Original Article

Anchorage Augmentation Technique in Cases of Procumbent Mandibular Incisors Employing Temporary Anchorage Devices with Class II Correctors

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ABSTRACT

Introduction: To assess following changes with mini implant anchored fixed functional appliance (Forsus Fatigue Resistant Device)

1. Change in mandibular incisors inclination during course of fixed functional treatment anchored to mini implants.
2. Pretreatment and post-treatment fixed functional airway changes.

Materials and methods: Fifteen Class II malocclusion subjects with mandibular retrusion were selected. Mandibular retrusion was corrected by fixed functional appliance therapy (Forsus Fatigue Resistant Device) and unfavorable labial tipping of mandibular incisors was minimized with usage of mini implants (1.3 × 10 mm Denticon) inserted between mandibular canine and first premolar root area bilaterally. Lateral cephalograms were taken before Forsus placement at mean age of (T1) is 14.25+/-1.65 years of age and after Forsus at T2 is 14.74+/-1.75 years of age. Student Paired t test was used for statistical analysis.

Results: Class I molar relationship and overjet correction achieved in an average period of 5.32+/-1.27 months. Increase in mandibular incisor inclination is minimal i.e. 1.07+/- 0.8 degrees with p value-0.061, also increase in upper pharyngeal airway width by 0.93+/-1.01 mm with p value-0.05 and highly significant increase in lower pharyngeal airway width by 2.7+/- 1.21 mm with p value <0.001.

Conclusion: Association of TADs with fixed functional appliance can reduce undesirable proclination of lower incisors and enhance skeletal response. Upper and lower pharyngeal airway dimensions exhibit changes, withlower airway showing highly significant changes.

Keywords: Forsus; Mini-implant; Fixed functional appliance; Class II correction.

INTRODUCTION

Class II malocclusion is commonly observed in orthodontic practice, its frequency being reported as approximately one third of the patient seeking orthodontic treatment.[1-3] Its prevalence was found to be between 15% and 30% in different population.[4-6] Most common characteristic of this malocclusion is mandibular retrusion, rather than maxillary protrusion or other combinations. According to Mcnamara,[7] the most common features of Skeletal Class II with retrognathic mandible are convex profile, increased overjet, mandibular incisors proclination as a natural compensation and restricted airway associated with mouth breathing.

The introduction of non compliance systems has markedly influenced Class II treatment. The Forsus Fatigue Resistant Device (FFRD) which is also a hybrid fixed functional appliance was introduced by Vogt in 2006 and the treatment effects are mainly dentoalveolar. Protrusion of mandibular incisors was reported to be a common finding that limits the skeletal effects of the appliance.[8]

This is especially undesirable in patients where the lower incisors already exhibit a compensatory proclination at the

start of treatment, for which reason, further proclination should be avoided during the correction of the sagittal discrepancy. Several attempts have been made using modifications in design, negative torqued mandibular incisor brackets, sectional arches to eliminate such protrusion but absolute anchorage control has not yet been achieved and loss of mandibular anchorage can be anticipated.[9,10]

Introduction of temporary anchorage devices (TADs) has brought the option of absolute anchorage control to daily clinical practice. It eliminates dentoalveolar adverse effect from fixed functional appliance therapy, especially mandibular anterior protrusion mini-implants can be used as anchoring units with virtually no adverse effects on any teeth.[11]

AIMS AND OBJECTIVES

- To assess change in mandibular incisors inclination during the course of fixed functional treatment anchored to mini implants.
- To assess the pre- and post-fixed functional airway changes.

MATERIAL AND METHODS

Selection of subjects: 15 subjects with Skeletal Class II malocclusion were selected by screening the patients visiting the OPD (out patient department) and by conducting free screening camps in various schools. The cephalograms of the subjects were categorized into two groups-Prefixed functional (T1) and postfixed functional (T2) (Figs 1 and 6).

Inclusion criteria included:

- Skeletal Class II malocclusion patients with retrognathic mandible.
- Patients in active growth period or at the end of the growth spurt.
- Positive VTO on clinical evaluation.
- Increased over jet.
- IMPA> 100.

Exclusion criteria included:

- Patients with negative VTO.
- Skeletal Class II malocclusion with prognathic maxilla.

