5mm overjet, a 50% overbite, and a fairly flat profile. There was a slight tooth-size discrepancy between the arches due to the size and shape of the maxillary lateral incisors.

The treatment plan was to treat the Class II malocclusion with a Pendex appliance, followed by fixed appliance treatment using headgear and elastics for anchorage. After five months of Pendex treatment (Fig. 14), the teeth were banded and bonded, and a stopped archwire was placed to maintain the new molar positions. Anchorage was lost while the Class II elastics and headgear were worn, however, so that the overjet increased to 9mm.

With the canines still not in a full Class I position, the decision was made to use FRDs during the remaining maxillary anterior retraction (Fig. 15). After four months of FRD wear (Fig. 16), the molars and canines were overcorrected, and the Forsus springs were removed. Once the remaining maxillary spaces were closed, the fixed appliances were debonded (Fig. 17). The patient was then

Fig. 16 Case 2. Patient after four months of FRD wear.

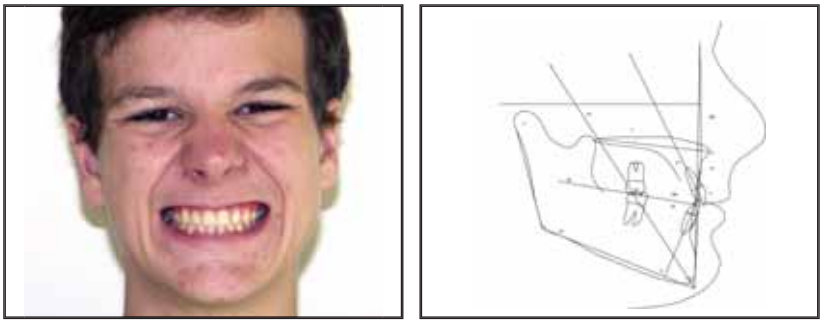

Fig. 17 Case 2. Patient after 33 months of active treatment.

Fig. 18 Case 2. Patient two years after treatment, showing composite buildups on maxillary lateral incisors.

referred to his general dentist for composite buildups of the maxillary lateral incisors (Fig. 18).

Case 3

A 15-year-old female presented with a Class II, division 1 malocclusion with severe mandibular crowding (Fig. 19). The mandibular first premolars were in lingual crossbite, and the patient had a deep bite and a fairly orthognathic profile.

Because of the mandibular crowding, the first premolars were extracted. After initial leveling and alignment, Wave Springs†† were used to retract the maxillary canines (Fig. 20). The

††Trademark of Ultimate Wireforms, Inc., 200 Central Ave., Bristol, CT 06010.

