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Treatment of Class II malocclusion in a non compliant patient

A case report with review of literature

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Abstract:
Treatment of Class II malocclusion in a non compliant patient is perplexing and challenging. When planning treatment in such cases, the orthodontist often faces the dilemma of selecting the right functional appliance from the numerous options. This case report presents one such case (along with review of literature) of a non compliant patient treated with Forsus Fatigue Resistant Device™ (a fixed functional appliance), which has greater elasticity and flexibility; allows greater range of movement of mandible, is available in pre fabricated assembly of springs, tubes and rods and is a simple, effective and reliable corrective appliance that provides non-compliant solution for treatment of Class II malocclusion and benefits not only growing patients but also malocclusions that previously required extraction and headgears. Following treatment with this appliance molar correction was achieved very quickly and there was a marked improvement in patient's smile, facial profile, lip competence, self confidence and quality of life.

KEY WORDS
Class II malocclusion, Non compliant patient, Forsus™ Fatigue Resistant Device.

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Introduction

Class II malocclusion is commonly seen problem in orthodontic practice with a frequency of 14% among the children between 12 and 14 years of age.[1] Earlier non-extraction approach required distal movement of maxillary molar teeth with headgear so as to achieve the Class I molar and canine relationship.[2] This treatment regime not only relied on good patient co-operation, but also had a tendency to generate unwanted lateral forces.[3] When mandibular retrusion is the cause of Class II malocclusion[4] removable or fixed functional appliances[5] are indicated to advance the mandible. Treatments of Angle Class II malocclusion in growing patients require a very good cooperation and the clinician is dependent on the patient's acceptance of the removable functional appliance (intermittent condylar displacement). Fixed functional appliances on the other hand are worn full-time, use continuous displacement and therefore can be expected to elicit a greater and more rapid neuromuscular response leading to short treatment period and thus provide non-compliant solution to orthodontic Class II treatment with desirable skeletal, dental and soft tissue changes. Herbst was the first fixed functional appliance, introduced by Emil Herbst in 1905. However, it was not used until Pancherz[6] reintroduced it in the late 1970s. The disadvantages of this appliance were the rigidity of the mechanism and the requirement of complex laboratory stages.[7] A vide variety of non-compliant variants are available commercially[8] but the basic force mechanism is the same. Most of these appliances apply posterior forces to the maxillary dentition and reciprocal anterior forces to the mandibular dentition. Although the force applied is large, it is usually well tolerated by patients.

The major disadvantage with these appliances was the propensity with which breakages can occur, both in the appliance itself and in the support system. Forsus Fatigue Resistant Device™ (3M Unitek), being a flexible fixed functional appliances overcomes these drawbacks, has more elasticity/flexibility and exerts a continuous elastic force that allows greater freedom of movement of the mandible; patients can carry out the lateral movements with ease; can close in centric relation; repeatedly bite with the appliance voluntarily and during swallowing of saliva thereby activating greater occlusal contacts on biting and as a result of which muscular force is distributed over a larger periodontal area which results in less inhibition of jaw elevator muscles by the periodontal mechanoreceptors thereby resulting in better mandible stabilization.[9] In this case report we present one such case of a non compliant patient treated with Forsus Fatigue Resistant Device™

Case Report

A 12 year old female reported to the orthodontic clinic with the chief complaint of forwardly placed teeth. Extra oral examination revealed that she had a convex profile; deep mentolabial sulcus and everted lower lip (Fig 1). She had average growth pattern, a positive VTO (Visual Treatment Objective) and was free of subjective neuromuscular or mandibular dysfunction symptoms. Intra oral examination of the patient revealed that she was in early permanent dentition stage and had a full Class II molar and canine relationship which was confirmed from the dental casts and lateral cephalogram (increased overjet, ANB, Wits and Convexity at point A). Other factors that contributed in the development of Class II malocclusion were decreased mandibular length (Co-Gn) and mandibular retrusion (Nperp-Pg) (Table 1). The patient gave history of failed orthodontic treatment with a removable appliance and she was reluctant to accept removable functional appliance as a treatment option as she considered it uncomfortable and unesthetic.

Treatment goals:

The goal of orthodontic treatment was to achieve a good facial balance; improve the facial profile; obtain optimal static and functional occlusion by reducing the overjet and overbite and correcting the molar relationship to Class I on both sides by active protrusion of the mandible with a functional appliance using a non-extraction approach and ensure stability of the treatment result.

