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Case Series

Correction of Class-II malocclusion in young adults using fixed functional appliances (Forsus) - A case series

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ABSTRACT

All over the world Class II malocclusions affects twenty percent of the population and Class II division 1 malocclusion is thought to be the most recognized problem practiced in orthodontics. A wide range of functional appliances including the removal and fixed are available for the correction of Class II skeletal pattern. The fixed functional appliances eliminate the need for patient compliance and place the treatment outcome under the control of the orthodontist.

Patients with Class II mandibular retrusion and those whose growth is about to finish are typically treated with fixed functional appliances, which require little maintenance. William Vogt, was the first to introduce the Forsus appliance. Fixed functional appliances in general and the Forsus (FRD) in particular considerably speed up the correction of Class II Division 1 malocclusions and shorten treatment time as they are used in conjunction with a fully bonded fixed orthodontic appliance. Forsus primarily achieves Class II correction through dentoalveolar effects, but if utilized by patients who are at or near pubertal growth, it can result in skeletal changes as well.

In this article, the management of two young adult patients with Class II Division 1 malocclusion and mandibular retrognathism is discussed. Both patients received a two-phase therapy in which first phase involved alignment of the arches with fixed orthodontic pre-adjusted appliance and second phase involved using the Forsus fixed functional appliance for at least six months.

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1. Introduction

All over the world Class II malocclusions affects twenty percent of the population and Class II division 1 malocclusion is thought to be the most recognized problem practiced in orthodontics.¹ The most common characteristic of Class II malocclusion is mandibular retrusion. Growing patients with Class II malocclusions have been treated using removable functional appliances and fixed functional appliances.²

The functional appliances are classified into fixed or removable appliances. They bring about an alteration in the position of the mandible and result in the change of the neuromuscular environment which brings about a modification of growth. A wide range of functional appliances are available for the correction of Class II skeletal pattern. The fixed functional appliances eliminate the need for patient compliance and place the treatment outcome under the control of the orthodontist.

William Vogt, was the first to introduce the Forsus appliance. The Forsus is a hybrid-functional appliance used with fixed orthodontic appliances. It resists fatigue

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and is the most popular fixed functional appliance used in the correction of Class II malocclusions. When used in conjunction with a fully bonded fixed appliance, fixed functional appliances in general and the Forsus (FRD) in particular considerably speed up the correction of Class II Division 1 malocclusions and shorten treatment time.^{3,4}

Depending on the anteroposterior disparity already present, the patient's level of cooperation, and their current stage of maturation, removable or fixed functional appliances can be utilized to treat Class II malocclusions. Patients with Class II mandibular retrusion and those whose growth is about to finish are typically treated with fixed functional appliances, which require little maintenance.^{5,6}

In this article, the management of two young post-pubertal patients with Class II Division 1 malocclusion and mandibular retrognathism is discussed. Both patients received a two-phase therapy. Firstly, both the arches were aligned with fixed Pre-Adjusted Appliance (0.018" MBT). Then, the mandible was unlocked to the Class I molar and canine relationship during the second phase, which involved using the Forsus fixed functional appliance for at least six months.

2. Case 1

A 15-year-old girl reported with the main complaint that her front top teeth were positioned too much forward. Clinical findings from the extraoral examination included a convex profile, an acute nasolabial angle, a deep M-L sulcus, and a retrognathic mandible (Figure 1). An intraoral examination revealed Class II canine and molar relationships on both the right and left side, as well as an overjet of 10 millimetres and an overbite of 4.5 millimetres (Figure 2). The lateral cephalometric radiograph (Figure 3 & Table 1) examination revealed skeletal Class II malocclusion (ANB: 5 degrees), with the maxilla in its normal position, the mandible being retrognathic, and the growth pattern of the patient being horizontal.



Fig. 1: Pre treatment extra oral photographs

2.1. Diagnosis

The patient was identified as having minor mandibular retrognathism, skeletal Class II malocclusion, and a



Fig. 2: Pre treatment intra oral photographs



Fig. 3: Pre treatment radiographs

mesodivergent facial type. Angle Class II Division 1 was the consequent dental diagnosis.

Treatment objectives: Correction of overbite and overjet, correction of molar and canine relation, Improvement of profile.

Treatment plan: Phase I Fixed mechanotherapy with 0.018 " MBT PEA with a non-extraction treatment plan. Phase II – Mandibular growth modulation with hybrid fixed functional appliance (FORSUS FRD) followed by retention.

Treatment results: A comparison of Pre-treatment & Post-treatment Cephalometric measurements is given in Table 1. The results showed correction in both skeletal and dental parameters. At the end of treatment, an ideal overjet & overbite were achieved along with the achievement of root parallelism (Figures 5, 6 and 7).

