



Non-Extraction Treatment Approach in a Growing Class II Skeletal Patient with Severely Increased Overjet, Traumatic Deep Bite and Scissor Bite using Forsus FRD and Micro Implants

Shafees Koya^{1*}, Akhter Husain², Ajithesh KV³ and Shiyas Koya¹

¹Specialist Orthodontist, Shiyas and Ifthikar Medical Centre, Sharjah, UAE

²Professor and Head, Department of Orthodontics and Dentofacial Orthopaedics, Yenepoya Dental College, Yenepoya University, Mangalore, Karnataka, India

³Private Practice, Kasargod, Kerala, India

*Corresponding Author: Shafees Koya, Specialist Orthodontist, Shiyas and Ifthikar Medical Centre, Sharjah, UAE.

Received: September 10, 2020; Published: September 17, 2020

Abstract

Forsus FRD and microimplants acts as a tremendous tool in orthodontic armamentarium. This article illustrates the efficiency of forsus FRD to correct a class II division I patient with severely increased overjet, traumatic deep bite and scissor bite along with micro implant intrusion. A female patient aged 13 Years 4 months with a Class II skeletal base and vertical growth tendency was reported. She presented with 14.5 mm over jet, 11.5 mm deep bite with palatal trauma and scissor bite extending from upper right second premolar to the left second premolar, 7 mm upper anterior spacing with proclination and 6 mm lower anterior crowding. Upper and lowers were bonded with MBT prescription and arch wires were sequenced till 0.019" x 0.025" stainless steel wire. Two micro implants were placed between the central and lateral incisors in the upper arch and loaded till a 4 mm of intrusion of the incisors were achieved. After 18 months of treatment, the current overjet was 7 mm and Forsus FRD was placed bilaterally and the mandible was gradually advanced to a Class I molar and canine relationship. Eight months later, the overjet was reduced to 2 mm and the Forsus was removed. The patient was successfully treated by non-extraction treatment approach with the advancement of the mandible over 31 months. A good functional and aesthetic result was achieved with a class I skeletal base with controlled vertical proportions and an Angles class I molar and canine relation.

Keywords: Class II Skeletal Pattern; Forsus FRD; Micro Implants; Growth Modulation; Scissor Bite; Deep Bite

Introduction

Treatment approach in a Class II malocclusion varies according to the age, growth pattern and complexity of the malocclusion. The most common feature in a class II Division I malocclusion is an excessive overjet and overbite. An excessive overjet may be due to an increased upper anterior proclination resulting in an incompetent lip with/without lower lip trap. An increased risk of incisor trauma has been well documented in children with an overjet greater than 6 mm [1]. An excessive over bite may be traumatic to gingival tissues labial to the lower anterior segment, palatal to the upper anterior segment or in both locations [2]. If there is a transverse discrepancy, an associated cross bite may be present and its severe form in which mandibular dentition is contained in the maxillary

arch is scissor bite. It may affect the chewing and muscle function and may impair normal growth and development of mandible [3]. Thus, management of a class II malocclusion is essentially a functional correction over aesthetic needs.

During growing period, the treatment strategy in a class II malocclusion is focused to allow growth modification. Growth modification can be either by restraining maxillary growth, encouraging mandibular growth or by a combination of the two. Functional appliances appear to produce restraint of maxillary growth while encouraging mandibular growth. Advancement of the mandible by functional appliances improves the skeletal pattern and thus the profile, reduces the overjet and corrects the overbite by creating

a posterior disocclusion allowing the extrusion of the posteriors. Combining intrusion of upper anteriors with microimplants along with extrusion of posterior teeth (relative intrusion) is an ideal treatment of choice for adolescents to correct deep bite [4]. Advancement of the mandible also corrects the scissors bites to some extent by allowing the broader part of the mandible to come in relation with the maxilla. The ideal time for treatment with fixed functional appliance is early permanent dentition (to ensure a stable intercuspation of teeth post treatment) and after the pubertal growth spurt (to reduce retention period) [5]. It also provides the advantage of not requiring the patient’s compliance and that can be worn in conjunction with fixed appliances.

