IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 18, Issue 4 Ser. 17 (April. 2019), PP 74-80
www.iosrjournals.org

Non-Extraction Treatment of a Skeletal Class II Malocclusion Using 'Forsus' Appliance – A Case Report

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Abstract: *This case report describes the diagnosis and treatment of a 14 year old skeletal Class II female patient. The patient was treated by using forsus fatigue resistant appliance. The total time duration of the treatment was 26 months. A fixed functional appliance is given in a growing skeletal Class II patient with positive VTO and acceptable tooth size-arch length discrepancy, so that the case can be managed by a non-extraction approach. This device uses remaining growth of the patient and utilizes it in improving the esthetics and hence self-esteem of the patient that to non-surgically.*

Keywords:*Orthodontics, Orthodontic management, Skeletal Class II malocclusion, Non-extraction approach, Forsus fatigue resistant appliance*

Date of Submission: 11-04-2019 Date of acceptance: 26-04-2019

I. Introduction

Class II Div 1 is one of the most commonly found malocclusions in India. Common features of this malocclusion includes Class II skeletal base with Class II canine relationship, Class II incisor relationship and Class II molar relationship with increased overjet and overbite. Profile is usually convex with incompetent lips and lip trap. The etiology may include eitherprognathic maxilla or retrognathic mandible, however, according to McNamara, mandibularretrognathism is more common.[1,2] In case of non-growing patients with retrognathic mandible, treatment approach is either camouflage treatment or surgical treatment for severe discrepancy while for growing patients use of functional jaw orthopaedicshelps in mandibular repositioning by producing remodeling at glenoid fossa.[3,4]Devices used for mandibular correction may either be removable or fixed, however, patient cooperation is must with such appliances which may be seen less with the removable appliances. Hence, fixed appliances are a better option as they are less bulky, work for 24 hours and can be used with multibracket therapy to bring about the changes in single phase.[5]Fixed functional appliances can be either rigid, flexible or hybrid type.[6] Hybrid fixed functional appliances are a combination of optimum strength and flexibility hence proving a good option for the correction of Class II malocclusion. Most common hybrid type of fixed functional appliance used in dentistry is Forsus which is a three piece or two piece system having spring and push rod. The spring attaches to the distal of maxillary first molar while the push rod can be placed either distal to canine or 1st premolar bracket thus facilitating the forward movement of mandible.[7,8] Many studies have shown favorable results with the use of forsus during postpubertal growth period showing its effect on restraining maxillary growth, distal movement of maxillary arch, stimulating mandibular growth and mesial movement of mandibular arch. [9-11]

Aim of this case report is to show the effect of forsus on a growing Class II Div 1 patient with marked improvement in overjet, profile and mandibular retrusion of the patient.

A 14 years old female patient reported to the department with the chief complain of forwardly placed upper front teeth. Her medical and dental histories were non-significant with no signs of temporomandibular dysfunction while family history included sister with similar type of malocclusion.

Pretreatment extraoral examination revealed mesoprosopic facial pattern with mesocephalic head form, convex profile and incompetent lips**(Fig. 1).** Smile of the patient was normal with normal gingival and incisal display on smiling. Lateral view revealed mandibular retrusion as the reason for convex profile and hyperdivergentgrowth pattern with positive VTO which helped us in planning for fixed functional appliance for the improvement of both profile and molar relationship.

Her intraoral examination revealed asymmetric 'V' shaped maxillary arch with crowding and asymmetric 'U' shaped mandibular arch with full cusp class II molar and Class II canine relation bilaterally with an overjet of 8 mm and overbite of 50%. Midlines were discordant with lower midline shifted to left by 1mm with good periodontal condition in both the arches **(Fig. 2).**

Fig. 1 – Pre-treatment extraoral photographs

Fig. 2 - Pre-treatment intraoral photographs

The panoramic radiograph demonstrated developing 3rd molar buds in all the quadrants with adequate bone support. **(Fig. 3)**Lateral Cephalogram of the patient showed CVMI-Stage IV with Cephalometric findings showing a skeletal Class II pattern with ANB of 5° and Witsincreased to 4.5 mm with orthognathic maxilla and retrognathicmandible**(Fig. 4).** Patient had a hyperdivergent growth pattern with Frankfort –Mandibular plane angle of 30° and SN-MP angle of39° with proclined maxillary incisors having U1-NA 7mm/33° while the mandibular incisors were are at their normal position with an inclination of 32° **(Fig. 5).**