Treatment objectives

To take advantage of growth and bring the mandible forward to a Class I relationship.

To achieve an ideal overjet and overbite.

To correct eversion of lower lip and deep mentolabial sulcus.

To improve hard- and soft-tissue profile and facial aesthetics.

To correct the skeletal Class II discrepancy and achieve adequate functional occlusal intercuspation with a Class I molar and a Class I canine relationship.

Treatment plan:

As the compliance of this patient was doubtful, after taking informed consent it was mutually agreed upon that the patient would be treated with a bilateral Forsus Fatigue Resistant DeviceTM (3M Unitek), a fixed functional appliance, which would provide the necessary mechanics to achieve our aims.

The primary advantage of fixed functional appliances is independence from the need for patient cooperation. This appliance is available in six different sizes in a prefabricated assembly of three-piece telescoping spring which is conveniently assembled within a few minutes, so that the appropriately sized mandibular push rod attaches directly to the lower arch wire distal to the canine teeth, and the spring to the headgear tube via the 'L' pin. Incremental forces (if required) can be created by placing 2-mm split crimps onto the mandibular push rod which increases the pressure on the spring.

Forsus Fatigue Resistant DeviceTM requires anchorage preparation before it can be placed, to minimize unwanted tooth movement and it is necessary to align and level arches prior to its insertion. The patient underwent non extraction fixed orthodontic mechanotherapy with standard edgewise (0.022-inch slot) with headgear tubes soldered on the upper molar bands. An initial 0.016-inch round nickel titanium arch wire was used for levelling and alignment of both arches. After 5 weeks, upper and lower 0.016-inch round steel wire was placed with appropriate bite-opening curves which were followed by upper and lower 0.017 x 0.025-inch stainless steel (SS) wires at 10 weeks. At the end of 16 weeks enough levelling and aligning had occurred to place upper and lower 0.019 x 0.025-inch SS wires. As Forsus Fatigue Resistant DeviceTM places a distal force on the upper arch and a mesial force on the lower arch for enabling Class II correction, a lingual crown torque of 10-15º was given in the lower anterior segment and pigtail ligation was done in both the arches from below the 0.019 x 0.025-inch SS arch wires from first molar of one side to the other. All the teeth were ligated to secure the arch-wire to the bracket and both the upper and lower arch wires were cinched back to further reinforce the anchorage. Mandible was advanced to an edge-to-edge incisor position (in order to achieve Class I molar and canine relation) and Forsus Fatigue Resistant DeviceTM was fitted bilaterally (for a period of 6 months) distal to the canine brackets with a 32-mm push rod, according to the manufacturer's guidelines (Figure 2). The patient was reviewed at 4-week intervals for a period of 6 months, following which the Forsus Fatigue Resistant DeviceTM was removed and .014 S.S. wires for occlusal settling were used following which the case was debonded and modified Hawley wraparound retainer was given (as it does not interfere with the occlusion).

Figure 2 Intraoral mid-treatment photograph with Forsus Fatigue Resistant Device™ ligated bilaterally distal to canine brackets.

	Variable	Mean±S.D	
		Pre-treatment	Post-treatment
Skeletal	FMA	23^0	24^0
	SNA	80^0	79^0
	SNB	74^0	77^0
	ANB	6^0	2^0
	Nperp-A	1.5 mm	1.4 mm
	Nperp-Pg	-10.5 mm	-5.5 mm
	Co-Gn	80 mm	82 mm
	Wits (AO-BO)	3.5 mm	1 mm
	Convexity at point A (relative to N-Pg)	4.5 mm	1.5 mm
Dental	IMPA	100^0	102^0
	U1-SN	105^0	104^0
	Overjet	6 mm	2 mm
Soft tissue	Nasolabial angle	102^0	104^0
	U lip-S line	2.5 mm	0 mm
	L lip-S line	3.5 mm	0 mm