After the rediscovery of Herbst appliance by Pancherz., *et al.* [6] in late 1970s a wide variety of fixed functional appliance design started to be available for the orthodontist with its own advantage and disadvantages. Forsus FRD* is a semi rigid telescoping system, incorporating a super elastic nickel titanium coil spring within a stainless steel internal frame [7-11]. It has gained popularity since its inception and few researches have analyzed its effectiveness [12-26].

This article illustrates the efficiency of forsus FRD to correct a class II division I patient with severely increased overjet, traumatic deep bite and scissor bite along with micro implant intrusion.

Case Report
Diagnosis and treatment planning

A female patient aged 13 Years 4 months complaints of “Forwardly placed front teeth” (Figure 1). On clinical examination, the patient had a Class II skeletal base and vertical growth tendency. Her lips were flaccid, protrusive and incompetent at rest. The lower lip exhibited a lip trap with the upper incisors. She had a convex profile, acute nasolabial angle, deep mentolabial sulcus and a hyperactive mentalis. Her clinical VTO improved the profile. On intra oral examination, she had an Angles class I molar and a class II canine relation. There were minor areas of fluorosis affecting upper right canine and her upper right first premolar was discolored and root canal treated. She presented with 14.5 mm over jet, 11.5 mm deep bite with palatal trauma and scissor bite extending from upper right second premolar to the left second premolar. The malocclusion was further complicated by 7 mm upper anterior spacing with proclination, extruded upper incisors, 6 mm lower anterior crowding with constricted arches, 6.5 mm curve of spee and 2 mm centerline discrepancy with respect to facial midline.



Figure 1: 13 Year 4 months old female patient with increased overjet, overbite, scissor bite and class II skeletal base before treatment.

Cephalometric analysis (Table 1) revealed a Class II skeletal antero-posterior relationship with an ANB of 5°, Wits appraisal of 3 mm, Yen Angle [27] (116°) and Beta angle (25°). Pog to N Perpendicular showed that the chin is retruded by 9 mm. The maxilla and the mandible was backwardly placed (SNA- 78°, SNB- 73°) and decreased in length, and the effective mandibular length was decreased for that maxilla. The vertical proportions assessed by the maxillary-mandibular planes angle was normal (27°), but other parameters like SN-Go-Gn angle (35°), face height ratio (57%), FMA (26°) were slightly increased indicating a vertical growth tendency. Upper incisor to NF was increased by 2 mm indicative of extruded upper incisor or VME.

	Norm	Pre-Treatment	Post Treatment	Difference
SNA	82° ± 3	78°	76°	-2°
SNB	79° ± 3	73°	74°	1°
ANB	3° ± 1	5°	2°	-3°
Wits appraisal	0 mm	3 mm	1 mm	-2 mm
Upper incisor to maxillary plane angle	108° ± 5	122°	110°	-12°
Lower incisor to mandibular plane angle	92° ± 5	64°	95°	31°
Interincisal angle	133° ± 10	125°	122°	-3°
Face Height Ratio	55%	57%	55%	-2%
SN-GoGn	32°	35°	34°	-1°
Lower lip to Ricketts E plane	-2 mm	2 mm	-1 mm	0 mm
FMA	22°	26°	27°	1°
1 TO NA (Linear)	4 mm	11 mm	4 mm	-7 mm
1 TO NA (Degree)	22°	35°	23°	-12°
Lower 1 TO NB (Linear)	4 mm	4 mm	6 mm	2 mm
Lower 1 TO NB (Degree)	25°	18°	23°	5°
YEN Angle	117-123°	116°	118°	2°
Beta angle	27° - 35°	25°	28°	3°
Effective maxillary length	92.1 ± 2.7 mm	83 mm	87 mm	4 mm
Effective mandibular length	118.9 ± 5 mm	104 mm	109 mm	5 mm
NLA	90-110°	89°	102°	13°
Pog to N perpendicular	-3.5 ± 5.3	-19 mm	-16 mm	3 mm
1 TO NF	27.5 ± 1.7	31 mm	30 mm	-1 mm

Table 1: Cephalometric analysis.

