



## Comparison of Maxillary Incisor Position in Labial and Lingual Post Treatment Lateral Cephalograms

### KEYWORDS

Cephalometric study, incisor inclination, lingual appliance

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**ABSTRACT** *The purpose of this cephalometric study was to compare the maxillary incisor inclination and position after completion of the orthodontic treatment treated with lingual and labial fixed orthodontic appliance. Post-treatment lateral cephalometric radiographs were traced using standard acetate mate paper. Landmarks were marked and measured the incisor inclination and position using parameters of Steiner analysis, UI-NAO and UI-NAMm. The final positions of maxillary incisors achieved after using both the systems were assessed and compared. Results: Lingual appliance torqued the maxillary incisors to normal positions in non-extraction cases as compared with labial appliance. But, lingual appliance uprighted the maxillary incisors after retraction in extraction cases as compared to labial appliance. Conclusion: Lingual appliance has better torque control and positioning of maxillary incisors than labial appliance in non-extraction cases. And with increasing the torque values, we can expect better torque control and positioning of maxillary incisors in extraction.*

### INTRODUCTION

The fixed lingual orthodontic appliance started with its development in mid 1970s.

The development was largely because of an increased interest in adult orthodontics. These lingual attached brackets were designed in an attempt to offer a beneficial service to many patients who were unwilling to undergo treatment with labial appliances because of esthetic concerns<sup>1</sup>.

Studies have shown favorable clinical and cephalometric changes in patients treated with lingual appliances<sup>1</sup>.

Though the lingual orthodontics has developed rapidly in recent years, the research on torque control variance of maxillary incisors in both labial and lingual orthodontics is still limited<sup>2</sup>.

The initial results were showing a phase of setback as clinical and technical detriments were revealed: i.e difficulties in bracket and arch wire application, deprivations like increased time input due to more difficult bracket and arch wire application and biomechanical problems such as reduced inter-bracket distance and the bowing effect were increasingly reported<sup>4</sup>.

With the recent techniques introduced and introduction of indirect bonding, the brackets achieved almost accurate positions which reduced the possibilities of inappropriate tooth movements.

The studies have shown that the incisor inclination differs post treatment with labial and lingual bracket systems.

The purpose of this study is to compare maxillary incisor inclination and position achieved after completion of treatment with labial and lingual orthodontic appliances using post treatment lateral cephalograms.

### AIM OF THE STUDY:

To study the final incisor inclination and position achieved after finishing of the treatment, using post treatment cephalometric radiographs of patients treated with lingual and labial fixed orthodontic appliances and to conclude with which the torque achieved is close to normal

### OBJECTIVES

To assess the inclination and position of maxillary incisors achieved using post treatment lateral cephalometric radiographs of patients treated with lingual and labial fixed orthodontic appliances.

To compare the maxillary incisor inclination and position of lingual and labial appliances with normal values.

### MATERIALS AND METHODS

#### SOURCE OF DATA

20 post treatment lateral cephalometric radiographs of patients treated with lingual and labial fixed orthodontic appliances, collected from our institution (V S Dental college, Bangalore).

#### There were ,

6 patients treated with non extraction lingual appliance ,

4 patients treated with 1<sup>st</sup> premolar extraction lingual appliance,

5 patients treated with non extraction labial appliance and,

5 patients treated with 1<sup>st</sup> premolar extraction labial appliance.

Consequently the sample was divided into the following categories:

Group 1 : Non extraction, treated with lingual orthodontic appliance(n=6)

Group 2 : Non extraction, treated with labial orthodontic appliance(n=5)

Group 3 : Extraction, treated with lingual orthodontic appliance(n=4)

Group 4 : Extraction, treated with labial orthodontic appliance(n=5)

**Inclusion criteria**

Records of patients treated with either lingual or labial orthodontic appliance  
 Patients treated with non extraction and 1<sup>st</sup> premolar extraction.  
 Patients with Angle's class I malocclusion – mild crowding and bimaxillary protrusion cases

**Exclusion criteria**

Records of patients other than 1<sup>st</sup> premolar extraction  
 Angle's class II and III malocclusions  
 Angle's class I malocclusion other than mild crowding and bimaxillary protrusion

**STUDY DESIGN**

Post Treatment Lateral Cephalometric radiographs of patients treated with lingual and labial orthodontic appliances were collected.

Tracing of all the lateral cephalograms and landmarks were marked and classified the same to each groups.

Measuring the maxillary incisor inclinations and positions on each tracings using parameters of Steiners analysis.

Comparing the maxillary incisor inclination achieved after lingual and labial bracket systems using normal values.

Results obtained were statistical analyzed.

