

Effects on Incisor Inclination in the Management of Skeletal Class II Malocclusion Using Three Different Treatment Protocols: A Case Study

R Thirunavukkarasu^{1*} Suresh Anand Kumar² C. Nirupama³ J. Tamizhmani⁴ C Prasanth⁵ Deepika Jegatheesan⁶

¹Professor and Head, Department of Orthodontics, Karpaga Vinayaga Institute of Dental Sciences, Kanchipuram, Chennai, India.

²Senior Lecturer, Department of Orthodontics, Karpaga Vinayaga Institute of Dental Sciences, Kanchipuram, Chennai, India.

³Professor, Department of Orthodontics, Karpaga Vinayaga Institute of Dental Sciences, Kanchipuram, Chennai, India.

⁴Senior Lecturer, Department of Orthodontics, Karpaga Vinayaga Institute of Dental Sciences, Kanchipuram, Chennai, India.

⁵Senior Lecturer, Department of Orthodontics, Karpaga Vinayaga Institute of Dental Sciences, Kanchipuram, Chennai, India.

⁶Crri, Karpaga Vinayaga Institute of Dental Sciences, Kanchipuram, Chennai, India.

ABSTRACT

Aim: To assess the effects of three different treatment approaches on incisor inclination changes in the management of Class II malocclusion.

Materials and Methods: Three patients with skeletal Class II division I malocclusion were treated with three different treatment approaches. Patient 1 was treated with fixed functional appliances (Herbst) without fixed appliance, Patient 2 was treated with prefunctional fixed appliance with extraction and fixed functional appliances (Powerscope) and Patient 3 was treated with presurgical fixed appliance with extraction and surgical mandibular advancement procedure. The amount of lower incisor proclination in each case was assessed using the comprehensive cephalometric analysis obtained and from its comparisons from the start of the treatment (T₁) and the end of the treatment (T₂).

Results: The incisor inclination was found to be more increased in case of treatment with Herbst fixed functional appliance alone followed by bilateral sagittal split osteotomy procedure and Powerscope with fixed appliance. The IMPA values of T₁ and T₂ for Herbst, BSSO and Power scope with fixed appliance are (T₁ - 95° T₂ - 116°) (T₁ - 96° T₂ - 102°) (T₁ - 110° T₂ - 102°) respectively, which shows an exaggerated incisor proclination when compared to the other two procedures.

Conclusion: The extraction protocol and fixed appliance plays a vital role in positioning the lower incisors during the correction of Class II skeletal mandibular retrognathism using fixed functional appliances (FFA).

Keywords: Mandibular retrognathism, mandibular incisor inclination, fixed functional appliances.

INTRODUCTION

Class II malocclusion whether it is skeletal or dental has always posed a problem to the virtue of the facial profile. Most of the class II malocclusions are generally due to retrognathic mandible. The

management of class II is broadly classified as growth modification procedures, camouflage and surgical management. Class II malocclusion in non-compliant patient is a great challenge. Fixed functional appliance (FFA) are of great use in these patients as they can be used along with fixed

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*Correspondence Dr. R Thirunavukkarasu.

Department of Orthodontics, Karpaga Vinayaga Institute of Dental Sciences, Kanchipuram, Chennai, India.

Email: tringortho@hotmail.com

appliance and that it can be used both in children and adults. During orthodontic treatment fixed functional appliance plays a significant role in the correction of anteroposterior malocclusion. One of the main disadvantage that occurs during the correction of skeletal class II malocclusion is the tendency of the lower incisor to proclain.

Lower incisor inclination is a result of growth rotation and is more prevalent in males than females. The lower incisor inclination is seen to increase more in pubertal growth spurt¹. Incisor proclination pose a concern for the periodontal status for anteriors. The stability of incisor positioning, deals with important factors such as facial esthetics lip protrusion and perioral functions. A marked increase in incisor proclination in the management of Class II is considered unstable and can result in side effects such as labiogingival recession as it causes breakdown of labiogingival attachment²⁻⁴. Hence the maintenance of incisor position during the treatment of skeletal class II malocclusion is more important.

All class II treatment methodologies are seen to increase lower incisor inclination. We conducted a case study to access the amount of inclination changes in three different class II management methods.

MATERIALS AND METHODS

Three female patients with Angles class 2 div 1 with overjet of 5-7mm and overbite of 4-6mm on a Class II skeletal base with ANB greater than or equal to 3° with retrognathic mandible and orthognathic maxilla and horizontal growth pattern were included in this study.