The dental parameters indicated the upper incisors proclined by 12° to NA plane (35°) and to maxillary plane (122°) by 10°. The lower incisors were retroclined by 7° to NB plane and by 28° to mandibular plane (64°). The upper and lower lips were both significantly protrusive relative to Ricketts’ E plane. Nasolabial angle showed to be acute.

Ashley Howe’s Analysis was done since the patient appeared to have constricted arches. Maxillary arch expansion of 1 mm and Mandibular arch expansion of 3 mm was indicated as per the analysis. Thus, a transverse discrepancy with a more constricted mandibular arch has resulted in scissor bite. In Bolton’s analysis the ratio was just outside one standard deviation of the mean, suggesting a small tooth size discrepancy. In this instance, the discrepancy was a result of slight anterior mandibular dental excess, owing to the broad central incisors, and equated to approximately 0.9

mm. This was not deemed to be clinically significant. Hand wrist radiograph was taken to assess the growth status of the patient. According to Fishman skeletal maturity indicator (SMI), the growth status was interpreted as SMI-5 indicating 72% of growth potential is remaining for the maxilla and 62% for the mandible.

Treatment objectives were to correct Class II skeletal pattern and skeletal proportions, relief of lower anterior crowding, closure of upper anterior spacing along with its intrusion, correct the over jet, over bite and scissor bite to facilitate proper mastication. And finally, to achieve a Class I molar and canine relationship and to retain the corrected result. A non-extraction treatment plan was decided with lower arch expansion, intrusion of upper anteriors using micro implants and advancement of the mandible with fixed functional appliances.

Treatment progress

Upper and lowers were bonded with pre-adjusted edgewise fixed appliances (0.022" x 0.028" slot) with MBT prescription and 0.014" nickel titanium arch wire were placed. During further appointment, lingual button was bonded in the lingually tipped lower right second premolar and cross bite elastics were given to upright it. Once sufficient levelling and aligning was achieved in the lower arch, lingual arch was placed with slight activation for arch expansion (Figure 2). The activation was done by compressing the anterior component of the lingual arch using a three-pong plier. Lingual arch was continued for next 5 months till 3 mm expansion was achieved. Upper and lower arch wires were stepped up as the alignment progressed through 0.014", 0.016", 0.018", 0.017" x 0.025", 0.019" x 0.025" nickel titanium wires and later to 0.019" x 0.025" stainless steel wire for the next 13 months.

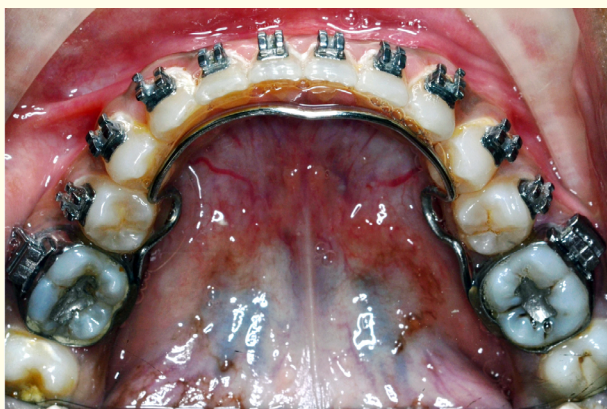


Figure 2: Lingual arch placed with slight activation for lower arch expansion.

At this point two micro implants (Length: 6 mm, diameter: 1.3 mm) was placed between the central and lateral incisors in the upper arch for intrusion of the incisors (Figure 3). Implant was loaded immediately with elastomeric chain tied loosely to the upper arch wire (0.019" X 0.025" SS) for a mild intrusive force. After gaining 4 mm intrusion elastomeric chain traction was discontinued (Figure 4). Remaining upper anterior space was closed.

