Rama Univ. J. Dent. Sci. 2022 JUNE; 9(2):15-20 ISSN No. 2394-417X (print), 2394-4188(online)

Orthodontic management of Class II Division 1 Malocclusion using the Forsus Fatigue Resistance Device- Case Report

Dr. Karuna Singh Sawhny [1]

[1] *Professor, Department of Orthodontics and Dentofacial Orthopedics, Rama Dental College Hospital and Research Centre, Kanpur, (U.P)*

Abstract

This case report presents the treatment of a 15-year-and-4-month-old girl with skeletal Class II division 1, mandibular retrusion, increased over jet, deep bite, and convex profile. The treatment plan involved forward movement of the mandible and the mandibular teeth to reduce the increased over jet using the Forsusfatigue-resistant device (FRD) appliance, semi-rigid fixed functional appliance. It is used most for treating Class II patients with retrognathic mandible.

The use of FRD appliance at appropriate time can result with significant changes in the facial profile and dentition, and the results can be maintained at the long-term follow-up periods.

Introduction

Angle's Class II malocclusion is one of the most encountered and treated malocclusions either with skeletal or dental clinical presentations in orthodontics.[1]The Angle's Class II malocclusion is the second in frequency, distribution, and prevalence among various Angle's malocclusion classes. However, it is the most reported and treated malocclusion in orthodontic practice. [2]

This malocclusion is described as a distal relationship of the mandible related to themaxilla with a combination of different dental and skeletal components which can affect facial aesthetics and functional harmony adversely. [3]

Moyers has classified Class II malocclusion into six horizontal types and five vertical types describing possible dental and skeletal features of Class II malocclusion out of which two such interesting types being associated with retrognathic maxilla. [4]The most common characteristic of Class I malocclusion is mandibular retrognathia rather than maxillary protrusion according to McNamara. [5]

Different orthodontic techniques and appliances have been instituted to treat Class I malocclusions, including functional orthopaedic appliances, variousintra-arch and inter-arch appliances, extra-oral appliances, particular extraction patterns, and orthographic surgery [6-9]

Appliance selection can involve removable or fixed functional appliances according to the existing antero-posterior discrepancy, co-operation, and growth period of the patient. No growing patients with Class II mandibular retrusion can be effectively treated with fixed functional appliances which do not require the patient's compliance. [10–12]

In such type of patients of Class II malocclusion which report late with minimal residual growth left can be treated with fixed functional appliances. One of the most preferred compliance free fixed functional appliances is Forsus Fatigue Resistant Device (FRD) which is used for the correction of Class II malocclusion with permanent dentition stage.[13]The Forsus FRD can deliver consistent forces and is resistant to fracture. It consists of superelastic nickel-titanium coil springs that can be assembled at chair side. FRD can apply consistent forces with nickel-titanium coil springs, and the force level can be adjusted by the clinician. [14]In the literature, favorable dentoalveoler effects have been presented during post-pubertal growth period by interarch fixed functional appliances.[13–15]Themain functions of the FRD appliance are restraining anteroposterior maxillary growth, enhancing mandibular growth,inducing distal movement of the maxillary archand mesial movement of themandibular arch.[10]

The purpose of this case report is to present the orthodontic management of Class II division 1 patient with mandibular retrusion, increased over jet, deep bite, and convex profile with FRD.

Case Presentation

A 15-year-and-4-month-old female was referred to Department of Orthodontics and Dent facial Orthopedics with a chief complaint of forwardly placed upper front teeth with spacing and backwardly positioned lower jaw. She was in good health with no significant systemic medical history, no oral habits, and no temporo mandibular joint (TMJ) symptoms.

Extra oral clinical examination indicated symmetric, mesoprosopic facial type with convex profile,

posterior divergence with retruded chin, deep labiomental sulcus and average nasolabial angle. The lips were short and incompetent with 7 mm of interlabial gap. (Figure-1).