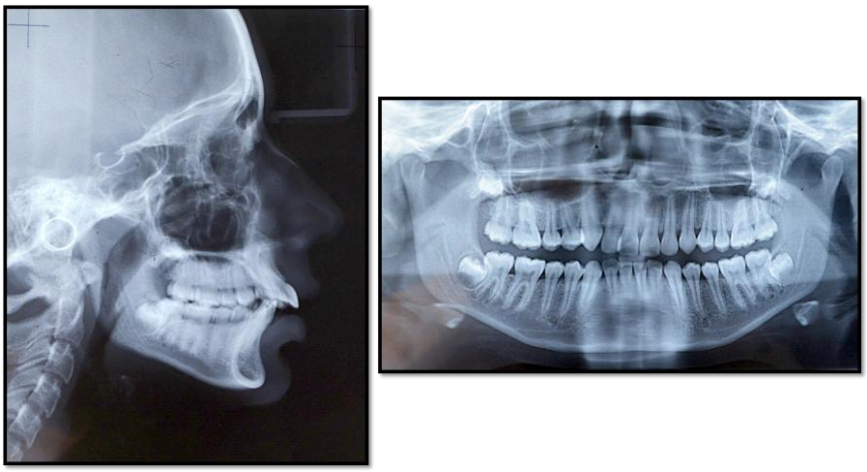

Fig. 3 – Pre-treatment radiographs (Lateral Cephalogram and OPG)

	pre	Stage	post
SNA	78 °	79°	80°
SNB	73 °	76°	77°
ANB (3.12°±1.8°)	5 °	3°	3°
Wits (-0.01mm)	4.5mm	2mm	2 mm
APP- BPP (5mm)	8.0mm	6mm	6mm
MM bisector (-5mm)	0mm	-3mm	0 mm

Fig. 4 – Cephalometric findings showing Pre-treatment Skeletal Class II base

FMA (23.83±2°)	30°	31°	31°
SN-MP (32-35°)	39°	38°	38°
Y Axis (59.62°±3)	64°	64°	64°
Bjork's sum (394°)	(136°+131°+130°)=397°	(130°+133°+130°)=393°	(130°+133°+130°)=393°
J ratio (59-63%)	58%	58%	58%
Gonial angle (123±7°)	130°	130°	130°
Upper anterior facial height (45%)	47%	45%	45.5%
Lower anterior facial height (55%)	53%	55%	54.5%

Mx 1 to A-Pg: 6.74±1.3mm	11mm	7.5mm	7.5mm
Mx 1 to NA: 4.92±2.05mm	7 mm	5mm	5mm
Mx 1 to NA: 24.02±5.82°	33 °	30°	30°
Mx 1 to Palatal Plane (71°)	50°	54°	60°
Md 1 to A-Pg (-2mm to 2mm)	2.2 mm	3mm	3mm
Md 1 to NB (6±1.7mm)	6 mm	6mm	7.5mm
Md 1 to NB (27±4.3 °)	32°	34°	36°
IMPA (100°)	101 °	102°	106°
Inter-incisor Angle (123°)	109 °	119°	119°

Fig. 5 – Cephalometric findings showing hyperdivergent growth pattern and pre-treatment proclined maxillary and mandibular anteriors

Treatment objectives were to

- Achieve Class I molar and canine relationship bilaterally
- Align and level the maxillary and mandibular dental arches
- Obtain normal overjet and overbite
- Correction of Curve of Spee of the lower arch
- Correction of protruded lips and to attain optimum soft tissue relationship

Treatment plan

Use of fixed functional appliance was planned to correct the skeletal Class II pattern, increased overjet and proper lip competency. Forsus was given as a fixed functional therapy which helped in mandibular repositioning by binging about the change or remodeling at the glenoid fossa. It was given after the leveling and alignment phase which helped in correction of crowding and deep curve of spee of the mandibular arch.