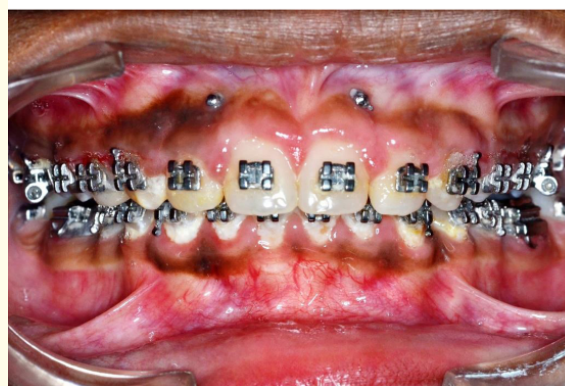
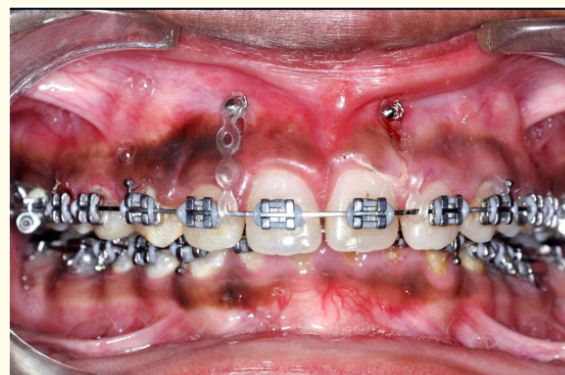


Figure 3: Two micro implants were placed between the central and lateral incisors in the upper arch and an intrusion of 4 mm was achieved.

After 18 months of treatment the current overjet was 7 mm and was decided to go ahead with the fixed functional appliance to correct the anteroposterior relationship. With 0.019" x 0.025" stainless steel wires placed in the upper and lower arch, brackets were consolidated from first molar to first molar. Both the arch wires were cinched back for reinforced anchorage. Forsus FRD[§] (25 mm size) with L-pin was placed bilaterally (Figure 4). Forsus FRD was activated in further appointments by adding crimps and the mandible was gradually advanced to a Class I molar and canine relationship. Eight months later, the overjet was reduced to 2 mm and

*Dentos, Daegu, Korea; www.dentos.co.kr. Distributed by Great Lakes Orthodontics Ltd., Tonawanda, NY; www.greatlakesortho.com

§Trademark of 3M Unitek, Monrovia, CA; www.3mUnitek.com.

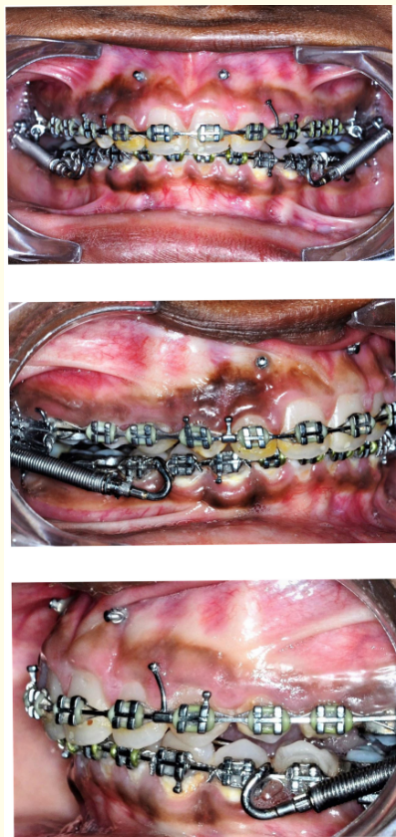


Figure 4: Forsus FRD placed bilaterally to correct the antero-posterior relationship with 0.019" × 0.025" stainless steel wires in the upper and lower arch and brackets been consolidated from first molar to first molar.

the Forsus was removed. Class II elastics was given to maintain the achieved advancement along with settling elastics. Settling elastics were given to settle the posterior occlusion. Fixed appliance was debonded after overall active treatment of 31 months. Beggs wrap around retainers were given for the upper arch and lower lingual fixed retainer was given. Gingivectomy and restorative procedures were carried out further.