Figure 1: Pretreatment Extraoral Photographs

The intraoral examination indicated U shaped symmetrical upper and lower arches. The upper arch showed anterior spacing, mesiolabial rotation of 13, 23 and mesiobuccal rotation of 24, 25. Lower arch showed mild anterior crowding and mesiolingual rotation of 33, 43.The canine relationship was Class II and molar relationship was Class II end on both right and left segments, respectively. The anterior over jet was increased, 7.5 mm. The anterior overbite was deep, 6.5 mm, maxillary incisors overlapping the mandibular incisors by 87.60%.Her maxillary midline was coincident with the facial midline, and the maxillary and mandibular midlines were coincident. (Figure 1).The study models analysis of maxillary and mandibular arches showed tooth material excess by 3.8 and 2.5mm, respectively. Panoramic radiographic evaluation showed permanent dentition till second molars. Tooth germs of all four third molars were present. (Figure 2).Examination of the lateral cephalometric radiograph indicated Class II skeletal base discrepancy with normal positioned maxilla (SNA: 81.5o), retrognathic mandible (SNB: 74.5o), skeletal Class II malocclusion (ANB: 7o), and average growth pattern (GoGnSN: 31o). The upper incisors were mildly proclaimed (U1-NA: 27o, 7mm) and the lower incisors were slightly proclaimed (L1-NB: 30o, 7 mm). (Figure 2).CVMI showed patient in CS 5 stage.

Figure 2: Pretreatment Intraoral Photographs

Diagnosis

The patient was diagnosed as Angle's class IIdivision 1 malocclusion with skeletal class II jawbases due to mandibular retrusion, short mandibular base length, having average growth pattern with increased overjet, deep overbite, mildly proclined upperand lower anteriors, mild spacing in upper anteriors.

Treatment Objectives-

The goal of orthodontic treatment was

(1). To achieve mandibular advancement, reduce facial convexity; improve patient's facial profile, and smileesthetics.
(2). Eliminate rotations with respect to 13, 23, 24, 25 and level and align the teeth.
(3). Eliminate the upper spacing,
(4). Reduce the over jet and overbite, and
(5). Correct the canine and molar relationship to Class I on both sides.

It was decided to treat the case with non extraction fixed appliance orthodontic treatment protocol including interarch Class II mechanics with bilateral Forsus Fatigue Resistant Device which would provide the mechanics necessary to achieve our objectives.

Treatment Progress

Treatment began with banding the first molars and bonding all other teeth (0.022 X 0.028-inch MBT appliance). In the upper arch, a transpalatal arch was placed to minimize the potential transverse adverse effects of the FRD appliance. Levelling and aligning stage started with 0.014- inch Ni-Ti for both the arches followed by 0.016-inch Ni-Ti for one month each. After that0.018-inch Ni-Ti, 0.017 × 0.025-inch Ni-Ti, 0.017 × 0.025-inch SS, 0.019 × 0.025-inch Ni-Ti, 0.019 × 0.025-inch SS arch wires were sequentially placed in both the arches, respectively. Tooth levelling and alignment were completed in 10months. After alignment and levelling upper anterior spacing was closed (Figure 3).After closure of upper anterior spaces, to prepare the teeth for Forsus FRD treatment, 0.021 x 0.025-inch Ni-Tiand 0.021 x 0.025-inchstainless steel wires were placed in both upper and lower arches. The Forsus FRD (29 mm) was assembled at chair side to push the mandible and the mandibular teeth forward(Figure 3).Tight inter ligation of the upper and lower arches was done and cinch back of the wires were used to secure the upper and lower arch position and to increase its anchorage. In addition to these, extra palatal root torque in upper incisor to maintain the inclination of the upper incisors. Labial root torque was applied to the lower incisors to limit the labial

proclamation of lower incisors. The appliance was inserted bilaterally from the distal part of the head gear tube on the maxillary molar to the arch wire distal to mandibular canine. Activation of the FRD appliance was done at3 month interval until a super Class I canine and molar relationships and a normal over jet were obtained. Active FRD application took 7 months. The Forsus FRD was removed after an ideal anterior overlap was achieved and occlusion detailing and settling began. Class II intermaxillary elastics were applied for better functional occlusion.

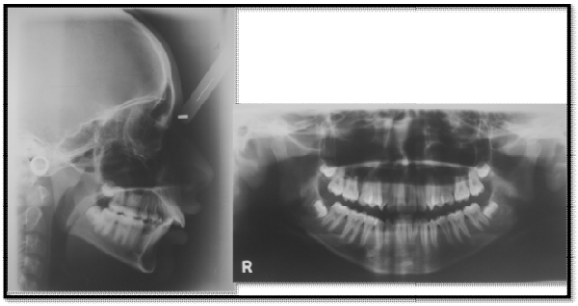

Figure 3: Pretreatment Lateral cephalograms and OPG

Finishing and detailing followed for 4 months after the molar correction. Total active treatment was 21 months. After obtaining ideal over jet, overbite and a functional interception, brackets were removed and the retention period began (Figure 4). During the retention period, the patient was instructed to wearupper Hawley retainer with anterior bite plane in the maxillary arch for 12 months all day to maintain the positions of the teeth after treatment.