**Measured Variables**

Post-treatment lateral cephalograms were traced on standard acetate paper. Landmarks were marked and analysed the incisor inclination and position using parameters of Steiner analysis, and were defined as:

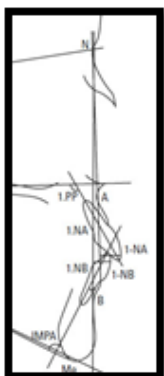


Fig1

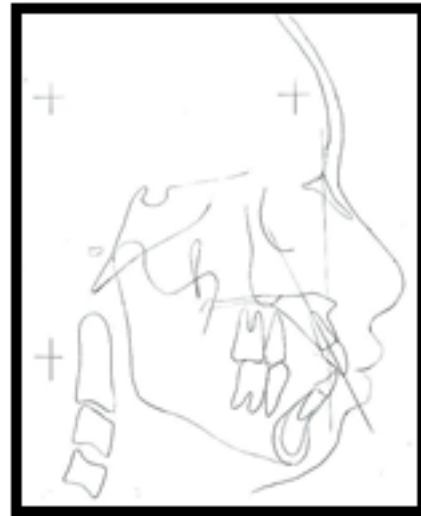


Fig 2

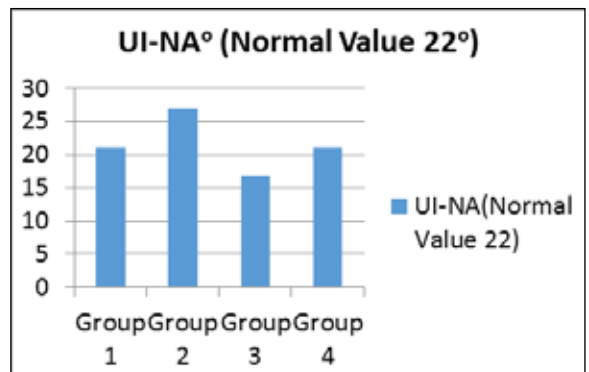
Figure 1 : Describes UI-NA angle UI-NA measurement to NA line, Figure 2 : Sample of tracing and measurements done for each group.

UI-NA° : maxillary inclination to NA line

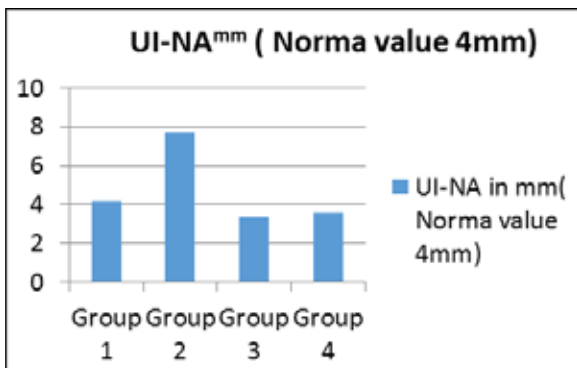
UI-NA<sup>mm</sup> : maxillary position measured to NA line

PARAMETER	Group 1	Group 2	Group 3	Group 4
UI-NA° Normal Values	22°	22°	22°	22°
UI-NA° Study Values (Mean)	21.17° (ranged from 19° to 26°)	27° (ranged from 24° to 35°)	16.75° (ranged from 14° to 19°)	21° (ranged from 18° to 26°)
UI-NA in mm Normal Values	4mm	4mm	4mm	4mm
UI-NA in mm Study Values (Mean)	4.17mm (ranged from 3.5mm to 5mm)	7.7mm (ranged from 3.5mm to 12mm)	3.38mm (ranged from 3.5mm to 4mm)	3.6mm (ranged from 2mm to 7mm)

Table 1 : Measured values of incisor inclination and positions of all 4 groups



Graph 1 : Showing average incisor inclination of each group



**Graph 2 : Showing average incisor position of each group**

**Results:**

In non extraction groups, the mean angle of inclination and incisor position in group 1 (lingual) were very close to acceptable normal values, while in the group 2 (labial) the inclination and position were above the normal acceptable values.

In extraction groups, the mean incisor inclination in group 3 (lingual) were below the normal values as compared with the group 4 (labial) in which the mean was very close to normal acceptable values, but the mean incisor position in both group 3 and group 4 was close to normal.

**STATISTICAL ANALYSIS**

Parameters	Group 1	Group 2	Group 3	Group 4
UI-NA°	21.16±2.56	27±4.63	16.75±2.2	21±3.16
	P=0.021*(<0.05)		P=0.038*(<0.05)	
UI-NA mm	4.16±0.51	7.7±3.19	3.37±0.94	3.6±2.07
	P=0.024*(<0.05)		P=0.82(P>0.05)	

\* Statistically significant

**Table 2 : Statistical report obtained with independent - t test**

Independent-t test was done to compare the values obtained.

When the incisor inclination was compared between non extraction groups 1 & 2 (were p = 0.021) and extraction group 3 & 6 (were p = 0.038), the results obtained were statistically significant.

When the incisor position was compared the results obtained were statistically significant in the non extraction groups 1 & 2 (were p = 0.024) and not in extraction groups 3 & 4 ( were p = 0.82), because the average value obtained were close to acceptable norms.