Treatment results

The patient was successfully treated by non-extraction treatment approach with the advancement of the mandible over 31 months. Her post treatment smile says the difference the treatment had made in her social life. A good functional and aesthetic result was achieved with good interdigitation (Figure 5). A class

I skeletal base with controlled vertical proportions were achieved along with an Angles class I molar and canine relation. The 14.5 mm over jet was successfully reduced to within normal limits. The complete palatal traumatic overbite of 11.5 mm was also corrected to normal. The scissor bite which was present between the upper second premolars was also addressed giving a good occlusion (Figure 6). The upper anterior spacing and proclination was corrected. In the lower arch, crowding and retroclination was also addressed achieving a normal interincisal angle. Dental midline was coinciding. The facial midline appeared to be shifted very slightly to the right side with respect to dental midline, but was unnoticeable since the axial inclination of centrals were parallel to facial midline. Patient profile was improved to a near straight profile. Lip trap was successfully corrected. The short upper lip was present post orthodontics, but was improved by the lip exercises performed during treatment. Nasolabial angle was corrected to its normal. Due to the short upper lip, along with vertical maxillary excess the patient exhibited a consonant gummy smile. Lips were potentially competent at rest. There was also some root resorption seen in the post treat-



Figure 5: Patient after 31 months of treatment, showing improved profile, lip position, overjet, overbite and proper interarch relationship with good interdigitation.

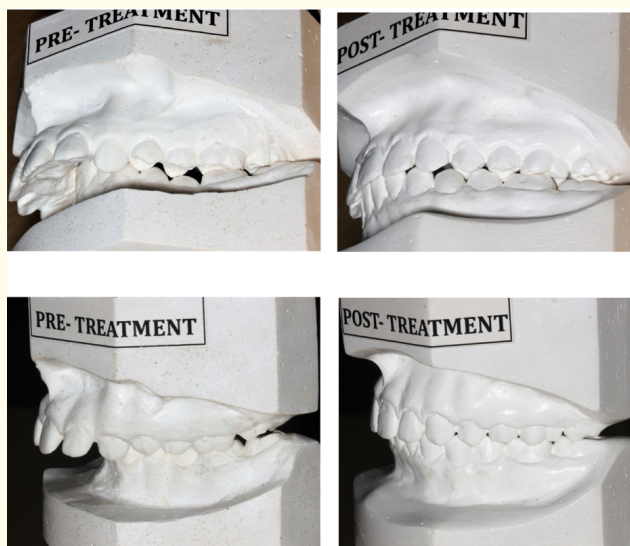


Figure 6: Pre and Post treatment cast showing corrected Scissor bite, overjet and overbite.

ment OPG affecting upper incisors, less than 2 mm which can be due to the micro implant intrusion. Patient exhibited gingival hyperplasia in the upper right region from canine to second premolar and gingivectomy was done after phase-I therapy post debonding. White spot lesions were also noticed in few teeth for which a conservative approach was adopted.