Table I

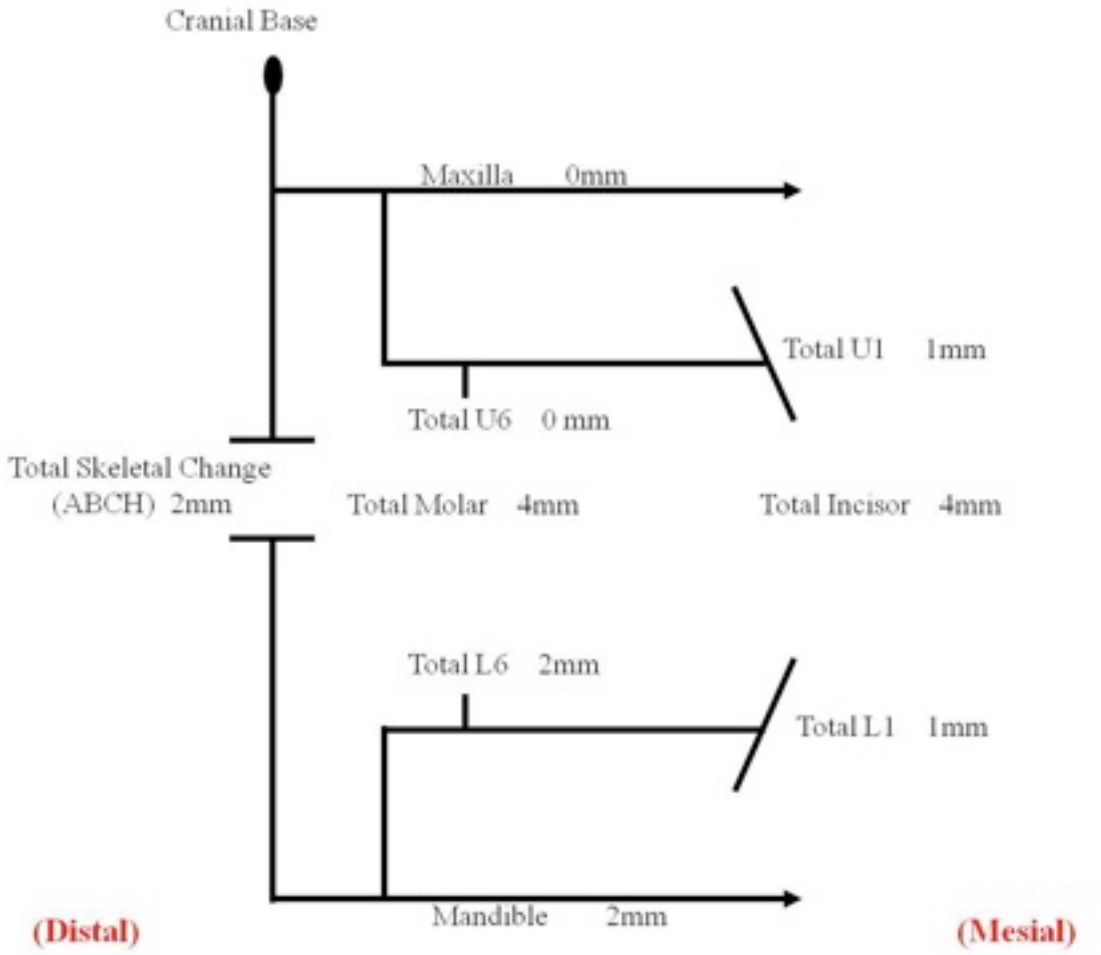

Figure 3

The Pitchfork diagram. Cranial base indicates base of the cranium; Maxilla, maxillary change in relation to the cranial base; Mandible, mandibular change in relation to the cranial base; ABCH, antero-posterior change in the relationship between maxilla and mandible; Total U6, total upper molar movement; Total L6, total lower molar movement; Total molar (ABCH + total U6 + total L6), the change in molar relationship; Total U1, total upper incisor movement; Total L1, total lower incisor movement; Total Incisor (ABCH + total U1 + total L1), the change in incisor relationship.

