

**Comparative Evaluation of the treatment effects of Twin block, Reverse inclined plane and Forsus Fatigue Resistant Device in correcting skeletal class II relationship**

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**Abstract**

**Introduction and Aim:** The Functional appliances are powerful appliances which are used for the alteration of the teeth's position by using the forces produced by the whole neuromuscular component and they do not act like a conventional appliance. There are various functional appliances in the literature for the corrections of class II malocclusions like Twin Block, Fixed functional appliance etc. Aim of this study was to compare treatment effects of patients treated with twin block, Forsus Fixed functional appliance and reverse incline plane and compare the results with control group.

**Material and methods:** A total of 20 patients who met the inclusion criteria were selected and 4 patients under each group was analysed. OPG, Lateral cephalogram were traced. These were then superimposed to compare the results.

**Results:** The pitchfork analysis showed that the mean maxillary change was maximum by the Twin block appliance (2.6 mm) compared to other appliances. This maxillary change represents the maximum resistance

offered by the appliance in correction of class II relationship. Almost similar mandibular forward movement was observed by the Twin block appliance (2.6mm) and Reverse inclined plane (2.5mm). Compared to other two appliances the dental contribution was more in the Twin block appliance group for the correction of class II relationship. Also pharyngeal airway space was significantly reduced in all the treatment group.

**Conclusion –** Significant changes both skeletal and dental were observed in all the groups.

**Keywords:** Twin block (TB), Reverse Inclined Plane (R.I.P.), Forsus Fatigue resistant device (FFR), Class II malocclusion.

**Introduction**

The Functional appliances are powerful appliances which are used for the alteration of the teeth's position by using the forces produced by the whole neuromuscular component and they do not act like a conventional appliance.<sup>1-3</sup> There are various functional appliances in the literature for the corrections of class II malocclusions.<sup>1-12</sup>

The goal of functional appliance therapy is to regulate or to redirect the growth pattern of mandible in a more favourable direction. There are various functional appliances in the literature for the correction of the Class II division 1 malocclusion, Class II division 2 malocclusion and Class III malocclusions. They are commonly used to correct the skeletal class II division 1 malocclusion where the class II condition is especially due to unfavourable growth pattern, or retroposition of mandible. According to the patient's requirement and compliance the functional appliances can either be made removable or it can be fixed to the molar band by soldering technique.

The antero-posterior relationship is usually corrected by bringing the mandibular arch forward with functional appliance, which transmits the forces on the periosteum, bones, teeth and at the same time it also restrains the forward growth of the maxilla.<sup>4</sup> Some studies have reported that functional appliances also leads to favorable changes in the temporomandibular joint.<sup>5-7</sup>

Twin block appliance is the most commonly used appliance for the correction of the class II division 1 malocclusion in the early mixed dentition period and during peak growth period nowadays. Fixed functional appliances are advised in those subjects who were in their last growing phase. Compared to other functional appliances the twin block is usually preferred because of its comfort, especially while eating and talking because of its two piece construction design. Since the other functional appliances are fabricated in a single piece and bulky in nature, patients find uncomfortable with these appliances especially during talking and with these appliances patients cannot eat also. The other advantages include, 24 hours wearing time of twin block appliance but other appliances are usually worn for 12 to 14 hours. Some disadvantages of twin block appliance are its

bulkiness, some amount of discomfort during speech and mastication. On the other hand the reverse inclined plane can either be removable or fixed through soldering in to the molar tubes. They help in bringing the mandible in forward position especially during the mandibular functional activity and swallowing period.<sup>8</sup> Since reverse inclined plane can be soldered in the molar tube, it can be given in those subjects where patient's cooperation is a big problem and in those subjects who refused to wear functional appliance or who do not wear functional appliance regularly.

The aim of our study was to compare the treatment effects of twin block, Forsus and reverse inclined plane for the correction of class II division 1 malocclusion.

#### **Materials and Methods**

For this study, class II patients were selected. Age group of patient varied from 11- 20 yrs, All the patients who were treated with the Forsus FRD, Twin block and Reverse inclined plane were included for this study. Total 20 subjects who met the inclusion criteria were assigned randomly into 4 different groups (Control group, Reverse inclined plane group, Twin block group and Forsus FRD group) and each group consist of 5 subjects. Consent form, history, OPG, Lateral cephalometry and study models were taken from all the patients in the beginning of treatment.