On cephalometric analysis (Table 1), SNA was reduced by 2° suggesting posterior remodeling of point A following upper incisor retroclination. There was no change in SNB. ANB was decreased by 3° and Wits appraisal by 2 mm indicating a class I skeletal pattern, thus showing improvement in the sagittal relationship without affecting the skeletal base due to the advancement of mandible. Effective mandibular length was also increased by 5 mm making it normal for the maxilla even though it was decreased for the age. Pog to N perpendicular showed the chin has improved by 3 mm but still it was decreased in length. The overall super imposition demonstrates the improvement of the chin and mandibular length. The vertical proportions were under control with the improvement of face height ratio (55%) to the normal range. Upper incisor to NF indicated an increased vertical maxillary excess by 1 mm despite intrusion of upper anteriors with micro implants. In analysis of dental parameters upper incisor to maxillary plane angle reduced by 12° following the space closure. The position of upper incisor to

NA decreased by 7 mm placing the incisors in the normal position. The lower incisors were proclined by 5° bringing it to the normal inclination. The lower incisor edge position advanced by +5 mm relative to upper incisor root centroid. The overall superimposition showed the mesial movement of lower molars and incisors which may be due to the advancement of the mandible (Figure 7). Maxillary superimposition confirms the retraction of upper incisors. Mandibular superimposition demonstrates that the lower incisors were proclined and the mandibular molars were extruded which opened the bite. The nasolabial angle was increased by 13° correcting it to the normal level. The lower lip to Rickett’s E plane was decreased by -1 mm bringing it to its near normal position.

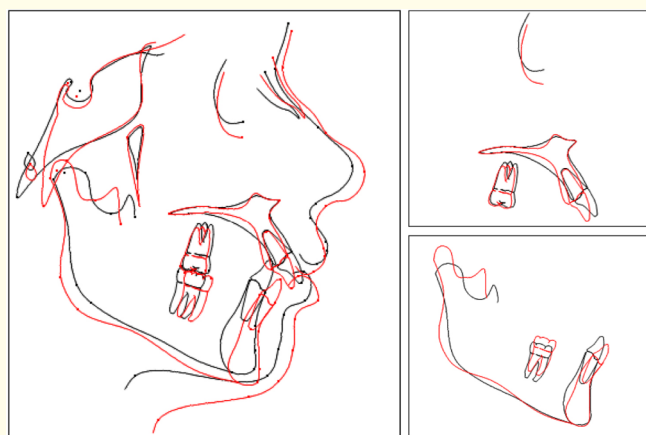


Figure 7: Superimposition of pre and post treatment cephalometric tracings

The final relationship of the lower incisor to the upper incisors in terms of inter incisal angle and incisor edge to centroid position should confer axial loading and stability of the overbite reduction. The habitual competent lips along with the lower lip covering the incisal one third of the upper incisors should enhance stability of the over jet. The patient was advised about the importance of long term retention due to possibility of further growth potential.

Three years later, the results were completely stable (Figure 8).

Discussion

Successful correction of class II division 1 cases using forsus FRD has been previously reported. In the literature, several studies have investigated the effects of a forsus FRD used alone between dental



Figure 8: Three years follow up photographs showing the results completely stable.

arches or anchored with miniscrews [12-26]. Most of the studies concluded that the FRD protocol is effective in correcting Class II malocclusion with a combination of skeletal (mainly maxillary) and dentoalveolar (mainly mandibular) modifications [15]. Cacciatore [19] evaluated treatment and posttreatment dentoskeletal effects induced by the Forsus device (FRD) in growing patients with Class II malocclusion in a retrospective controlled clinical study. He concluded that the FRD protocol was effective in correcting Class II malocclusion mainly at the dentoalveolar level when evaluated 2 years after the end of comprehensive treatment. The timing of the appliance placement is crucial for a greater skeletal effect in class II correction. Servello [20] assessed skeletal and dental changes in patients successfully treated with the Forsus appliance based on cervical vertebral maturation status. He concluded that forsus appliance treatment initiated during cervical vertebral maturation status (CS) 3 - 4 elicits more effective and efficient correction of Class II molar relationships than when initiated during CS 5 - 6. This enhanced efficiency of skeletal and dental effects was primarily due to maxillary skeletal and dentoalveolar restraint during a period of more rapid mandibular growth. Mahamad, *et al.* [21] and later Guintini, *et al.* [22] compared the dentoskeletal changes produced by the forsus Fatigue Resistant Device vs Twin-block

