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Case Report

Correction of Class II malocclusion in a patient using the forsus fatigue resistant appliance – A case report

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ABSTRACT

Functional appliances, fixed or removable, are primarily orthopaedic tools used to influence the facial skeleton in a growing child. Class II malocclusion with a retrognathic mandible in a non -compliant post pubertal patient can be treated using the fixed functional appliances. One such appliance which is in common use in clinical practice today is the Forsus Fatigue Resistant Device. To treat a 13 year old female patient having a class II base, a retrognathic mandible, horizontal growth pattern, convex profile, an overjet of 7mm, mild proclination of maxillary and mandibular incisors, Class II molar and canine relationship bilaterally and a positive VTO.

1. Introduction

Clinicians are periodically encountered with malocclusions that do not respond favourably to tooth moving mechanotherapies because the disharmony exists in the basal jaw bone.[1] Patients with Class II Division 1 malocclusion can exhibit maxillary protrusion, mandibular retrusion, or both, together with abnormal dental relationship problems and facial esthetic disorders. These malocclusions are treated with various orthodontic and orthopaedic appliances. Removable (activator, Balters bionator, Frankel) and fixed (Herbst, Jasper jumper, mandibular anterior repositioning appliance [MARA]) functional appliances are commonly used to treat Class II Division 1 malocclusions during the pubertal growth period in children.[2]

Functional appliances are primarily orthopaedic tools used to influence the facial skeleton in a growing child.[3] The aim of functional appliance therapy is to eliminate or minimise skeletal, dentoalveolar and muscular problems prior to the cessation of growth. Timing of treatment is critical and functional therapy or growth modification must be complete before the growth spurt ends.[4] Tulloch advises that one should consider the patient's age and maturity, severity of the initial condition, growth pattern and compliance before embarking on functional therapy.[5]

Since the discovery of the Herbst Appliance by Pancherz in the 1970s, many different non-compliant variants have come onto the market. They claim to allow greater freedom of movement of the mandible and allow lateral jaw movements to be carried out with ease. The major drawback with these appliances is the propensity with which fractures can occur, both in the appliance itself and in the support system.[6]

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2. Forsus Fatigue Resistant Device

The Forsus Fatigue Resistant Device (3M Unitek, Monrovia) is an innovative three-piece telescoping spring for Class II correction. It comprises a 0.5×3.0 mm spring bar (45% nickel,55% titanium) with a transparent plastic coating.[1] 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. The Forsus™ spring is supplied in four different lengths: 28 mm, 31 mm, 34 mm, and 37 mm, in each case for right and left fitting. Measurements are made in habitual occlusion mesially from the headgear tube of the upper first molar distally to the bracket of the lower canine. 12 mm is added to this measurement (4 mm play, 4 mm headgear tube, 4 mm activation) and this gives the length of the module to be used.[7] 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. 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]

The Forsus springs require anchorage preparation before they can be placed to minimize unwanted movement. It is necessary to align and level arches prior to insertion of the device with a minimum of 0.016 x 0.022-inch stainless steel (SS) required in a 0.018-inch slot, or a 0.019 x 0.025-inch wire in a 0.022-inch slot. The archwires should be tightly cinched and lower canines tied into the archwire with steel ligatures. The appliance places a distal force on the upper arch and a mesial force on the lower arch, allowing for Class II correction. Incremental forces can be created by placing 2-mm split crimps onto the push rod, increasing the pressure on the spring.[6]

3. Case Report

A 13-year-old female patient having a chief complaint of forwardly placed anterior teeth had reported with class II skeletal base having orthognathic maxilla and retrognathic mandible with a retruded chin. The patient exhibited horizontal growth pattern with competent lips, obtuse nasolabial angle and a deep mentolabial sulcus (Figure 1). The patient had a convex facial profile with an overjet of 7mm showing dental class II molar and canine relationship bilaterally. There was mild proclination of upper and lower incisors with mild crowding in the maxillary anterior region. The upper midline was shifted on the right side by 3mm (Figure 2).

Fig. 1: Pre-treatment Extraoral Photographs

Fig. 2: Pre-treatment Intraoral Photographs

Fig. 3: Clinical VTO

Fig. 4: FORSUS appliance in place

Fig. 5: Post-treatmentExtraoral Photographs

Table 1: Pre and post functionalcephalometric analysis.