Lateral cephalograms of the selected sample were evaluated for: Skeletal Class II ANB of > 4°, Beta angle <27°, increased IMPA (>100) (Figs 7A and B). Increased wits appraisal. Records that included in the study were diagnostic casts, patient intra and extra oral photographs, orthopantogram and lateral cephalogram, before placement of fixed functional appliance (T1) and before removal of fixed functional appliance (T2).

Mini-implants (1.3 × 7 mm Dentos) were inserted between the mandibular canine and first premolar root area bilaterally

Figure 1 Pretreatment cephalogram

Figure 2 Miniimplant inserted and indirect anchorage established using 0.019 × 0.025 inch stainless steel archwire between canine tooth and miniscrew slot

(Fig. 2). An indirect anchorage was established by using a 0.019 × 0.025 inch stainless steel archwire between the canine tooth and the miniscrew slot with Transbond XT composite material.

Before placing the Forsus appliance, measurement guide was used to determine correct push rod length (Figs 3 to 6).

Prefixed functional and postfixed functional lateral cephalograms were traced on fine acetate matte tracing paper measuring 8 × 10 inch and 0.003 inch in thickness using a transilluminator.

STATISTICAL METHOD

1. Arithmetic mean

$$(x) - \frac{\sum x}{n}$$

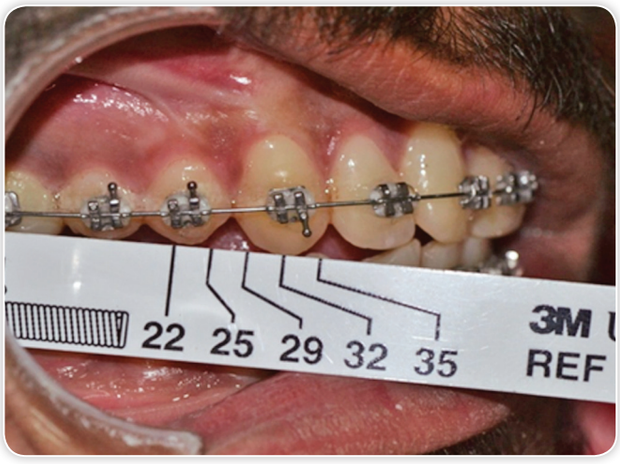


Figure 3 Measurement guide

Figure 5 Postfixed functional treatment

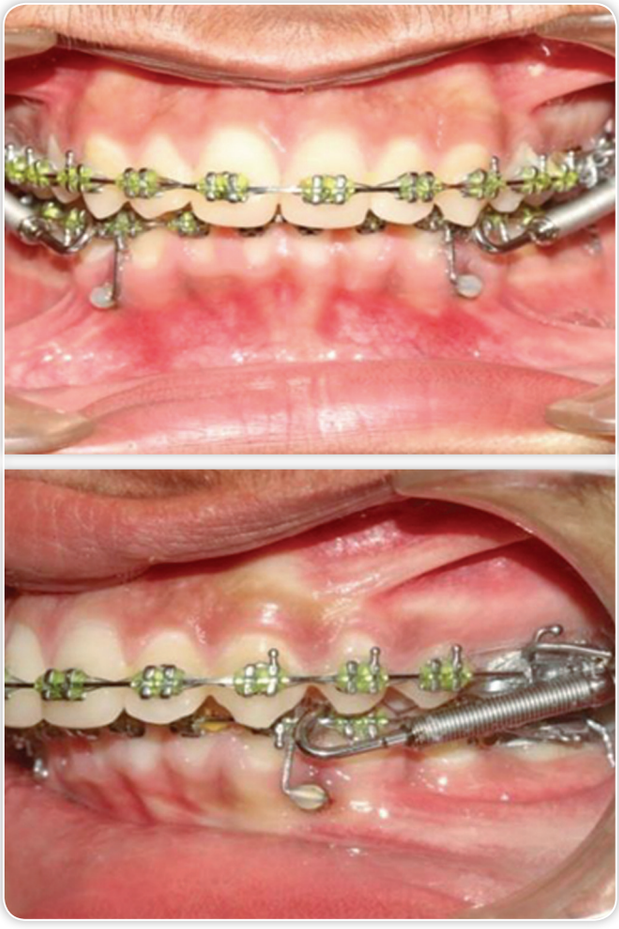


Figure 4 After Forsus placement

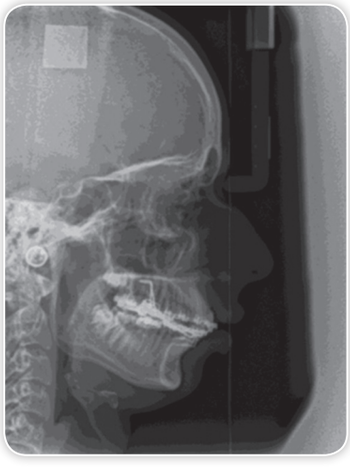
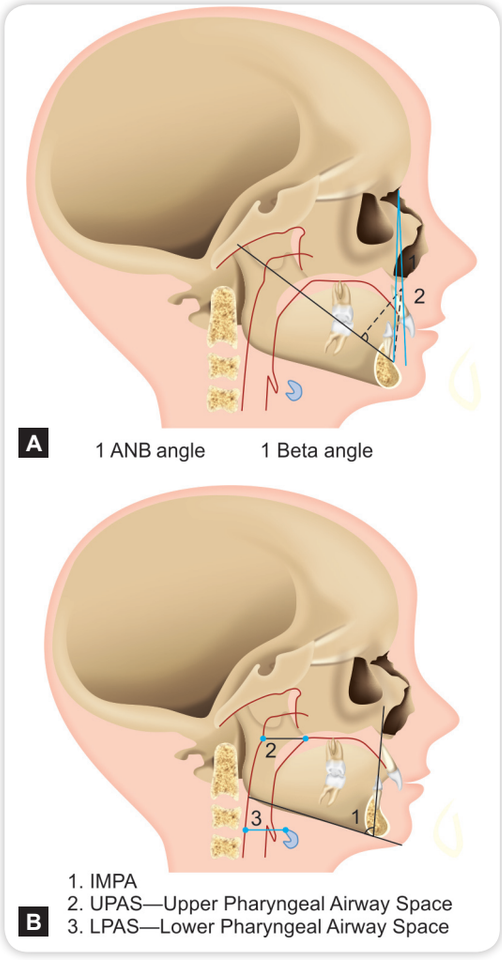


Figure 6 Postfixed functional cephalogram



Figures 7A and B (A) Parameters used for sample selection, (B) Parameters used in the study

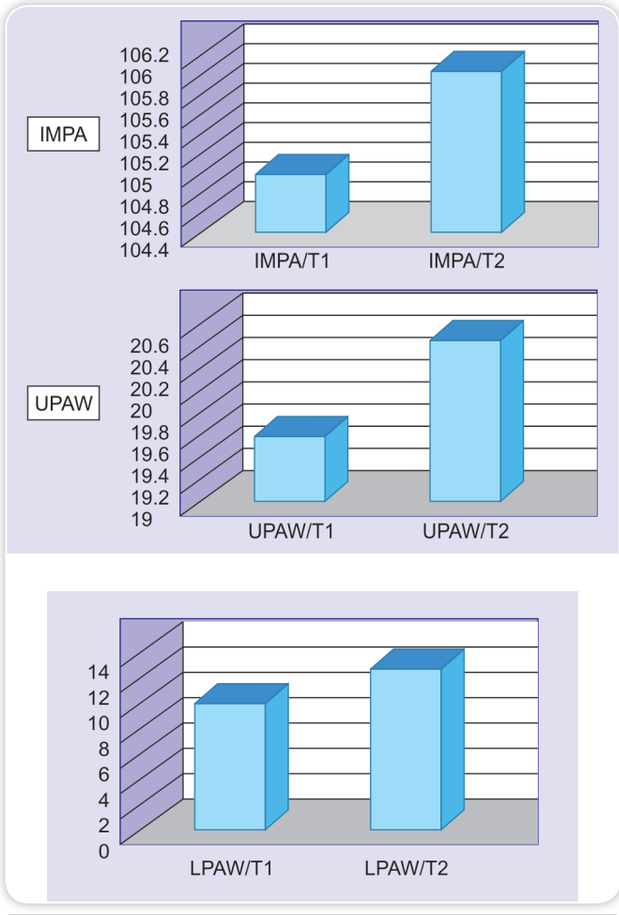


Figure 8 Paired t test valve of LPAW

2. **Standard deviation (σ)**
3. The significance of difference was tested by means of large samples 'T' test as under:

$$T = \frac{\text{Difference in mean}}{\sqrt{\frac{\sigma_{12}}{n_1} + \frac{\sigma_{22}}{n_2}}}$$

σ_1 **and** σ_2 are standard deviations of the two groups, being compared with n_1 **and** n_2 as number of samples. The significance (*p* level) was determined by consulting the table of normal distribution.