appliance in growing patients having Class II division 1 malocclusion. They concluded that both treatment protocols (TB and FRD) were effective in correcting Class II malocclusion, but twin block produced greater skeletal effects than did the FRD in terms of mandibular advancement and growth stimulation. Even though forsus anchored with miniscrew was attempted to overcome the dentoalveolar effect and mandibular incisor protrusion, they were successful only in minimizing the protrusion [23-25]. In this case, the lower incisors were retroclined and proclination of them were favored which were achieved. Reasonable amount of skeletal changes was noticed as per the cephalometric values. This could be due to the ideal treatment time as suggested by Servello [20].

Compared to other cases reported with respect to treatment using forsus our case exhibited three major features. Firstly, the patient exhibited severe overjet (14.5 mm). Secondly, the patient exhibited palatally traumatic deep bite (11.5 mm) and thirdly, the scissor bite involving many teeth. The increased overjet was corrected by anterior space closure and advancement of mandible. Traumatic deep bite was corrected by a combination of upper anterior intrusion using micro implants and extrusion of posterior teeth to the gap created during advancement of forsus. Scissor bite was corrected by a combination of expansion of lower arch using lingual arch and allowing the broader part of the mandible to come in relation with the maxilla during its advancement. One of the advantage of Forsus FRD compared to other fixed functional appliance is the minimal discomfort. Bowman, *et al.* [28] did a survey focused on patient's comprehensive experience with Forsus FRD, both initially and after several months of wear. He concluded that Forsus FRD is relatively well accepted by patients. Most patients experience some discomfort and functional limitations; however, the effect generally diminishes with time, and patients adapt to the appliance, but the practitioners should be especially vigilant about problems with cheek irritation.

Conclusion

Forsus FRD is effective in correcting angles class II division 1 growing patient with severe overjet, over bite and scissor bite. Three years follow up shows the result were stable.

Bibliography

1. Dearing SG. Overbite, overjet, lip-drape and incisor tooth fracture in children. *NZ Dent J.* 1984;80:50-52.
2. Glickman I. Role of occlusion in the aetiology and treatment of periodontal disease. *J Dent Res.* 1971; 50:199-204.