#### **Inclusion criteria**

- ANB  $>4^{\circ}$
- Overjet  $>5$
- FMA ( $20^{\circ}$ - $27^{\circ}$ )
- Angle class II molar relationship on both sides
- Mild to moderate spacing and crowding
- Without any systemic diseases

#### **Twin block**

All the patients were having normal physical growth, no systemic disease, class II skeletal, molar and canine

relationship with overjet of more than 5mm, ANB more than 4degree. In 2 subjects the maxilla was constricted, hence expansion screw was incorporated in the upper twin block appliance. Pre and post lateral cephalometry, OPG, study models and extraoral and intraoral photographs were taken. Standard Twin block was given in all the patients with single advancement. The vertical height was 2 mm in the anterior region, which leads to the interocclusal distance of 5mm in the premolar region. The treatment duration lasted for 9-10 months in all the patients. After the active treatment (after correction of ANB, molar in class I) all the patients were shifted to fixed mechanotherapy and to retain the achieved correction reverse inclined plane was given.

#### Reverse Inclined plane

All the subjects were having skeletal and dental class II relationship, ANB more than 4 degree. Two patients were having class II division 2 malocclusion in the beginning, in these patients first the retroclination of central incisors and proclinations of lateral incisors were corrected. After properly alignment of upper and lower incisors the reverse inclined plane was fixed in the molar band. All the patients were informed regarding the difficulty in speech, mastication's and pain for few days after the appliance insertion. Also informed regarding its benefit on improving their facial profile. After their agreement and sign in the consent form only, all the patients were assigned for this treatment. Following was the treatment sequence followed for all patients:

- fixed mechanotherapy with 0.022 MBT bracket slot,
- followed by alignment and levelling with round 0.016 NITI wires,
- followed by 0.019 x 0.025 NITI rectangular wires,
- followed by 0.019 x 0.025 SS rectangular wires,
- after that all patients were given reverse inclined plane.

#### Forsus FRD

Patients were treated with fixed mechanotherapy and after reaching in heavy wire (0.019 x 0.025 SS) in upper and lower arch the Forsus FRD was inserted according to the instructions given by the manufactured company. Transpalatal arch in the maxilla and Lingual arch in the mandible was incorporated in all patients, so that the expansive nature by the fixed functional appliance is minimised.

#### Control group

In the control group total 5subjects were included. All the subjects were having skeletal and dental class II relationship, ANB more than 4 degree, overjet more than 5mm, without any systematic diseases, normal physical growth, no facial asymmetries, no congenital defects, no bone or muscular defects. Their age group range from 11 – 13 years. Pre and post lateral cephalograms, OPG, study models and extraoral and intraoral photographs were obtained for all the subjects. Out of 5 subjects, only 3 subjects came for the follow up till 9 months. Hence, only those 3 subjects were included for final analysis.

The Pitchfork analysis of Johnston<sup>9</sup> was used for the comparison between pre and post treatment effects of twin block, reverse inclined plane and the control groups.

Comparison of facial profile of subjects in all the three groups are shown in Figure 1,2,3,4

#### Control group



Before



After 2 yrs When no treatment was taken

Fig 1- Pre and Post treatment facial profile changes in Control group

Photos Fixed Functional Appliance



Pre treatment



Post treatment

Fig 2- Pre and Post treatment facial profile changes in Forsus Fatigue resistant group

Case treated with Reverse inclined plane



Pre treatment



Post treatment

Fig 3- Pre and Post treatment facial profile changes in Reverse inclined plane group

Case treated with twin block



Pre treatment



Post treatment

Fig 4- Pre and Post treatment facial profile changes in Twin block group

**Results**

The mean age of the Twin block appliance group was compared to the Reverse inclined plane group and Forsus FRD group. (Table 1)

The pitchfork analysis showed that the mean maxillary change was maximum by the Twin block appliance (2.5mm) compared to other appliances. This maxillary change represents the maximum resistance offered by the appliance in correction of class II relationship. Almost similar mandibular forward movement was observed by the Twin block appliance (2.6mm) and Reverse inclined plane (2.5mm). Compared to other two appliances the dental contribution was more in the Twin block appliance group for the correction of class II relationship. (Table 2). Also all the mean changes are compared in all the groups in table 2.

Pitchfork analysis is shown in table 3.