All the patients were in different growth phases. Patient 1 was in her early pre-pubertal growth phase with an age of 9- 10yrs, she was treated with Herbst fixed functional appliance alone, without fixed appliance. The Patient 2 was in her post pubertal growth phase(13yrs) was treated with fixed functional appliance(Powerscope) along with extraction of first premolar and fixed appliance. Patient 3 was 20yrs, in her post growth phase was treated with extraction of first premolar and fixed appliance and surgical advancement (BSSO).

Two lateral cephalograms were taken for each patient with cephalostat in a standardized position one at the start of the treatment (T₁) and the other at the end of the comprehensive treatment (T₂). Customized comprehensive cephalometric analysis of Steiner's and Tweed's were made for each cephalogram. The most sought after variables that bring out the angular and linear values of the lower incisor inclination were considered.

RESULTS

From the cephalometric analyses, it is obvious that all the three patients had skeletal class II defects, and the malocclusion has been corrected after the treatment which is interpreted in the following table. The comparative tables I, II, III show the initial and the final measurements of the variables that depicts the changes in the sagittal discrepancies and the incisor inclination. The table I shows, the ANB values of pre and post treatment measurements explains the changes in the magnitude of the discrepancy between maxilla and mandible. The patient 1 had a change in the ANB value of : T₁- 8°; T₂- 5°, the patient 2 on the other hand had: T₁- 6°; T₂- 4°, and the ANB value for the patient 3 changed to : T₁-7°; T₂- 4°.

The table II shows, all the three treatment methods advanced the mandible forward as presented by the change in ANB value which reduced by about 3 degrees on an average. The reduction in ANB value was due to the decrease in SNA and increase in SNB value. In patient 1 and patient 2 the changes in SNA value is more than compared to patient 3.

Table III shows the mandibular incisor position at the end of the treatment, there was an increased incisor inclination in all the three patients. There was an increased dentoalveolar changes in patient 1 treated with Herbst fixed functional appliance without fixed appliance than the other two treatment procedures.

At the end of the treatment, in patient 1, the IMPA and $\angle$ to NB increased by about 20° and 13°, 2mm respectively. In patient 2 and patient 3, the $\angle$ to NB decreased by around 10° and 2mm and the IMPA increased by 10 degrees. This effect

Table 1: Pre and post treatment changes in skeletal mandibular position and mandibular incisor inclination.

VARIABLES	PATIENT 1		PATIENT 2		PATIENT 3	
STAGE	T 1	T 2	T 1	T 2	T 1	T 2
SNA	83°	81°	86	82°	81°	80°
SNB	75°	76°	80°	78°	75°	76°
ANB	8°	5°	6°	4°	6°	4°
AO- BO	9mm	4mm	4mm	3mm	6mm	2mm
N – POG	-20mm	-11mm	-12mm	-7mm	-19mm	-13mm
N – B	-20mm	-12mm	-11mm	-8mm	-20mm	-15mm
∠ – NB	25°	38°	21°	26°	19°	30°
∠ – NB LINEAR	8mm	10mm	3mm	5mm	3mm	4mm
APog- ∠	4mm	4mm	3mm	1mm	-3mm	0mm
IMPA	95°	116°	97°	102°	96°	102°
FMIA	54°	36°	68	58	59	51°

Table II : Pre and post treatment values of ANB.

VARIABLE	Patient 1		Patient 2		Patient 3	
STAGE	T1	T2	T1	T2	T1	T2
ANB	8°	5°	6°	4°	7°	4°

Table III: Comparison of pre and post treatment incisor inclination changes.

VARIABLES	Patient 1		Patient 2		Patient 3	
STAGE	T1	T2	T1	T2	T1	T2
∠ – NB	25°	38°	35°	26°	19°	30°
∠ – NB LINEAR	8mm	10mm	7mm	5mm	3mm	4mm
IMPA	95°	116°	110°	102°	96°	102°

in patients 2 & 3 were due to first premolar extraction done as a part of pre functional and pre surgical planning. The post treatment lower incisor position was more anterior to A-Pog in patient 3 than the other two patients.

DISCUSSION

Class II malocclusion results from various combination of both skeletal and dentoalveolar components. One of the most distinguishing skeletal feature of this type of malocclusion in mandibular retrognathism which manifests as convexity in the facial profile. Treating class II

malocclusion depends entirely on the severity of the problem and the age at which it presents for treatment. FFA and surgical advancement procedures are the common mode of treatment for the correction of mandibular retrognathism. Over the years, many FFA have been used by Orthodontists and only a few have shown well acceptance and favorable on the patients.