3. Nojima K, Takaku S, Murase C, Nishii Y, Sueishi K. A case report of bilateral Brodie bite in early mixed dentition using bonded constriction quad-helix appliance. *Bull Tokyo Dent Coll.* 2011;52(1):39-46.
4. Helling E. Increased overbite and craniomandibular disorders- A clinical approach. *Am J Orthod Dentofac Orthop.* 1990;98:516-522.
5. Issacson KA. Functional orthodontic appliances, RT Reed, C.D. Stephens, Blackwell scientific publication, 1990.
6. Pancherz H. Treatment of Class II malocclusions by jumping the bite with the Herbst appliance, A cephalometric investigation. *Am J Orthod Dentofacial Orthop.* 1979;76:423-442.
7. Vogt W. The Forsus Fatigue Resistant Device. *J Clin Orthod.* 2006;40:368-377.
8. Sood S. The Forsus Fatigue Resistant Device as a fixed functional appliance. *J Clin Orthod.* 2011;45:463-466.
9. Jain AK, Patil AK, Ganeshkar SV, Sangamesh B, Chugh T. Non-extraction treatment of skeletal class II malocclusion. *Contemp Clin Dent.* 2012;3:334-337.
10. Basavaraddi S, Gandedkar NH, Belludi A, Patil A. Correction of an adult Class II division 2 individual using fixed functional appliance: A noncompliance approach. *Contemp Clin Dent.* 2016;7:82-86.
11. Jung MH. Effective mechanics for vertical control with the Forsus Fatigue Resistant Device. *J Clin Orthod.* 2015;49:378-387.
12. Zhang R, Bai Y, Li S. Use of Forsus fatigue-resistant device in a patient with Class I malocclusion and mandibular incisor agenesis. *Am J Orthod Dentofacial Orthop.* 2014;145:817-827.
13. Jones G, Buschang PH, Kim KB, Oliver DR. Class II nonextraction patients treated with the Forsus Fatigue Resistant Device versus intermaxillary elastics. *Angle Orthod.* 2008;78:332-338.
14. Temani P, Jain P, Rathee P, Temani R. Volumetric changes in pharyngeal airway in Class II division 1 patients treated with Forsus-fixed functional appliance: A three-dimensional cone-beam computed tomography study. *Contemp Clin Dent.* 2016;7:31-35.
15. Franchi L, Alvetro L, Giuntini V, Masucci C, Defraia E, Baccetti T. Effectiveness of comprehensive fixed appliance treatment used with the Forsus Fatigue Resistant Device in Class II patients. *Angle Orthod.* 2011;81:678-683.
16. Aras I, Pasaoglu A. Class II subdivision treatment with the Forsus Fatigue Resistant Device vs intermaxillary elastics. *Angle Orthod.* 2017;87:371-376.
17. Aras A, Ada E, Saracoglu H, Gezer NS, Aras I. Comparison of treatments with the Forsus Fatigue Resistant Device in relation to skeletal maturity: A cephalometric and magnetic resonance imaging study. *Am J Orthod.* 2011;140:616-625.
18. Aslan BI, Kucukkaraca E, Turkoz C, Dincer M. Treatment effects of the Forsus Fatigue Resistant Device used with miniscrew anchorage. *Angle Orthodont.* 2014;84:76-87.
19. Cacciatore G, Ghislanzoni LT, Alvetro L, Giuntini V, Franchi L. Treatment and post treatment effects induced by the Forsus appliance: a controlled clinical study. *Angle Orthod.* 2014;84:1010-1017.
20. Servello DF, Fallis DW, Alvetro L. Analysis of Class II patients, successfully treated with the straight-wire and forsus appliances based on cervical vertebral maturation status. *Angle Orthod.* 2015;85:80-86.
21. Mahamad IK, Neela PK, Mascarenhas R, Husain A. A comparison of Twin-block and Forsus (FRD) functional appliance—a cephalometric study. *International Journal of Orthodontics.* 2012;23:49-58.
22. Giuntini V, Vangelisti A, Masucci C, Defraia E, McNamara JA, Franchi L. Treatment effects produced by the Twin-block appliance vs the Forsus Fatigue Resistant Device in growing Class II patients. *Angle Orthod.* 2015;85:784-789.
23. Turkkahramana H, Eliacikb SK, Findik Y. Effects of miniplate anchored and conventional Forsus Fatigue Resistant Devices in the treatment of Class II malocclusion. *Angle Orthod.* 2016;86:1026-1032.
24. Celikoglu, Buyuk SK, Ekizer A, Unal T. Treatment effects of skeletally anchored Forsus FRD EZ and Herbst appliances: A retrospective clinical study. *Angle Orthod.* 2016;86:306-314.
25. Upadhyay M, Yadav S, Nagaraj K, Uribe F, Nanda R. Mini-implants vs fixed functional appliances for treatment of young adult Class II female patients: A prospective clinical trial. *Angle Orthod.* 2012;82:294-303.
26. Uslu-Akcam O, Altug AT, Memikoglu UT. Class II young adult treatment with Twin Force Bite corrector: 10-year follow-up. *Contemp Clin Dent.* 2017;8:490-495.

27. Neela P, Mascarenhas R, Husain A. A new sagittal dysplasia indicator: The Yen angle. *World J Orthod.* 2009;10(2):147-151.
28. Bowman AC., Saltaji H, Flores Mir C, Preston B, Tabbaa S. Patient experiences with the Forsus Fatigue Resistant Device. *Angle Orthod.* 2013;83:437-446.

Volume 3 Issue 10 October 2020

**© All rights are reserved by Shafees Koya,
et al.**