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Research Article

Correlation Of Inter Incisal Angle and Facial Profile after Retraction of Anterior Teeth

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Abstract: The treatment of class II division 1 malocclusion in adult patients is generally carried out with the extraction of two maxillary premolars, in order to retract the anterior teeth so that a change in the inter incisal angle can be obtained so that it can change the facial profile better. The purphose of this research is to evaluate cephalometric changes in inter incisal angle and profile position after orthodontic treatment with extractions of two maxillary premolars and anterior teeth retraction.

The study was conducted on pre and post treatment lateral cephalometric radiographs from 25 patients with Class II division 1 malocclusion were used to evaluate the following measurements inter incisal angle and Holdaway analysis.

The results showed an increased in the inter incisal and a decreased in Holdaway angle measurement. The statistical test using t test shows significant result ($p \leq 0{,}05$). Spearman correlation analysis showed there was a correlation between inter incisal angle and Holdaway angle but statistically not significant.

Based on the results of the study, the inter incisal angle increased and the Holdaway angle decreased significantly after retraction of the anterior teeth. There is a correlation between changes in incisal angle and changes in facial profile but not significant.

Keywords: Facial profile, Inter incisal angle, Incisor retraction

I. Introduction

Orthodontic Treatment goals are to obtain a harmonious tooth structure, optimal occlusion, good facial and aesthetic profile.[1,2] Facial harmony is a major concern for patients and professionals. Facial soft tissue covering the face plays an important role in facial aesthetics, speech function and other physiological functions. The success of orthodontic treatment is closely related to facial soft tissue changes.[3]

Class II division 1 malocclusion has the characteristics of protrusive anterior teeth, deep bite and convex profile so that the patient feels ashamed of having a poor facial profile. In the class II division 1 malocclusion treatment is often performed the extraction of two upper premolars to give the anterior teeth retraction in order to correct a large overjet, using a maximum anchorage to avoid mesial movement of the molar teeth. This action can result in lip retraction, in aesthetic and skeletal balance, dental and soft tissue improvements. By correcting a large overjet hopefully will improve the profile of a convex face.

Kocadereli (2002) and Hagler et al (1998) claimed premature tooth retraction with canine retracting and incisor teeth caused a decrease in lip clearance.[4,5] Several lines and parameters have been introduced to assess the antero-posterior position of the upper and lower lips and the aesthetic quality of the soft tissue profile. One of which is Holdaway analysis. Holdaway argues that the relationship between the apical base of the maxilla and mandibular, the convexity angle of the skeletal pattern and the relationship of the anterior teeth to the apical base affects the soft tissue profile.[6] According to Holdaway's a soft tissue profile analysis is both as a means of diagnosis and as a method for determining changes in the soft tissue profile induced by growth and orthodontic treatment. He proposed to determine the soft tissue profile used "H" angle formed by a line from the soft tissue chin point that intersects with the upper lip and N-B line.[7] The Harmony line should be 7° to 8° when the ANB angle was between 1° to 3° and the lower lip was on the H line.[8] Upper and lower incisors position rather than inclination have a strong correlation with the mid facial structures and soft tissue chin.[9]

Orthodontist ability to predict soft tissue changes when determining orthodontic treatment plans for patient is still controversial, because many factors can affect soft tissue changes, such as soft tissue morphology, thickness, tone and muscle pattern of patient. Since soft tissue profile is an important factor in achieving facial aesthetics, it is necessary to evaluate and predict post-treatment soft tissue profile before determining a treatment plan. The purpose of this study was therefore to examine the effects of the retraction of anterior teeth on inter incisal angle and facial profile changes in Class II division 1 malocclusion.

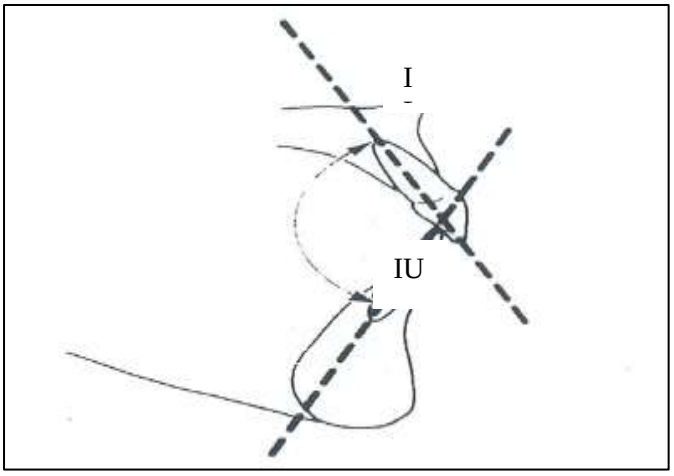
II. Material and Method

Material: Pre and post treatment cephalometric lateral radiographs from patients with malocclusion class II division 1 in the Post- Graduation course in Orthodontics of the Faculty of Dentistry Padjadjaran Universities were assessed. Among the radiographs evaluated, 25 individual Indonesian (5 boys and 15 girls) were selected. The inclusion criteria were