RESULT

Incisor Mandibular Plane Angle (IMPA): Mean value for IMPA at T1 is 105+/- 1.81 and at T2 is 106.07+/-1.75. When T1 was compared with T2, statistically nonsignificant (P=0.061, i.e. P>0.05) relation was found (Table 1).

Upper Pharyngeal Airway Width (UPAW): Mean value for UPAW at T1 is 19.6+/- 1.87 and at T2 is 20.53+/-1.85. On comparison of mean values of T1and T2 the mean values of T2 is higher with a difference of 0.93333 which is statistically significant with a p value of 0.05 (Table 1) (Fig. 8).

Lower Pharyngeal Airway Width (LPAW): Mean value for LPAW at T1 is 10.3 +/– 1.73 and at T2 is 13 +/– 1.73. On comparison of mean values of T1 and T2 the mean values of T2 is higher with a difference of 2.7 is statistically highly significant with a p value of <0.001 (Table 1).

Time: The mean age of the sample before fixed functional appliance (T1) is 14.25+/-1.65 years of age and at T2 is 14.74+/- 1.75 years of age. The mean treatment duration of fixed functional appliance is 5.32+/-1.27 months (Fig. 8).

DISCUSSION

The Forsus Fatigue Resistant Device (FFRD) was introduced by Vogt in 2006.[12] The Forsus FRD (3M Unitek Corp,

Table 1
Paired *t* test parameters used in the study

					Paired difference				
		Mean value	*N*	*Standard deviation*	*Mean difference*	*Standard deviation*	*T*	*Df*	*P value*
IMPA	T1	105	15	1.81265	1.06667	0.79881	-5.172	14	**0.061**
	T2	106.0667	15	1.75119					
UPAW	T1	19.6	15	1.87274	0.93333	1.01536	-3.56	14	**0.05**
	T2	20.5333	15	1.85614					
LPAW	T1	10.3	15	1.72999	2.7	1.20712	-8.663	14	**<0.001**
	T2	13	15	1.76271					

Monrovia, Calif) is a hybrid fixed functional appliance. The FRD is a three-piece, telescoping system incorporating a superelastic nickel-titanium coil spring that is easy to install and thus saves chair time.[13] Distal and intrusive movement of maxillary molars, mesial movement of mandibular molars, retrusion of maxillary incisors, labial tipping of mandibular incisors, and varying amounts of skeletal effects have been reported in previous studies with this appliance.[14-16] The use of miniscrew and miniplate anchorage in orthodontics has reduced the undesirable effects of many appliances.In the study by Aslan (2014), the use of miniscrews was successful in minimizing the protrusion.

To measure the mandibular incisor inclination the parameter we used in this study was IMPA, the component of Tweeds facial triangle. IMPA was measured before Forsus (T1) and after Forsus (T2) and the mean difference of IMPA between T1 and T2 is 1.07+/-0.9.

Upper pharyngeal airway width (UPAW)[17] is measured from PSP (PNS part of soft palate) to the posterior pharyngeal wall perpendicular to Vertical Reference Line (VRL). There is significant increase in upper pharyngeal airway by 0.93+/-1.01 mm with p value-0.05.

Lower pharyngeal airway width (LPAW)[17]—distance between anterior and posterior wall perpendicular to VRL at level of the superior margin of the body of hyoid bone. There is statistically highly significant increase in lower pharyngeal airway by 2.7+/-1.21 mm with p value<0.001.

The increase of the nasopharyngeal space was probably related to growth, and the increase of the oro- and laryngopharyngeal dimensions was probably related to the forward shift of the mandible. In our study, the increase in upper airway is may be due to more skeletal correction by minimizing the dentoalveolar changes as anchorage is taken from mini implants.

CONCLUSION

The following points were concluded:

1. The increase in mandibular incisor inclination is minimal i.e 1.07+/- 0.8 degrees with p value-0.061.
2. There is an increase in the upper pharyngeal airway width by 0.93+/- 1.01 mm with p value-0.05.
3. There is a highly significant increase in the lower pharyngeal airway width by 2.7+/- 1.21 mm with p value <0.001.

The limitations of this study were there is no control group and the shortcoming of being two dimensional study of a three dimensional face.

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