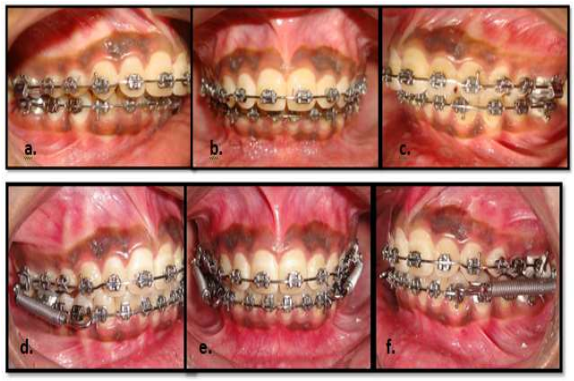

Figure 4: Mid treatment Intraoral Photographs, installation of Forsus device

Treatment Results-

The teeth were well aligned and levelled after treatment and the occlusion was stable. The first molars were in a Class I relationship, with the mesial buccal tip of the maxillary first molar occluded in the mesial buccal groove of the mandibular first molar. Normal anterior overbite and over jet were established. Overset was reduced from 7.5 mm to 2.6 mm and overbite reduced from 6.5mm to 2.2mm.

There was increase in the mentolabial angle (Figure 5) and midlines were coincident. The patient's harmonized profile and facial esthetics were achieved (Figs 5 and 6).

Figure 5: Post treatment Extra oral Photographs

Figure 6: Posttreatment Intraoral Photographs

Cephalometric measurements at the pre-treatment, post-treatment periods are given in Table1. The results indicated improvement in both skeletal and dental parameters. Cephalometric superimposition indicated downward and forward movement of the mandibular dent alveolar arch and backward movement of the maxillary dent alveolar arch. ANB angle decreased from 7 degrees to 4.5 degrees, because of retraction of maxillary arch and protrusion of mandibular arch. There was slight decrease in SNA and increase in SNB angle which indicated forward positioning of mandible. The mandibular plane angle was slightly increased, the facial convexity decreased and the prominence of labiomental fold diminished.

Table 1: The post-treatment panoramic radiograph showed no alveolar bone loss or apical root resorption and root parallelism was achieved, and no marked root resorption was detected. (Figure 7).

Cepalometric variables	Values normal	Pre-treatment values	Post treatment values
1.SNA	82	81.5 ^{o}	81.5^{o}
2.SNB	79	74.5 ^{o}	77 ^{o}
3. ANB	3	7 ^{o}	4.5 ^{o}
4.Wits	0	2.5 mm	1 mm
5.FMA	24	29 ^{o}	30 ^{o}
6.Y axis	59.4+-3.8	62.5 ^{o}	63
7.Angle of convexity	1.5+-5.8	12	9
8. U1-NA (^{o})	25	27 ^{o}	19 ^{o}
9. U1-NA (mm)	5mm	8.5 mm	+ 4 mm
10. L1-NB (^{o})	28	31 ^{o}	33^{o}
11.L1-NB (mm)	6mm	8 mm	7 mm
12.LOWER LIP – E-LINE (mm)	-2mm+-2mm	0.5 mm	+2 mm
13.Interincisal angle	131 ^{o}	115 ^{o}	120 ^{o}
14.U1-SN	102	107.5	100
15.IMPA	101 ^{o}	101 ^{o}	103 ^{o}
16. Nasolabial angle	90 – 110^{o}	90 ^{o}	100 ^{o}

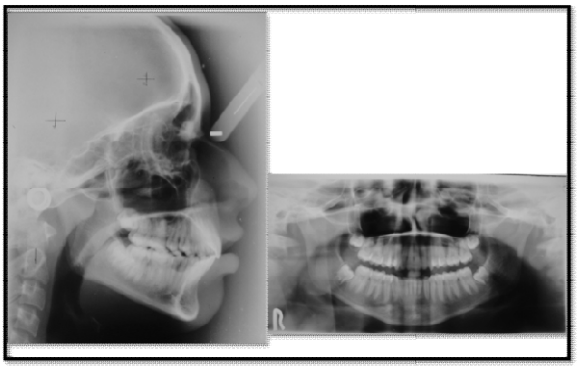

Figure 7: Post treatment Lateral cephalograms and OPG.