the following: a) Class II skeletal pattern (ANB angle more than 4°), b) permanent dentition, c) no dental agenesis, d) treatment plan including two upper first premolars extraction, e) no previous orthodontic treatment, f) no functional treatment, g) no extra oral appliance. Orthodontic treatment was standardized with fixed appliances, Edgewise standard system, with extraction of the two maxillary first pre-molars, followed by upper canine and incisor retraction.

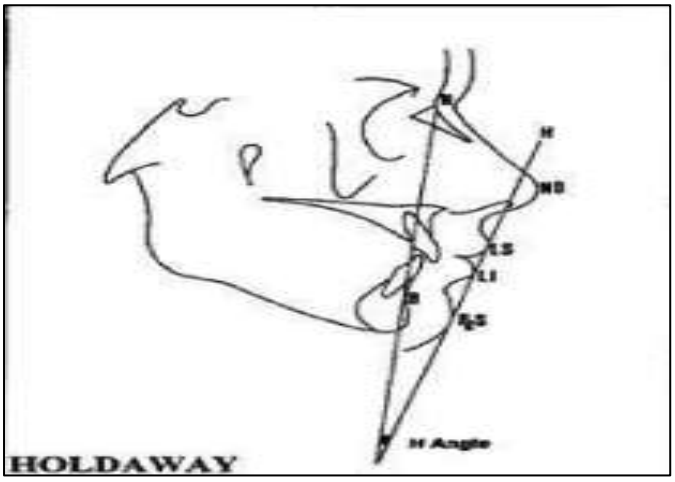
Method. Lateral cephalograms of the subjects were traced manually. Inter incisal angle measurements are performed by calculating the angle formed through the long axis line of the maxillary incisor (IU) and the mandibular incisor (IL) (Fig.1).[10] Furthermore, to find out the soft tissue profile of the lips, the measurements were made using the Holdaway soft-tissue analysis, the H-corner formed by the N-B line and the H line is the line drawn from the upper lip (LS) to the soft tissue Pogonion (PgS) (Fig 2)

Figure 1. Lateral cephalometric landmarks used to assess inter incisal angle



Inter incisal angle measurements are performed by calculating the angle formed through the long axis line of the maxillary incisor (IU) and the mandibular incisor (IL)

Figure 2. Reference planes were used to assess soft tissue profile with Holdaway'H Line



Holdaway's H- line is drawn tangent to the upper lip from soft tissue Pogonion. 'H' line angle is taken between the Nasion-point B line and H line.

Statistical Analysis

Inter incisal angle and facial profile changes after Orthodontic fixed appliance treatment of Class II Division 1 malocclusion with upper premolar extraction performed statistical analysis test. The differences between before and after treatment were determined with *t* test. *P* values less than 0.05 were considered significant. The analysis of correlations among the inter incisal angle and Holdaway analysis observed by the Spearman test.

III. Result

All patients have a dento skeletal class II division 1. Skeletal relationships based on angle measurements of SNA, SNB and ANB prior to treatment. The mean SNA is 83.34 º, indicating normal maxillary and anterior cranial relationship. Mean SNB 77.60 º, indicating mandibular retrognation. And ANB average 5.80 º means class II malocclusion (Table 1).

Table 1. Cephalometric measurement

No	Measurement	Avarage	SD
1	SNA (º)	83.34	4.34
2	SNB (º)	77.60	3.61
3	ANB (º)	5.80	1.94

After the measurement of the inter incisal angle in the treatment of class II division 1 malocclusion cases, it was found that the inter incisal angle before orthodontic treatment had a minimum value of 91.5, a maximum value of 137.0 with an average of 108.9 with a standard deviation of 10.6. while after orthodontic treatment the minimum inter incisal angle changes to 98.0, the maximum value becomes 140.0 on average 121.8 with a standard deviation of 9.4 (Table 2).

