

Treatment of a skeletal Class II malocclusion using fixed functional appliance with miniplate anchorage

Mevlut Celikoglu¹, Tuba Unal¹, Mehmet Bayram¹, Celal Candirli²

Correspondence: Dr. Mevlut Celikoglu
Email: mevlutcelikoglu@hotmail.com

¹Department of Orthodontics, Faculty of Dentistry, Karadeniz Technical University, Trabzon, Türkiye,
²Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Karadeniz Technical University, Trabzon, Türkiye

ABSTRACT

Based on our literature search, we found that the use of miniplate anchorage with Forsus fatigue-resistance device (FRD) has not yet been reported. Therefore, the aim of the present case report was to present the treatment of a patient with skeletal Class II malocclusion with mandibular retrusion using Forsus FRD with miniplate anchorage. Fixed appliances with 0.022-inch slots were attached to the maxillary teeth and after 8 months of the leveling and alignment of the upper arch, 0.019 × 0.025-inch stainless steel archwire was inserted and cinched back. Two weeks after the placement of the miniplates bilaterally at the symphysis of the mandible, Forsus FRD was adjusted to the miniplates with a 35-mm length of rod chosen. Nine months after the skeletal anchored Forsus worn, Class I canine and molar relations were achieved and overjet was eliminated.

Key words: Fixed functional appliance, Forsus, miniplate, skeletal anchorage

INTRODUCTION

There are several types of removable and fixed functional appliances for the correction of Class II Division 1 malocclusions with mandibular deficiency in order to stimulate mandibular growth by forward positioning the mandible. The selection of the appliance varies according to the clinicians' preference, type of the anomaly and growth pattern.^[1] As compared to removable functional appliances, fixed functional appliances do not require patient compliance and can be used with brackets.^[2] Thus, compliance-free inter-arch appliances such as Herbst, Jumper and Forsus were commonly used in the correction of Class II malocclusions due to the mandibular retrusion or small mandibular size.^[3]

Several studies evaluated the effects fixed functional appliances such as herbst,^[4] jumper jumper,^[5] twin force^[6] and Forsus.^[7] Previous studies proved the

efficiency of those fixed functional appliances; however, distal and intrusive movement of maxillary molars, mesial movement of mandibular molars, retrusion of maxillary incisors, protrusion of mandibular incisors have been reported to be some disadvantages of fixed functional appliances.^[8-12]

Although data from the literature showed that the use of skeletal anchorage in orthodontics has increased, there were few studies showing the use Herbst^[13] and Forsus fatigue-resistance device (FRD)^[9] with miniscrew anchorage. According to those studies,^[9,13] unfavorable labial tipping of the mandibular incisors was effectively minimized with the usage of miniscrews. However, overjet and molar correction was found to be totally dentoalveolar in the Forsus FRD study.^[9]

The present case report shows the treatment of a patient with skeletal Class II malocclusion with mandibular

How to cite this article: Celikoglu M, Unal T, Bayram M, Candirli C. Treatment of a skeletal Class II malocclusion using fixed functional appliance with miniplate anchorage. Eur J Dent 2014;8:276-80.

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DOI: 10.4103/1305-7456.130637

retrusion using Forsus FRD with miniplate anchorage. Based on our literature search, we found that the use of miniplate anchorage with Forsus FRD has not yet been reported.

CASE REPORT

A 13.5-year-old female patient presented to our department with the chief complains of irregular maxillary and mandibular anterior teeth and backwardly placed of mandibular central incisors. Pretreatment clinical examination showed that she had Class II Division I malocclusion associated with mandibular retrusion and an increased overjet. The profile was convex with 100% incisor exposure while smiling. The maxillary and mandibular arch-length deficiencies were 3 and 5 mm, respectively [Figure 1]. Examination of cephalometric radiograph revealed skeletal Class II malocclusion due to mandibular retrusion (SNA: 80.7°, SNB: 76.5° and ANB: 4.2°)

and average vertical growth pattern (SN-GoGn: 28.4°) [Table 1]. Panoramic radiograph revealed the presence of third molars in all quadrants. Examination of left hand and wrist using the reference atlas Greulich and Pyle showed that skeletal age was 14 years and a DP3u stage [Figure 2].

Treatment objectives were to relieve the crowding in anterior teeth, to eliminate increased overjet and to achieve Class I canine and molar relationships. Fixed MBT appliances with 0.022-inch slots were attached to the maxillary teeth and bands were placed with a transpalatal arch to minimize side effects on the posterior segment. After the leveling and alignment of the upper arch, a 0.019 × 0.025-inch stainless steel archwire was inserted and cinched back. Leveling and alignment was completed in 8 months and after the first phase of the treatment the overjet and overbite measurements were 6 and 5 mm, respectively [Figure 3].