Parameters	Normal value	Pretreatment	Post functional
SNA	82 ± 2^0	82^0	80^0
SNB	80 ± 2^0	75^0	76^0
ANB	2 ± 4^0	7^0	4^0
WITS appraisal	-1mm	3mm	2mm
Effective Maxillary Length	96±4mm	85mm	84mm
Effective Mandibular Length	127±6mmmm	99mm	101mm
Angle of convexity	-8.5 ± 10^0	12^0	10^0
Beta Angle	$27\ -35^0$	22^0	26^0
FMA	$22\text{-}25^0$	20^0	27^0
Y axis	53^0	60^0	70^0
LAFH	67-69mm	50mm	54mm
Sn-Go-Gn	32^0	27^0	29^0
Upper Incisor to NA	22^0/4mm	34^0/4mm	22^0/4mm
Upper Incisor to FH plane	107^0	115^0	107^0
Lower Incisor to NB	25^0/4mm	29^0/4mm	32^0/6mm
Lower Incisor to Mand Plane	90^0	105^0	105^0
Interincisal angle	135.4^0	120^0	120^0
Overjet	2 mm	7mm	2mm
Overbite	2 mm	0mm	3mm
Nasolabial angle	$102+8^0$	122^0	120^0
Lip strain	1 mm	3mm	2mm
Lower Lip to E line	-2 mm	-2mm	0mm
Upper Lip to S line	0 mm	1mm	0mm

Fig. 6: Post-treatment Intraoral Photographs

The cephalometric analysis of the patient dictated class 2 skeletal base with SNB angle of 75^o ANB of 7^o and BETA angle of 22^o. The upper incisors showed a value of 34^o /4mm and lower incisors of 29^o /4mm (Table 1). The cervical vertebrae evaluation indicated the MATURATION STAGE (Hassal and Farman)[10] as per which it could be predicted that the patient is towards the end of her pubertal growth spurt and the Visual treatment objective of the patient was positive as well (Figure 3).

After all the diagnostic evaluation it was decided to treat the patient with a non- extraction treatment therapy with a fixed functional appliance followed by finishing and settling. Levelling and aligning were initiated using 0.022 MBT pre-adjusted edgewise bracket prescription using 0.016 NiTi wires in both the arches. The 2^{nd}molars were banded as well and involved for anchorage preparation. Transpalatal arch in the maxillary and lingual arch in the mandibular arch was given respectively during the initial levelling and aligning.

After 6 months of treatment, adequate levelling and alignment had been achieved for placement of the Forsus FRD. Upper and lower .019" × .025" stainless steel wires were placed, 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 (Figure 4).

4. Result

Final arch coordination and detailing were completed, after 18 months of treatment. (Figure 6). Improved maxillomandibular relation was established by reduction in ANB angle and increase in Beta angle (Table 1). Intraorally class I molar and canine relation was obtained bilaterally (Figure 6). Patient's facial profile showed significant improvement (Figure 5).

5. Discussion

Conversion of the class II division 2 into a division 1 is essential to free the restriction of the upper incisors on the lower incisors to allow maximal advancement of the mandible with the FFRD. Removable functional appliances are quite effective, but they rely heavily on patient cooperation for achieving predictable results in reasonable time frame. Beside this there are many difficulties faced during performing other functions like speech with these appliances. To eliminate these drawbacks, fixed bite jumping appliance have been developed.[11]

Jones (2008)[8] in a study stated that Forsus fatigue resistant device as compared to class II elastics leads to a significant mesial movement of the lower molar and total molar correction in the Forsus group. Also, Franchi and Bacetti (2011)[12] assessed the overall effects of FFRD in comparison with fixed orthodontic treatment in the correction of class II malocclusion. They concluded that FFRD showed significant changes in the maxillomandibular relations with restraining effect on the maxilla.

The wide variety of functional appliances that are available to posture the mandible forward for the correction or Class II skeletal discrepancies which, gives the orthodontist a wide variety of appliance selection and at the same time challenges the rationale for selecting the most appropriate appliance. The decision as to which appliance is to be used is based primarily on the status of the dental and skeletal tissues of the patient, the type of dental response desired, the rate and amount of skeletal growth remaining, and the degree of co-operation anticipated from the patients.[11]

6. Conclusion

Newer innovations have come into this field, and with newer technology it is up to the clinician to decide as to when, where and how to apply it appropriately. As we all know, it is not the appliance and the philosophy but the clinician behind the appliance who can make the difference between success and failure.

7. Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

8. Source of Funding

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