Treatment progress

Treatment was started with a pre-adjusted straight wire appliance. MBT appliance with 0.022 × 0.028″ slot was used. It was started with leveling and Alignment with a series of Nickel-Titanium wires followed by stainless steel wires like 0.016″ nickel-titanium, 0.018″ Nickel titanium, 020" Nickel titanium, 0.017×0.025″ nickel titanium, 0.019×0.025″ nickel titanium and 0.019×0.025″ stainless steel arch wires in a sequence that were cinched distal to molar to avoid maxillary and mandibular incisor proclination just after the crowding was relieved.Crowding of both maxillary and mandibular arches and curve of spee got corrected during this phase. After alignment, at 19 x 25" stainless steel wire planning for placement of forsus was done. The distance between distal to buccal tube of 1st molar and distal to canine bracket in both the quadrants of maxillary arch was measured and forsus of 31mm was placed with cinched 19 x 25" stainless steel wire in both the arches**(Fig. 6).** As functional appliances have a tendency to procline lower anteriors, so Figure of 8 was also done along

with cinch back in both the arches. Forsus was placed for 5 months with regular activation after which Class I molar and canine relation was achieved and it was removed. After removal of forsus, 19 x 25" stainless steel wire with labial root torque was placed for a period of 2 months in the lower arch for correction of proclination that occurred due to the effect of forsus. Finally after all the corrections, finishing and detailing phase was carried out using flexible round wire and settling elastics**(Fig. 7).**A panoramic radiograph was taken to evaluate the roots and their angulation and after getting satisfactory results the patient was debonded after a period of 26 months.

Fig. 6 – Forsus placed for skeletal Class II correction

Fig. 7 – Settling carried out using round wire and settling elastics

At the end of the treatment Class I molar and Class I canine relation was achieved with overjet reduced to 2 mm and overbite reduced to 30%**(Fig. 8).**

After removing the fixed appliance, retainers were given in both the arches with removable wraparound Hawley retainer with reverse inclined plane in the upper arch and a fixed canine-to-canine bonded lingual retainer in the lower arch and she is been recalled every month for reevaluation.