Cephalometric superimposition (Figure 8) indicated downward and forward movement of the mandibular dentoalveolar arch and restraint of the maxillary



Fig. 4: Forsus in situ



Fig. 6: Post treatment intra oral photographs



Fig. 5: Post treatment extra oral photographs

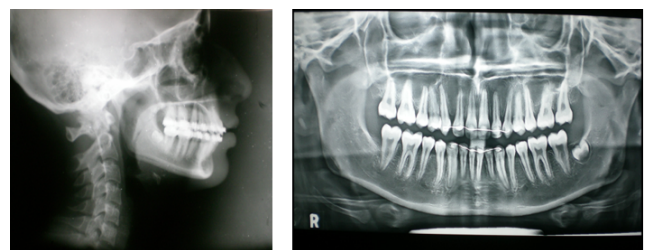


Fig. 7: Post treatment radiographs

dentoalveolar segment. ANB angle decreased from 5 degrees to 2 degrees with SNA of 83 degrees and an SNB angle of 81 degrees and Wits from +4 to -1mm. Cephalometric measurements indicated that mandibular incisors were proclined from IMPA of 103 degrees to 108 degrees (Table 1).

2.2. Case 2

A 14 years old girl reported with the chief complaint of unattractive appearance and proclined upper front teeth. Clinical examination revealed convex profile, deep mentolabial sulcus (Figure 9), spacing between 13, 12, 11, 21, 22 & 23 and 42, 41, 31, accentuated COS 3mm (R) and 3 mm (L), Class II molar and canines bilaterally, Overjet:

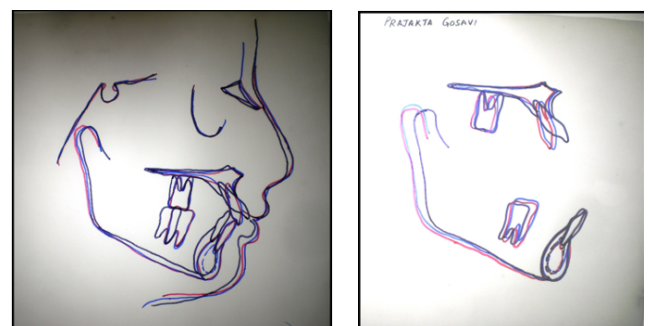


Fig. 8: Pre and post treatment superimposition

Table 1:

Cephalometric Value	Pre-treatment	Post-treatment
SNA	83 deg	83 deg
SNB	78 deg	81 deg
ANB	5 deg	2 deg
WITS	+ 4 mm	-1 mm
IMPA	103 deg	108 deg
(U1-SN)	120 deg	101 deg
(U1-NA)	36 deg & 9mm	22 deg & 5mm
(U1-NB)	30 deg & 6 mm	30 deg & 5mm
GO GN TO SN	26 deg	28 deg

Table 2:

Cephalometric Value	Pre-treatment	Post-treatment
SNA	82 deg	82 deg
SNB	77 deg	80 deg
ANB	5 deg	2 deg
WITS	+ 4 mm	-1 mm
0mm(females)		
IMPA	96 deg	102 deg
(U1-SN)	123 deg	101 deg
(U1-NA)	40 deg & 9 mm	25 deg & 5mm
(L1-NB)	22 deg & 4 mm	29 deg & 5mm
GO GN TO SN)	25 deg	28 deg

10mm, Ellis Class II Fracture of 22 and Deep overbite of 5mm (Figure 10). Examination of the lateral cephalometric radiograph (Figure 11, Table 2) indicated skeletal Class II malocclusion and horizontal growth pattern.

2.3. Diagnosis

The patient was diagnosed as having skeletal Class II malocclusion with mild mandibular retrognathism, mesodivergent facial type. The dental diagnosis was Angle Class II Division 1.

Treatment objectives: Leveling and alignment, Improvement of the profile, Correction of molar and canine relation and correction of overbite and overjet.

Treatment plan: Phase I - leveling and alignment using fixed mechanotherapy and 0.018" MBT PEA was the treatment strategy. Phase II-Similar mechanics to those in case 1 were used in this case as well, and the Forsus (Fatigue Resistant Device) was in place for 07 months of the total duration of a 24-month treatment period (Figure 12).

Treatment results: Table 2 shows the cephalometric measurements taken before and after the treatment. The results showed improvement in both skeletal and dental parameters. At the conclusion of the course of the treatment, the patient's overjet and overbite were returned to normal, along with the achievement of optimal profile (Figures 13 and 14). Also, after completion of treatment teeth were arranged in Angles Class I occlusion along with the

achievement of root parallelism (Figure 15). Cephalometric measurements indicated that maxillary incisors were retroclined to nearly ideal position (U1-SN: 123 degrees to 101 degrees), and mandibular incisors were proclined from IMPA of 96 degrees to 102 degrees. Cephalometric superimposition (Figure 16) indicated downward and forward movement of the mandibular dentoalveolar arch.