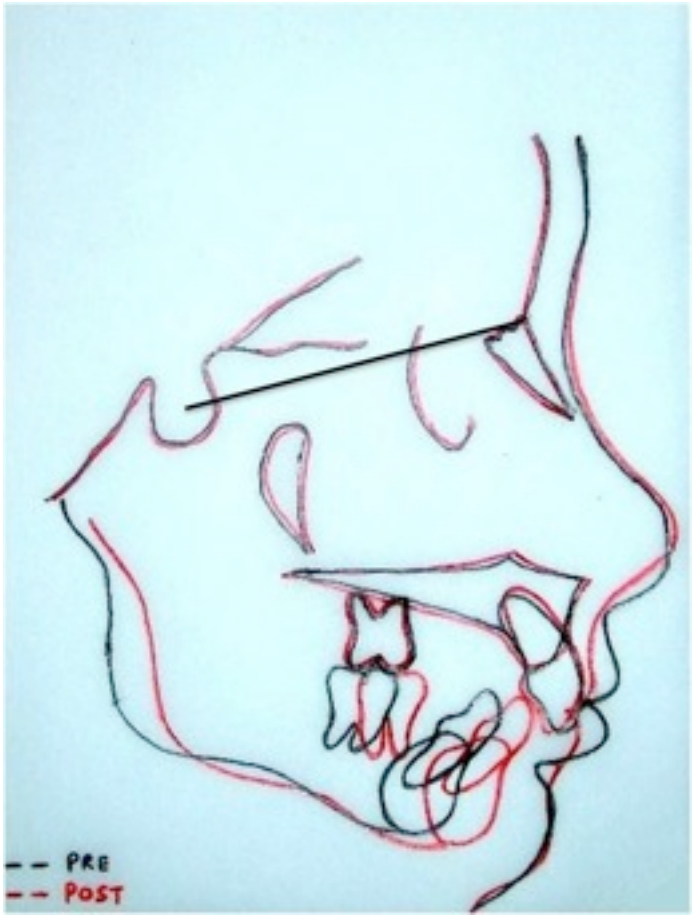

Figure 4 Cephalometric superimposition

Figure 5 Post-treatment photographs.

Result

For evaluation of skeletal and dentoalveolar changes that contributed to the Class II correction, pitchfork analysis[10] was used. This analysis accounts for and summarizes sagittal maxillary and mandibular advancement relative to the cranial base, sagittal mandibular and maxillary molar movements, incisor movements that affect overjet and the combination of all of these movements in correcting the molar and incisor relationship. Measurements are defined as positive if they contribute to Class II correction and negative if they aggravate the Class II relationship. All measurements were made at the level of the functional occlusal plane, which was drawn through the occlusal contact points of the molars and premolars. The pitchfork diagram[10] of this patient (Figure 3) revealed that the maxilla did not move (0 mm); the mandible moved mesially (2 mm); the average apical base (ABCH) change was 2 mm. The maxillary molar (U6) did not move (0 mm), and the mandibular molar (L6) moved mesially (2 mm). The total molar change (ABCH + total U6 + total L6), was 4 mm. The upper incisor (U1) moved distally (1 mm), and the lower incisor (L1) moved mesially (1 mm). Total incisor change (ABCH + total U1 + total L1), was 4 mm. Cephalometric superimposition (Fig 4) corroborates these skeletal and dentoalveolar changes and shows marked improvement in patient's hard and soft tissue profile and facial aesthetics.

Treatment Effects

Following 6 months of treatment with Forsus Fatigue Resistant Device™ a good functional occlusion with normal overjet and overbite and a Class I molar and Class I canine relationship was achieved (Fig 5) (Table 1).

Improvement of occlusal relationships resulted from almost equal amounts of skeletal and dental changes.

Class II corrected from an increase in mandibular length, distal movement of maxillary molars and mesial movement of mandibular molars.

Overjet correction occurred as a result of an increase in mandibular length and vestibular movement of the mandibular incisors.

The restraining effect on maxilla and distal movement of the maxillary incisors also contributed to the improved occlusion.

There was a marked improvement in patient's smile, facial profile, lip competence, patient's self confidence and quality of life.

Discussion

Class II malocclusions comprise commonly used treatment protocols in orthodontic practices and provide a therapeutic challenge for orthodontists. Earlier most orthodontists applied extraction and non extraction therapies for class II correction, independent of structural diagnosis and soft tissue considerations. However, due to identification of components 11-13 involved in the morphologic deviations of class II patients, orthodontists can now direct their therapy to correct the feature that directly or indirectly affects the dentoalveolar, skeletal and soft tissue components. Many class II malocclusions have maxillae in neutral or retruded positions, while a small percentage of patients display maxillary protrusions. On the other hand many class II patients display mandibular retrusions.[4] Clinicians can treat mandibular class II malocclusions with either removable functional appliances (eg Activator, Bionator, Frankel, Twin block) or fixed functional appliances (eg Herbst, Jasper Jumper, Mandibular protraction appliance, Forsus™ fatigue resistant device and several other). Mode of action of functional appliance therapy has been linked to neuromuscular and skeletal adaptations to altered function in orofacial region and in order to achieve adequate neuromuscular response with functional appliance, compliance of the patient is deciding factor.[14] In some patients the concept of non-compliant appliances is attractive to the clinician for getting the desired result as the goal of functional appliance therapy is to encourage or to redirect the growth in a favourable direction.