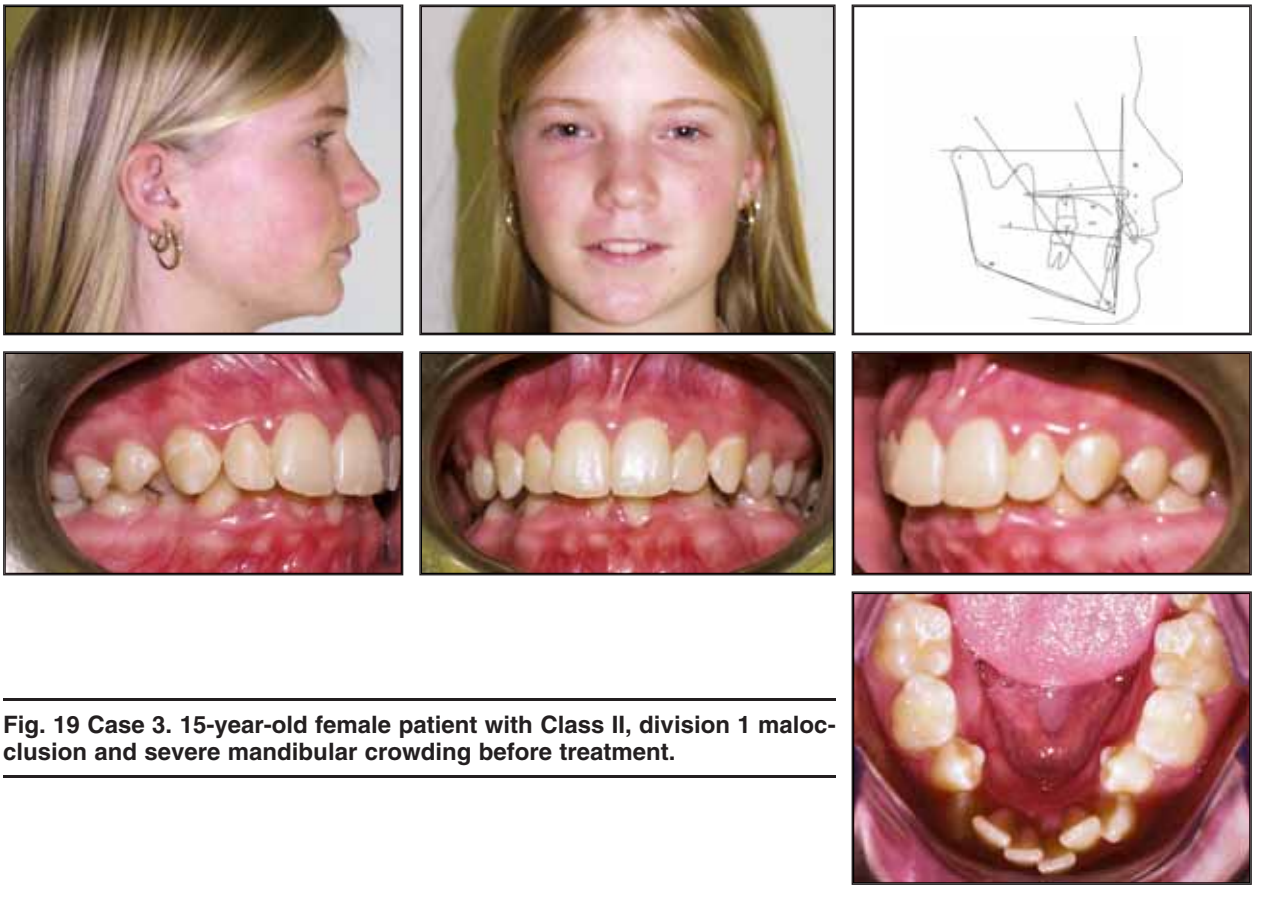

Fig. 19 Case 3. 15-year-old female patient with Class II, division 1 malocclusion and severe mandibular crowding before treatment.

Fig. 20 Case 3. Wave Springs used for canine retraction.

Fig. 21 Case 3. Excessive overjet remaining after one year of Class II elastic wear.

Fig. 22 Case 3. FRD placement.

Fig. 23 Case 3. Patient after three months of FRD wear.

maxillary incisors were retracted with anchorage from Class II elastics, but the overjet was still excessive after a year of elastic wear (Fig. 21). FRDs were then inserted to correct the remaining overjet (Fig. 22). After three months of wear (Fig. 23), the FRDs were removed for finishing with fixed appliances (Figs. 24,25).

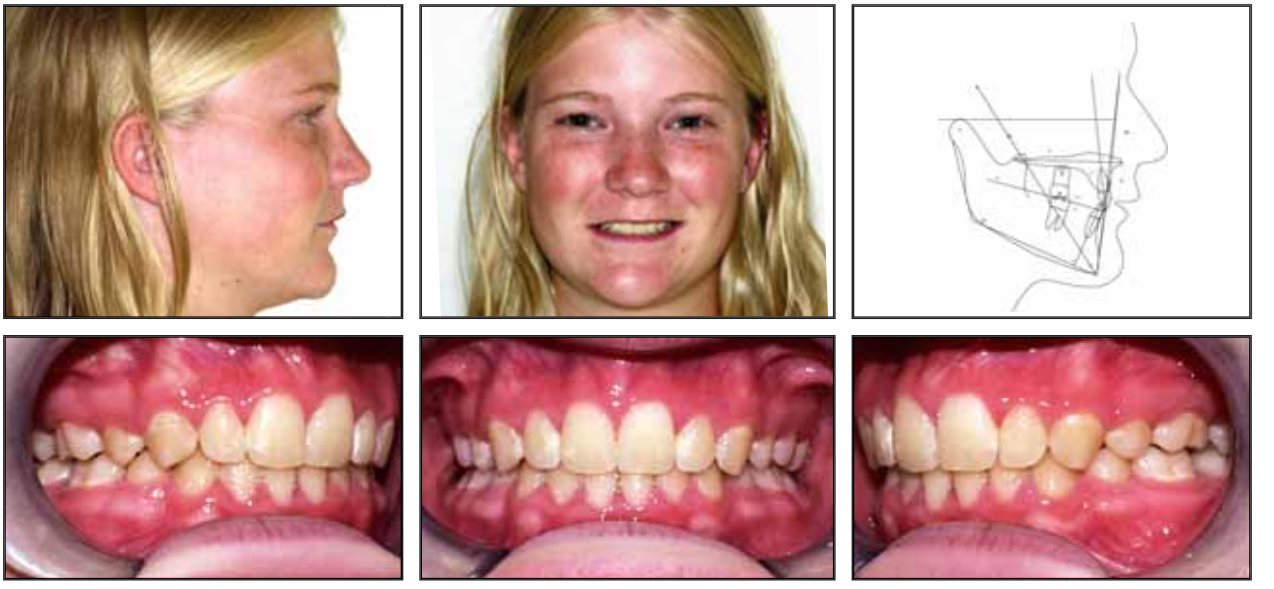

Fig. 24 Case 3. Patient after 31 months of active treatment.

Fig. 25 Case 3. Patient two years after treatment.

Conclusion

The Forsus FRD can be used instead of Class II elastics in mild cases and instead of Herbst appliances in severe cases. Forsus springs work best in patients with convex profiles, but they are indicated in any Class II patients except those with normal mandibles and protrusive maxillae, or with protrusive or overly large mandibles relative to the other cranial structures.

Although FRDs can serve as last-resort appliances in cases of non-compliance, it is preferable to incorporate them into the treatment plan from the beginning. Brackets with negative crown torque can then be used to offset the spring forces that will tend to flare the mandibular incisors. Advance planning also makes treatment time estimates much more accurate, because the factor of patient cooperation has been largely eliminated.

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