Discussion

Class II malocclusions resulting from mandibular retrusion are generally treated with functional orthodontic appliances that create orthopedic forces directed at the mandibular structures.These appliances influence the jaws via the following mechanisms: remodelling of the mandibular condyle, remodelling of the glenoid fossa, repositioning the mandibular condyle in theglenoid fossa, and autorotation of the mandibular bone. [16]

Amongst the fixed functional appliances available, Forsus-FRD has long been proved to be one of the best treatment modalities for mild to moderate class II malocclusion. It is capable of achieving a class II correction in 3 to 6 months depending uponthe situation and the biological response.[17]

The correction achieved is by a combination of skeletal and dental effects, 66% being dental and remaining 34% skeletal. [15], [18]

Significant improvement was noted in the soft tissue profile and pleasant smile was achieved for the patient. The result achieved was stable and highly satisfying for both the clinician as well as the patient. This appliance can lead mandibular growth and favourable dent alveolar changes in patients at or before the peak phase of pubertal growth.[19, 20]On the other hand, mostly dental changes are encountered for the patients at post pubertal period. [21]However, in this case report, the increase of the SNB angle was nearly 3oand the patient showed slight forward mandibular displacement after the treatment. This result can be correlated with the minimal residual growth of the patient during orthodontic treatment.

The dent alveolar changes were evident at both maxillary and mandibular arches (Table 1). Maxillary incisors and first molars demonstrated distal movement and intrusion. Mandibular first molars showed mesial movement and extrusion, and lower incisors exhibited proclination. The correction of the over jet was achieved by both retroclination of the upper incisors and protrusion of the lower incisors. Similar dental changes are also reported by the other studies.[10, 14]

Application of negative torque to the lower incisors and a lingual arch did not eliminate the unfavourable lower incisor protrusion. Even with these anchorage mechanics, mandibular incisors were proclined by 5 degrees. Increase in the mandibular incisor inclination is a similar common finding of fixed functional appliances as shown by the other studies. [22]

To eliminate this side effect of the FRD appliance, it could be effective to use miniscrew anchorage as shown by Aslan et al. [23]

Furthermore, mandibular rectangular archwires of greater size and addition of negative torque in the lower incisor region can be considered. Gao et al. [24] evaluated the effects and the stability of FRD appliance treatment and concluded relatively stable results 2 years after treatment.

Thus, Forsus FRD offers the advantages like predictable results, can be used in non-compliant or handicapped patients,ease of installation, less

breakages and robust in clinical usage**,** shortens the duration of treatment, can make use of residual growth even beyond the pubertal growth spurt, susceptibility to mechanical fatigue is negligible due to the spring.

Advantages for the patients include freedom of jaw movements and no tissue impingement.

Conclusion

We conclude that most class II situations are on account of a functional retrusion of the mandible. It would be very unwise to consider extractions in such situations. They are best managed by a non-extraction approach of mandibular advancement wherein Forsus FRD is the treatment of choice, especially for growing noncompliant patients.

Fixed functional appliance (FRD) application with appropriate treatment time resulted in prominent changes in the facial profile and dentition. Thus, Forsus FRD is one of the best treatment options for class II correction, with stable long term results achieved by sagittal forward displacement of mandible and remodelling at glenoid fossa.