**DISCUSSION**

Lingual orthodontics makes the correction of tooth malpositions and intermaxillary jaw discrepancies through brackets attached to the lingual tooth surfaces<sup>4</sup>.

Due to the broad bucco-lingual dimension of these pre-fabricated bracket systems, these systems were reported to cause clinical problems, such as speech deterioration as

a result of restricted functional space for the tongue, oral discomfort due to injury or irritation of the tongue, and restriction of mastication<sup>6</sup>.

Customization of the appliance for each patient due to exceptionally irregular lingual morphology within and amongst patients is the key to successful treatment in lingual orthodontics. Attempts at bracket base customization using intra-oral jigs and laboratory setups are fraught with unavoidable errors affecting final treatment outcome. With the approach of computer-aided design and computer-aided manufacturing (CAD/CAM) technology the venture of true customization is now a reality<sup>7</sup>.

With implementation of customized lingual brackets and computerized archwire fabrication resulted in a decrease of the above subjective impairments<sup>4</sup>.

Incisor inclinations and positions were examined to evaluate torque control provided by lingual and labial fixed orthodontic appliances and to see whether the final positions achieved were close to acceptable norms.

Studies have shown that the incisor inclinations and positions were close to normal values in non extractions, and the maxillary incisors were upright in extraction cases treated with lingual appliance<sup>1</sup>.

In this investigation the maxillary incisors were inclined and positioned very close to normal values in non extraction cases treated with lingual appliance as compared with cases treated with labial appliance in which the maxillary incisors were significantly proclined and forwardly placed at the end of treatment.

And in extraction groups the results obtained was opposite, in this the maxillary incisors were upright in cases treated with lingual appliance as compared with the cases treated with labial appliance in which the mean values were close to normal.

According to the results obtained in this study, it suggests that the lingual appliance as the ability to torque the maxillary incisors to normal positions in non extraction cases as compared with labial appliance.

But, contrarily the lingual appliance uprighted the maxillary incisors after retraction in extraction cases as compared to labial appliance in which the incisors were torqued to normal values.

So it is indeed necessary to increase the torque values for maxillary incisors in extraction cases using lingual fixed orthodontic appliance so as to avoid the more upright positions after final treatment outcome.

The torque can be controlled in extraction cases by increasing the torque prescription in the initial setup and incorporating the compensatory curves(i.e. rocking horse curve in maxillary arch wire). By this we can avoid the more upright positions of maxillary incisors<sup>8</sup>.

During anterior retraction, increase in the lingual anterior retraction hooks vertical height increased the amount of lingual root inclination and intrusion of the incisors. In particular, with increasing vertical height, the tooth movement pattern changed from controlled tipping to bodily displacement and then to lingual root movement<sup>9</sup>.

In the current study we demonstrated that lingual orthodontic appliance is as effective as labial appliance to reach good clinical results, since most of the studied variables (i.e. maxillary incisor inclination and position) have statistically significant differences between lingual and labial post-treatment cephalometric values.

This study compared the incisor inclination and position using radiographic. Hence, further studies with CBT and 3 dimensional comparison will be needed.

## CONCLUSION

With the results obtained from this study, we conclude that the lingual appliance has better torque control and positioning of maxillary incisors than labial appliance in non extraction cases.

And with increasing the torque values , we can expect better torque control and positioning of maxillary incisors in extraction cases , that avoids the more uprighted positions.

## REFERENCES

1. D T Fulmer and M M Kuftinec. (1989). Cephalometric appraisal of patients treated with fixed lingual orthodontic appliances: Historic review and analysis of cases. *AJODO*, 95(6), 514-520.
2. Wei Liang. et. al. (2009). Torque control of the maxillary incisors in lingual and labial orthodontics: A 3-dimensional finite element analysis. *AJODO*, 135(3), 316-322.
3. Thomas Creekmore. (1989). Lingual orthodontics - Its renaissance. *AJODO*, 96(2), 120-137.
4. G.E.Mancini. Et. Al. (2011). Lingual orthodontic technique: a case series analysis. *EJl*, 9(2), 47-52.
5. Kurz C. et. al. (1982). Lingual orthodontics: a status report. Part 2. Research and development. *JCO*, 16, 735-740.
6. Fujita.k. (1982). Multilingual-bracket and mushroom arch wire technique: A clinical report. *AJODO*, 82(2),120-140.
7. Ameet V. Revankar, Haroutioun Dedeyan. (2013). Lingual Orthodontics simplified : Incognito -customization perfected. *APOS Trends in Orthodontics*, 3(4), 116 – 120.
8. Takemoto K, Scuzzo G. (2001). The straight-wire concept in lingual orthodontics. *JCO*, 35, 46-52.
9. Sung Seo Mo et. Al. (2013). Torque control during lingual anterior retraction without posterior appliances. *Korean J Orthod*, 43(1), 3-14.