**Fig. 9:** Pre treatment extra oral photographs**Fig. 10:** Pre treatment intra oral photographs

3. Discussion

Options for treating Class II malocclusions are numerous. Due to the fact that both the patients were adolescents, it was decided to use a technique of growth modulation to treat them. A growing youngster may choose between a fixed functional appliance or a removable functional appliance for growth modulation. The use of a removable

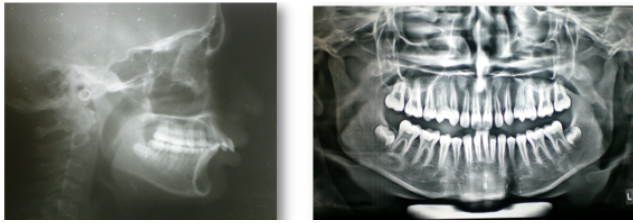


Fig. 11: Pre treatment radiographs



Fig. 12: Forsus in situ



Fig. 14: Post treatment intra oral photographs



Fig. 13: Post treatment extra oral photographs

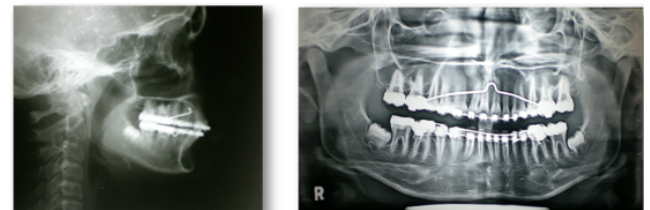


Fig. 15: Pre debonding radiographs

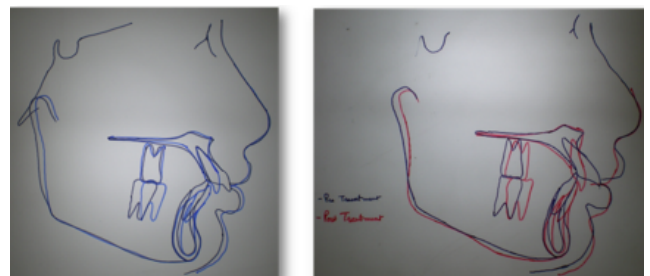


Fig. 16: Pre and post treatment superimposition

functional appliance was ruled out because there was very little active growth left in both the cases and moreover patient's compliance was questionable. Since we lacked the laboratory setup to construct the Herbst appliance, we were unable to employ a rigid fixed functional appliance. Consequently, we chose to use the (Forsus) flexible fixed functional appliance in both our cases.

The benefit of using a growth modulation approach in these cases was that it prevented the need for future orthognathic surgery and premolar extraction. The usage of Forsus appliance helps to unify the functional appliance and fixed orthodontic appliance stages of therapy into a single phase of treatment and lowers the duration of treatment. With this device, patient's compliance is not a limiting constraint. Additionally, Gao et al⁷ revealed that the effects and stability of treatment results obtained by the Forsus

appliance are relatively stable. Even while this device (Forsus) primarily achieves Class II correction through dentoalveolar effects, if utilized by patients who are at or near pubertal growth, it can result in mandibular growth.⁸

One of the non-compliance appliances used to treat Class II malocclusion is the ForsusTM device. When the appliance is properly placed in the mouth, it brings about forward positioning of the mandible and prevents the patient from biting in a Class II position. The Forsus appliance

brings about mandibular advancement by changing the neuromuscular pattern thus stimulating the mandible to grow. It also brings about a mild distalisation of the maxillary molars. The appliance is used along with fixed orthodontic bonded appliance after dental arches are properly aligned and the required dental corrections have been carried out. This addition to the fixed orthodontic treatment is designed to correct not only the overjet but also the overbite while maintaining or improving facial aesthetics. The Forsus appliance being a fixed functional appliance, limits lateral movement of the mandible to an extent.^{9,10}

Forsus appliance has many advantages and is well accepted by patients as it is virtually unnoticeable as placed posteriorly in the mouth, allows normal jaw movement, as well as mastication. It is resilient which, results in fewer emergencies' and is not compliance-driven as the patient can't remove the spring. The Forsus springs allow correction of Class II conditions in a time period of 3 to 6 months and are thus helpful in the treatment of difficult cases in the shortest period possible.^{9,10}

The appliance has a few disadvantages like most of patients experience discomfort and mastication problems initially, which reduces gradually. Few patients experience sensitivity, soreness of the lip, and cheek irritation. Sometimes, it may also lead to the development of ulcers in the buccal mucosal.^{9,10}

The maxillary and mandibular arches both displayed dentoalveolar alterations (Tables 1 and 2). First molars and maxillary incisors showed distal movement and intrusion. Lower incisors showed proclination, and the mandibular first molars displayed mesial movement.

4. Conclusion

The Forsus is a very valuable appliance in the treatment of Class II cases with mandibular retrognathism. It is advantageous, especially in patients who are at the end of their growth by bringing about a great magnitude of dentoalveolar changes thereby significantly reducing the overjet and overbite.

5. Conflict of Interest

None.


6. Source of Funding

None.

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