References

1. W. R. Proffit, H. W. Fields Jr., and L. J. Moray, "Prevalence of malocclusion and orthodontic treatment need in the United States: estimates from the NHANES-III survey," The International Journal of Adult Orthodontics and Orthognathic Surgery, 1998, 13(2); 97–106.
2. Kharbanda OP. Orthodontics: Diagnosis and Management of Malocclusion and Dentofacial Deformities. 2 nd Ed. New Delhi: Elsevier India; 2013. P. 4, 57, 459-519.
3. M. Alarashi, L. Franchi, A.Marinelli, and E. Defraia, "Morph metric analysis of the transverse dent skeletal features of class II malocclusion in the mixed dentition, "The Angle Orthodontist, 2003; 73(1), 21–25.
4. Moyers RE, Riolo ML, Guire KE, Weeknight RL, Book stein FL. Differential diagnosis of class II malocclusions. Part 1. Facial types associated with class II malocclusions. Am J Orthod, 1980; 78: 477-94?
5. J. A. McNamara Jr., "Components of class II malocclusion in children 8–10 years of age," The Angle Orthodontist, 1981; 51(3): 177–202.
6. Graber TM, Rakosi T, Petrovic A. Dent facial Orthopaedics with Functional Appliances. St. Louis, Mo: Mosby; 1997:346–352.
7. Nelson C, Harkness M, Herbison P. Mandibular changes during functional appliance treatment. Am J Orthod Dent facial Orthop. 1993; 104:153–161.
8. Patel HP, Moseley HC, Noar JH. Cephalometric determinants of successful functional appliance therapy. Angle Orthod. 2002; 72:410–417.
9. Kulbersh VP, Berger JL,et al. Treatment effects of the mandibular anterior repositioning appliance on patients with Class II malocclusion. Am J Orthod Dent facial Orthop. 2003; 123:286–295.
10. L. Franchi, L. Alvetro, V. Giuntini, C. Masucci, E. Defraia, and T. Baccetti, "Effectiveness of comprehensive fixed appliance treatment used with the Forsus Fatigue Resistant Device in Class II patients," The Angle Orthodontist, 2011;81(4):678–683.
11. V. F. Zymperdikas, V. Koretsi, S. N. Papageorgiou, and M. A. Papadopoulos, "Treatment effects of fixed functional appliances in patients with Class II malocclusion: a systematic review and meta-analysis," The European Journal of Orthodontics, 2015.
12. O. Dalci, A. T. Altu˘g, and U. T. Memikoglu, "Treatment effects of a twin-force bite corrector versus an activator in comparison with an untreated Class II sample: a preliminary report," Australian Orthodontic Journal, 2014; 30(1):45–53.
13. E. A. Gunay, T. Arun, and D. Nalbantgil, "Evaluation of the immediate dentofacial changes in late adolescent patients treated with the Forsus_ FRD," European Journal of Dentistry, 2011;5(4):423–432.
14. G. Jones, P. H. Buschang, K. B. Kim, and D. R. Oliver, "Class II non-extraction patients treated with the forsus fatigue resistant device versus inter maxillary elastics," The Angle Orthodontist, 2008;78(2):332–338.
15. N. Heinig and G. Goz, "Clinical application and effects of the Forsus spring. A study of a new Herbst hybrid," Journal ofOrofacial Orthopedics, 2001; 62(6):436–450,.
16. Pancherz H, Ruf S, Kohlhas P. "Effective condylar growth" and chin position changes in Herbst treatment: a cephalometric roentgen graphic long-term study. Am J Orthod Dentofacial Orthop1998; 114:437-46.
17. Seniz Karacaya, Erol Akina, Huseyin Olmezb, A. Umit Gurtonb, Deniz Sagdic. Forsus Nitinol Flat Spring and Jasper Jumper Corrections of Class II division 1 Malocclusions. Angle Orthodontist. 2006; 76:666-72.
18. McNamara JA Jr, Bookstein FL, Shaughnessy TG. Skeletal and dental changes following functional regulator therapy on Class II patients. Am J Orthod. 1985; 88:91-110.
19. F. Bilgic¸, O. Hamamci, and G. Bas¸aran, "Comparison of the effects of fixed and removable functional appliances on the skeletal and dent alveolar structures," Australian Orthodontic Journal, 2011; 27(2):110–116.
20. I. K. Mahamad, P. K. Neela, R. Mascarenhas, and A. Husain, "A comparison of Twin-block and Forsus (FRD) functional appliance—A Cephalometric study," International Journal of Orthodontics, 2012; 23(3):49–58.
21. M. Upadhyay, S. Yadav, K. Nagaraj, F. Uribe, and R. Nanda, "Mini-implants vs fixed functional appliances for treatment of young adult Class II female patients: a prospective clinical trial," The Angle Orthodontist, 2012; 82(2):294–303.

22. A. Aras, E. Ada, H. Saracoˇglu, N. S. Gezer, and I. Aras, “Comparison of treatments with the Forsus fatigue resistant device in relation to skeletal maturity: a cephalometric and magnetic resonance imaging study,” American Journal of Orthodontics and Dent facial Orthopedics, 2011;140(5),616–625.
23. B. I. Aslan, E. Kucukkaraca, C. Turkoz, and M. Dincer, “Treatment effects of the Forsus Fatigue Resistant Device used with minis crew anchorage,” The Angle Orthodontist, 2014; 84(1):76–87.
24. W. Gao, X. Li, and Y. Bai, “An assessment of late fixed functional treatment and the stability of Forsus appliance effects,” Australian Orthodontic Journal, 2014; 30(1):2–10.

To cite this article: Orthodontic management of Class II Division 1 Malocclusion using the Forsus Fatigue Resistance Device- Case Report: Dr. Karuna Singh Sawhny, Rama Univ. J. Dent. Sci. 2022 June; 9 (2): 15-20