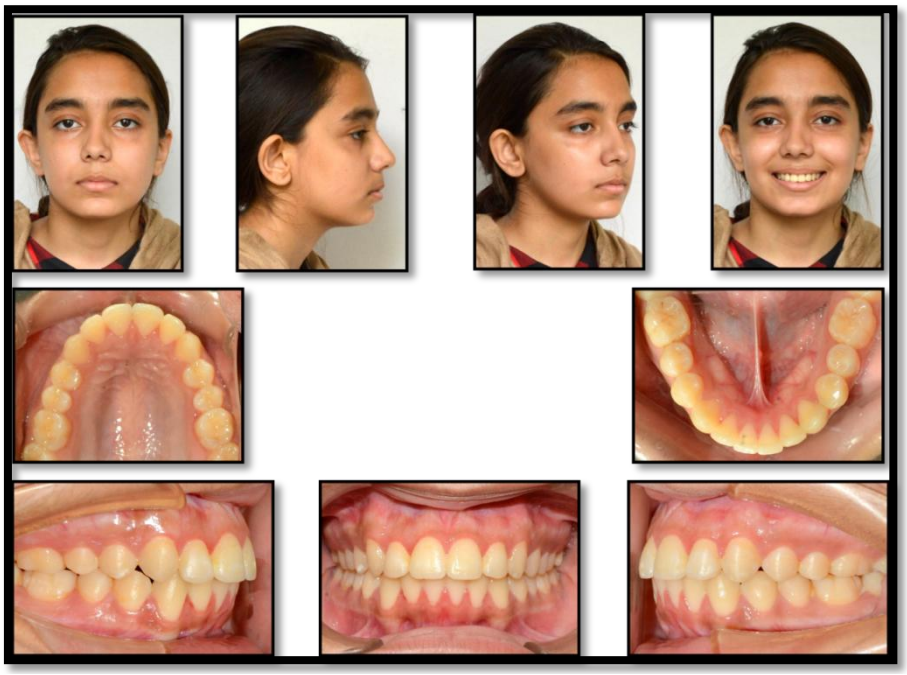

Fig. 8 – Post treatment photographs

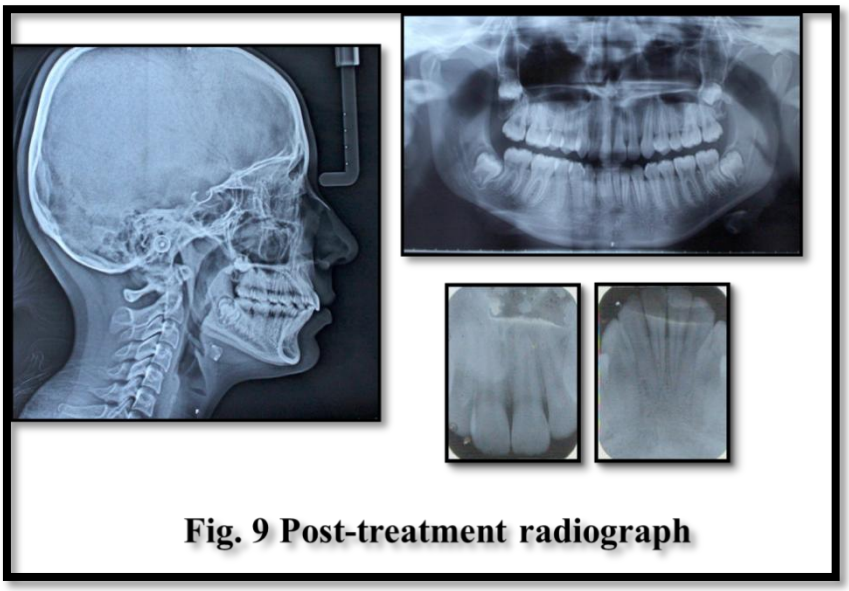

Fig. 9 Post-treatment radiograph

Fig. 10 – Pre and Post treatment Extraoral comparison

Fig. 11 Pre and Post Treatment intraoral comparison

II. Discussion

Class II Div 1 malocclusion is quite common in Indian population. It may result either because of maxillary prognathism or mandibular retrognathism. In case of non-growing individuals with madibularretrognathism, camouflage or surgical treatment can be planned depending on the severity of discrepancy[12]while forgrowing individuals, functional orthopaedic therapy is planned to bring about growth modulation. A common feature of such cases is normally positioned maxillary and mandibular anteriors with positive VTO,convex profile and an unaesthetic appearance. Growing age and positive VTO of the patient with minimum tooth size-arch length discrepancy point towards the use of functional appliances for correction of facial esthetics using growth modulation.Since this patient was in growing phase, VTO was positive and to avoid any problem with patient compliance, fixed functional appliance was used for treatment. Forsus in Class II patients in the growing age or during puberty may affect mandibular growth in a positive manner however in later stages it only facilitates dental changes by mesializing the entire mandibular arch and proclining mandibular anteriors to bring Class I molar and canine relation.[13] However, in our case SNB increased by 4 degrees showing forward displacement of the mandible skeletally and not only dental correction which occurred due to the residual growth in the patient that could be utilized by us in a positive manner. Along with SNB, ANB reduced to 3 degree from 5 degree, upper incisor to NA reduced from 7mm/33 degree to 5mm/30 degree while lower incisor to NB increased from 6mm/32 degree to 7.5mm/36 degree due to the proclining effect of forsus on mandibular incisors. Even cinching of arch wire and figure of 8 could not eliminate this effect of forsus like the other studies that quoted similar results.[14] Use of miniscrews as advocated by Aslanet al.[15] may eliminate this effect of proclination. Along with miniscrews, use of larger dimension wire with labial root torque may also help in reducing the proclining effect of forsus on lower anteriors.

Along with molar relation, overjetin the patient also reduced from 8mm to 2mm and both molar and canine changed from Angle's Class II relation to Class I relation. Profile became straight from convex and lip competency was achieved along with well aligned arches.

The advantage of using patient's residual growth helped in avoiding orthognathic surgery and use of fixed functional therapy in conjunction with fixed orthodontic treatment concluded the treatment in single phase thus reducing the treatment timing and patient compliance was also not an issue.

III. Conclusion

The treatment plan should be properly decided prior to starting the treatment. Whether to go for extraction or not, or to utilize remaining growth of the patient or not, each and everything should be discussed before starting the treatment so that best results possible in that case could be attained. Our results showed a satisfactory improvement in SNB and ANB angle and a pleasing soft tissue profile was achieved. Dental relationship got changed from Class II to Class I with proper interdigitation thus providing stable results to the patient. The combined effect of skeletal and orthodontically corrected results gave the patient a balanced and pleasing profile.

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Dr. Yumna Qamar. "Non-Extraction Treatment of A Skeletal Class Ii Malocclusion Using 'Forsus' Appliance – A Case Report." IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 18, no. 04, 2019, pp 74-80.