Figure 1: Extra- and intra-oral photographs of the patient prior to orthodontic treatment

The miniplates (Tasarım Med, Istanbul, Turkey) were placed bilaterally at the symphysis of the mandible under local anesthesia. The miniplates were adjusted to fit the contour of the symphysis and



Figure 2: Radiographic views of the patient prior to orthodontic treatment

fixed by three bone screws made of titanium (length, 7.0 mm; diameter, 2.0 mm). Two weeks after the surgery, Forsus FRD was adjusted to the miniplates with a 35 mm length of rod chosen [Figure 4]. The patient was observed at 4-week intervals, and activation was performed by crimping stoppers onto the pushrod if needed. Nine months after the skeletal anchored Forsus worn, Class I canine and molar relations were achieved and overjet was eliminated [Figure 5]. Lateral cephalometric radiograph taken after skeletal anchored Forsus treatment [Figure 6] showed retardation of maxillary growth (mean SNA: -0.7° , mean Co-A: -0.4 mm and mean A-PMV: -0.6 mm), forward movement of the mandible (mean SNB: 1.6° , mean Co-Gn: 3.1 mm and mean Pog-PMV: 3.0 mm) and thus the correction of skeletal Class II malocclusion (mean ANB: 2.3°) and profile convexity. In addition, both maxillary and mandibular incisors (-9.1° and -7.8° , respectively) were retruded as could be clinically observed [Table 1]. After 17 months of orthodontic



Figure 3: Extra- and intra-oral photographs of the patient after alignment and leveling

treatment, fixed MBT appliances with 0.022-inch slots were attached to the mandibular teeth and the treatment still goes on.

DISCUSSION

Although several attempts were performed using miniscrew anchorages in order to eliminate the protrusion of mandibular incisors and to improve the skeletal contribution of Class II correction, they were successful to decrease the lower incisor protrusion but unsuccessful for the improvement of skeletal contribution.^[9,13] In this case report, a new approach that was not previously described in the literature was firstly described. The aim of using miniplate anchored Forsus FRD was to eliminate lower incisor protrusion which was a common finding of both removable and fixed functional appliances.^[3,8,9,11,12] And thus, our hypothesis

was that the mandibular advancement could be improved.

Various options including the use of negative torque lower incisors brackets, sectional arches and miniscrews have been used to eliminate the lower incisor protrusion.^[8,9,11,13] Of them, miniscrew anchored Forsus was found to be effective to eliminate lower incisor protrusion. However, according to the authors,^[9] the changes were totally dentoalveolar and thus it seems it was unsuccessful to improve the mandibular advancement. One explanation for no significant mandibular advancement might be that short

Table 1: Mean values of the examined parameters at the beginning (T0), prior to (T1) and after (T2) skeletal anchored forsus FRD

Parameters	T0	T1	T2
SNA (°)	80.7°	81.3°	80.6°
SNB (°)	76.5°	76.9°	78.5°
ANB (°)	4.2°	4.4°	2.1°
SN/GoGn (°)	28.4°	28.3°	30.2°
FMA (°)	25.3°	25.5°	26.8°
U1-SN (°)	100.4°	102.3°	93.2°
IMPA (°)	95.2°	95.3°	87.5°
U1-NA (°)	19.7°	20.9°	12.7°
U1-NA (mm)	4.5	3.9	1.4
L1-NB (°)	23.6°	21.6°	11.8°
L1-NB (mm)	3.4	2.9	-0.3
Co-A (mm)	81.7	82.3	81.9
Co-Gn (mm)	98.4	99.2	103.3
A-PMV (mm)	46.4	47.3	46.7
Pog-PMV (mm)	39.1	40	43
Ls-E (mm)	-4.8	-2	-4.8
Li-E (mm)	-1.5	-1.7	-5.3
Overjet (mm)	5.5	6	2
Overbite (mm)	5.5	5	6



Figure 5: Extra- and intra-oral photographs of the patient after skeletal anchored Forsus FRD



Figure 6: Cephalometric lateral films before and after skeletal anchored Forsus FRD



Figure 4: Adjustment of the miniplates on symphysis and application of skeletal anchored Forsus FRD

period (6 months) of Forsus use may be not enough duration for mandibular growth.^[9] In the present case report, maxillary growth was slightly restrained (mean SNA: -0.7° , mean Co-A: -0.4 mm and mean A-PMV: -0.6 mm) and mandibular growth was prominently accelerated (mean SNB: 1.6° , mean Co-Gn: 3.1 mm and mean Pog-PMV: 3.0 mm). Upper and lower incisors were retruded and these changes caused an increase for overbite. Although the retrusion of maxillary incisors was a common finding in previous studies,^[3,8-12] the use of skeletal anchorage in the present case might increase the upper incisor retrusion. On the other hand, the decrease for IMPA in this case report was surprisingly found to be very high (-7.8°) as not expected by the authors prior to the treatment. We think that it might be due to the pressure of upper incisors and lower lip. However, this change might be an advantage for the treatment of Class II subjects since an increased IMPA was a common finding^[3,8,9] in these patients.

Despite those favorable results, the minor surgical procedure to place miniplates on mandibular symphysis and the necessity of a second operation for the removal of the miniplates at the end of the treatment are disadvantages of this system. On the other hand, a limitation of the present study was that long-term results of this new approach were needed. Further studies are needed to prove/discuss our findings, and clinicians should consider both advantages and disadvantages of miniplate anchored Forsus FRD before using in their clinics.

ACKNOWLEDGMENT

This case report was part of work that was supported by a research grant from Karadeniz Technical University, Scientific Research Projects Unit, and Project number: 9705.

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Source of Support: Nil.

Conflict of Interest: None declared