The incisor inclination plays a vital role in esthetics, stability and periodontal problems. According to Raleigh William's keys to lower retention, incisal edges of the lower incisors should be placed on the A-P line or 1mm in

front of it. It is pertinent to add incisor angulation of 90° to mandibular plane⁵. This has been described as the optimum position and esthetic appropriateness. However the incisor inclination tends to change after Class II correction.

FFA can be given to achieve better esthetics and functional harmony. In this study we used three treatment options for the correction class II malocclusion with mandibular retrognathism;

1. **Herbst** appliance
2. Powerscope appliance with fixed appliance & prefunctional extraction.
3. BSSO surgical advancement procedure with fixed appliance & presurgical extraction.

Patient 1: Our results showed that there was increased compliance of the patient with **Herbst** appliance. There was a pronounced class 2 correction, the ANB changed by about 3 degrees. There was decrease in the SNA angle and increase in the SNB angle in conjunction with Asli Baysal⁶. The lower incisor inclination increased by about 11 degrees. There was forward positioning of the incisor of about 2mm.

Patient 2: Powerscope is one of the latest innovation in treating Class II cases, which is a direct derivative of **Herbst** appliance and it can be used along with fixed appliance. Our second patient was in the peak of pubertal growth spurt, she was treated using prefunctional extraction. Powerscope was placed after space closure. A treatment period of 6 months was required to correct the Class II using Powerscope. There was marked decrease in the SNA angle, and increase in the SNB angle, incisor inclination increased by 5 degrees and they forwardly placed by 2mm. The findings presented an increased incisor inclination but very less compared to that in patient 1.

Patient 3: The patient was in the post growth phase she was treated with a presurgical phase of all four premolar extraction followed by BSSO surgical advancement procedure. The surgical procedure reduced facial convexity, ANB decreased by 2 degrees chin prominence increased by 6mm providing significant improvement in the soft tissue profile. The incisor inclination increased by

about 6 degrees and they were forwardly placed by 1mm were similar to changes in patient 2.

Our findings show that class II correction achieved was very similar in all the three types of treatment methods, the correction is attributed to both changes in SNA and SNB. The results presented a headgear kind of effect in both the types of fixed functional appliance patients which is in concurrence with Jones G. Buschang PH, et al⁷ and Fracnchi L, et al⁸. In comparing the results, there was very similar dental and skeletal changes in both the treatment methods in patient 2 and 3 respectively. In patient 1 there was more changes in SNA than compared to patient 2 and 3. There was marked difference in the dental changes, the forward placement of the lower incisor more in patients 2 and 3 than patient 1. The value A-Pog and 1 to NB, IMPA values increased in patient 1 suggesting a more angular change that has taken place than bodily repositioning, our findings analogous to the results of Pancherz, et al⁹ and Gregory. A. Barnett, et al.¹⁰

Class II mechanics always tends to increase lower incisor inclination. The importance of positioning the incisor in relation to mandible relates the stability of Orthodontic results. The excessive proclination at the end of FFA treatment could be attributed to the force concentrated in the lower anterior segment, as seen Robert A. Millers¹¹ et al study which concluded that fixed functional appliance with and without fixed appliance presented a same amount of incisor inclination. The anteriorly directed forces of the telescope mechanism on the lower premolar triggers a forward movement of the entire mandibular dentoalveolar segment which results in a proclination of the lower incisors. Pancherz et al¹² studies on effect of FFA presented that dental changes are more pronounced than skeletal changes. Lower incisor inclination increases as an immediate post treatment result but tends to recover very soon. The dental effects of the fixed functional appliance is very similar to the other removable functional appliance, Siara-Olds et al¹³ concluded that twin block, Herbst, MARA, Bionator devices produced incisor proclination and there were no significant long term changes among the four patients. Increase in the lower incisor inclination is attributed to be

one of the factors in gingival recession , controversies exist , Systematic review¹⁴ by concluded that there was no clinically significant association between incisor inclination and gingival recession.

CONCLUSION

Class II correction is effective with both FFA and BSSO surgery advancement treatment. The success in the management of class II malocclusion lies in choosing the correct treatment protocol.

Our study revealed,

Incisor proclination was present in all the three methods.

Incisor proclination is pronounced in management methods without using fixed appliance.

Extraction if needed, to be used in the pre-functional or pre-surgical stage as it helps in maintaining the lower incisor inclination

Both surgical and fixed functional appliance methodologies show very similar and stable class II corrections.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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