In the case presented, removable functional appliance was unacceptable to the patient and so Forsus Fatigue Resistant Device™, a fixed functional appliance was used. Following six months of treatment with this appliance it was observed that the forward growth of maxilla was restricted. This may be due to the headgear effect of the appliance, as when the mandible was postured forward a reciprocal force acted distally on the maxilla and restricted its forward growth. Many previous studies also reported restriction in the forward growth of maxilla. [15-17]

In the case presented, we found 2 mm mandibular growth following six months treatment with this appliance. Even though lengthening of the mandible by functional appliance therapy is controversial, some authors[15], 18-21 have claimed extra mandibular growth while others[22-24] have found no extra mandibular growth with functional appliances. The fixed functional appliance used in this patient delivered an anterior component of force on the mandible through the dental arch to skeletal base and thus resulted in 2mm extra mandibular growth.

The ABCH value represents the maxillomandibular differential. A positive value indicates the mandible outgrew the maxilla, and a negative value means that the maxilla outgrew the mandible. In the case presented, the outgrowth of the mandible was greater along with the orthopaedic action of restriction in the forward growth of maxilla. This observation was in agreement with the results of many previous studies. [17, 19, 21, 22, 25, 26] Thus, this appliance was efficient in correcting the maxillomandibular skeletal relationship in Class II subjects.

Distal movement of the maxillary molars (U6) and mesial movement of the mandibular molars (L6), as the mandible moves forward, are ideal conditions for the correction of a Class II molar relationship. In the present case it is observed that the appliance restricted forward movement of the U6 because the reciprocal force acted distally on the maxillary dental arch when the mandible was postured forward by the appliance. Thus it was effective in restraining the forward movement of maxillary molars. Tumor and Gultan[26] also made a similar observation although some other studies have reported distal movement of U6 due to the headgear effect during treatment.[15, 18] The greater forward movement of the L6 (2mm) in this case was a one of the factor contributing to the Class II molar correction. Similar findings have been reported by other studies[15, 18, 28] with functional appliances. The significantly greater mesial movement of the L6 was because of the mesial vector of force by the appliance, when it postured the mandible forward. The molar correction was largely due to the mandible outgrowing the maxilla, and movements of mandibular molars. In the case presented, 50% of the molar correction was contributed by skeletal change and 50% due to dentoalveolar changes. O'Brien et al[29] found only a 41% skeletal contribution to molar correction with the twin-block appliance.

Retroclination of the maxillary incisors (U1) and proclination of mandibular incisors (L1) are a widely accepted consensus with various functional appliances.[15,17,20-22,25,27-29] In the present case, the retroclination of U1 could be due to the so-called headgear effect of the appliance due to the reciprocal force that acted distally on the maxillary dental arch. Lingual tipping of the U1 can also be due to the contact of lip musculature during treatment15. The most prominent dentoalveolar effect in case presented was proclination of mandibular incisors. This is due to the mesial force on the L1 induced by the forward posture of the mandible and this finding is in accordance with the effects of functional appliances. [15,21,25-31] The change in overjet is the total change in incisor relationship and is the algebraic sum of the ABCH + total U1 + total L1.

As a result of treatment, overjet was decreased significantly and additional mandibular growth was one of the factors contributing to overjet correction. Mills and McCulloch[18] reported that 50% of overjet correction was due to skeletal changes. Similar overjet correction has been reported Herbst appliances.[21] In the case presented, combined movements of U1 (1mm) and L1 (1mm) contributed equal to ABCH (2mm) for the overjet correction. Thus there was 50% skeletal and 50% dentoalveolar contribution for the overjet correction.

Conclusions

The practitioner should be vigilant to non compliant patients and incorporate modifications in their treatment plan and/or selection of the appliance in order to overcome treatment failure.

Forsus Fatigue Resistant Device™ effects skeletal, dental, and soft tissue changes and is a simple, effective, reliable corrective fixed functional appliance that provides non compliant solution for the patients who do not tolerate removable functional appliances for the correction of Class II malocclusion.

Forward displacement of the mandible with Forsus Fatigue Resistant Device™ stimulated the mandibular growth; inhibited the maxillary growth; caused incisor and molar movements and these dentoalveolar changes were equally effective along with the skeletal changes for the correction of Class II molar relation and overjet correction.

Following treatment there was a marked improvement in patient's smile, facial profile, lip competence, patient's self confidence and quality of life.

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