**Table 1 sample size distribution (mean age)**

Group	N	T1	T2
Control group	3	12 y	12y 9mo
Twin block	5	13 y 8mo	14y 9mo
Reverse Inclined plane	4	14 y 6mo	16y
Forsus FRD	4	14y 2 mo	15 y

**Table 2 showing mean treatment effects by TB, RIP, FORSUS and control group**

PARAMETERS	TB	FORSUS	RIP
Max change	2.5	2	1.8
ABCH	3.5	2.3	2.3
Mand change	2.6	2.1	2.5
Upper 6	1.8	1.3	1.3
Upper 1	3.8	3.5	2.8
Lower 6	4	3.5	3.5
Lower 1	3.8	3	3.3

**Table 3 – Pitchfork Analysis Twin Block Pt name : D. J. 13yrs/M (Twin Block)**

Parameters	Value
Maxillary change	2mm
Apical base change	6mm
Mandibular change	4mm
U6 change	2.5mm
U1 change	6mm
L6	5.5mm
L1	5mm

Advancement - 4 mm

**Pt name: S. B., 12 yrs/ F (Twin block)**

Parameters	Value
Maxillary change	2.5mm
Apical base change	5.5mm
Mandibular change	5mm
U6 change	0.5mm
U1 change	2mm
L6	4mm
L1	4mm

Advancement - 5 mm

**Pt name: A. P., 14 yrs/ M (Twin Block)**

Parameters	Value
Maxillary change	2mm
Apical base change	1mm
Mandibular change	1mm
U6 change	2mm
U1 change	4mm
L6	4mm
L1	5mm

Advancement- 1mm

**A.A. 15yrs/F (Twin block)**

Parameters	Value
Maxillary change	1mm
Apical base change	2mm
Mandibular change	1mm
U6 change	0mm
U1 change	3mm
L6	2.5mm
L1	4mm

Advancement- 1mm

**S. K., 15 yrs/M (Twin block)**

Parameters	Value
Maxillary change	5mm
Apical base change	3mm
Mandibular change	2mm
U6 change	4mm
U1 change	4mm
L6	4mm
L1	1mm

Advancement- 2mm

**FORSUS FRD**

**P.S., 16yrs/m (Forsus)**

Parameters	Value
Maxillary change	1.5mm
Apical base change	4mm
Mandibular change	2.5mm
U6 change	2mm
U1 change	3mm
L6	3mm
L1	2mm

Advancement- 2.5mm

**A.P., 14yrs/M (Forsus)**

Parameters	Value
Maxillary change	4mm
Apical base change	1.5mm
Mandibular change	2.5mm
U6 change	1.5mm
U1 change	5mm
L6	3mm
L1	2mm

Advancement- 2.5mm

**S.S., 14YRS/ M**

Parameters	Value
Maxillary change	0.5mm
Apical base change	3mm
Mandibular change	2.5mm
U6 change	-1mm
U1 change	+1mm
L6	5mm
L1	5mm

Advancement- 2.5mm

**S.L. 13YRS/ F**

Parameters	Value
Maxillary change	2mm
Apical base change	1mm
Mandibular change	1mm
U6 change	1mm
U1 change	5mm
L6	3mm
L1	3mm

Advancement-1mm

**Control Group A.A., 11 yrs/ m**

Parameters	Value
Maxillary change	3mm
Apical base change	1mm
Mandibular change	2mm
U6 change	1.5mm
U1 change	1.5mm
L6	1.5mm
L1	1mm

Advancement- 2mm

**Discussion**

This study aims to understand the treatment effects by Twin block appliance, Forsus FRD and Reverse inclined plane on correction of skeletal class II relationship. The skeletal and dental effects by all this appliance was assessed by superimposing the lateral cephalogram which was taken just before beginning the treatment and another lateral cephalogram was taken just after discontinuation of the appliance. The Pitchfork analysis by Lyslie Johnston<sup>9</sup> was used for this study because this analysis allow us to differentiate the dental changes and skeletal changes occurred by the appliance.

The mean treatment duration for the appliances was 9.8 months for Twin block appliance, 8.7 months for Forsus FRD and 9 months for Reverse inclined plane. In a study by Goel et al on Forsus FRD the treatment duration was 6 month.<sup>10</sup>

In all the patients, molar and overjet correction was evident before discontinuation of the appliance. This study finding suggests that all types of appliance are capable of correcting class II relationship.

The mean mandibular forward movement found in Forsus group in this study was 2.1mm. Wherease, in a previous study the mandibular change reported by Goel et al was 3.2mm by the Forsus FRD appliance.<sup>10</sup> According to

Jones et al<sup>11</sup> study the mean mandibular forward movement reported was 4.4mm by Forsus FRD appliance.

The additional finding of this study was improvement in the pharyngeal airway. This study found increase in the upper and lower pharyngeal airway by the all appliances. The increase of upper and lower pharyngeal airway was approximately 2 mm of enlargement in the upper airway and 1-2mm of enlargement of the lower pharyngeal airway. All this finding was similar in the entire appliance group. Similarly Jena et al<sup>12</sup> also found the improvement in pharyngeal airway by the Twin block and MPA- IV appliance. They also reported that Twin block appliance has more effect on the hypopharyngeal airway dimension.

**Conclusion**

Significant changes were observed with all the three groups and post treatment profile significantly improved when compared to control group.

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