Table 2. Inter Incisal Angle Before and After Treatment

	N	***Minimum***	***Maximum***	***Mean***	***Std. Deviation***
Before	25	91.5	137.0	108.9	10.6
After	25	98.0	140.0	121.8	9.4

N=number of sample

The results of this study stated that there was a significant change in the inter incisal angle of 12.9 degrees after treatment with the extraction of two maxillary first premolar teeth (Table 3). This shows that the retraction of the anterior teeth causes a greater change in the inter incisal angle.

Table 3. Comparison of Inter incisal Angle Test before and after Treatment

	Average (SD)	*p-value*	conclusion
Before	108.9 (10.6)	0,000*	significant
After	121.8 (9.4)		

SD=standard deviation, *significant at $p \leq 0.05$

Based on the Table 4 , of the 25 samples tested using the facial profile measurement before the treatment using the Holdaway analysis, the minimum value of 10.0 is a maximum of 25.0, the average is 16.8, with a standard deviation of 3.7. While after orthodontic treatment, the minimum facial profile changed to 6.0, the maximum was 26.0, the average was 13.3,

with a standard deviation of 4.4.

Tabel 4. Holdaway Analysis Before and After Treatment

	N	Minimum	Maximum	Mean	Std. Deviation
Before	25	10.0	25.0	16.8	3.7
After	25	6.0	26.0	13.3	4.4

N-number of sample

In the present study, on evaluating Holdaway's H line showed statistically significant differences on comparison between before and after treatment, there is a significant change in Holdaway angle of 3.5 degrees, this indicates that the retraction of the anterior teeth in the case of extraction of the upper premolars causes a change in holdaway angles (Table 5). This shows the retraction of the anterior teeth causing an increase in facial profile.

Table 5. Comparison Test of Holdaway angle before and after Treatment

	Average (SD)	*p-value*	conclusion
Before	16.8 (3.7)	0,000*	significant
After	13.3 (4.4)		

SD=standard deviation, *significant at $p \leq 0.05$

The results obtained in the analysis of correlations among the inter incisal angle and Holdaway analysis observed by the Spearman test are shown in Table 6. Evaluation of orthodontic treatment results in class II division 1 malocclusion with extraction of two upper first premolar showed that retraction of anterior teeth cause increased inter incisal angle and changes soft tissue profile, and there was correlation between inter incisal angle and facial profile but not significant.

Table 6. Correlation between Inter incisal Angle with Facial Profile change

	Inter Incisal Angle Change
Holdaway Analysis Pearson Correlation	.233
Sig. (2-tailed)	.262
N	25

IV. Discussion

Patients with class II division I malocclusion have a convex facial profile due to protrusive maxillary incisors. The position of incisor teeth is key in determining orthodontic treatment plans so as to obtain aesthetic and a harmonious smile. Facial profiles are often a reference for inclination of incisors. Class II division 1 malocclusion treatment was generally carried out by extraction of two maxillary premolars, followed by retraction of canines and fourth incisors. Incisor tooth retraction is expected to change the soft tissue profile. The effect of fixed orthodontic treatment depends on several factors including the type of orthodontic appliance, duration and soft tissue profile.[11,12] Orthodontic treatment cause changes in the position and shape of the lips, this is because the lips rest on the hard tissue that undergoes changes due to orthodontic treatment.[13]

Many factors can influence soft tissue changes in protrusive incisor tooth retraction, such as soft tissue morphology, thickness, tonicity and muscle pattern of the patient. Changes in the soft tissue profile in patients with extraction treatment depend on patient age, extraction protocol, and treatment associated retraction of the upper incisors.[14]

Kusnoto et al (2001) stated that every 1 mm of mandibular incisor retraction would result in 0.4 mm upper lip retraction and 0.6 mm lower lip retraction.[13] Kasai (1998) stated that 4.3 mm of upper incisor retraction caused the upper lip to retreat by 1.9 mm.[15] Heagler et al (1998) stated that due to maxillary incisor retraction the upper lip retreated 2mm.[5] Comparison of the upper incisor tooth retraction against retraction of the upper lip is 4.3: 1.9 mm.[16] Every 1 mm of maxillary incisor tip retraction would produce a 0.38 mm retraction of the lower lip.[17] Kocadereli (2002) and Geagler et al (1998) stated that the removal of premolar teeth followed by retraction of canines and incisor teeth reduced lip curvature.[4,5] Reduced lip curvature causing changes in soft tissue profile.

The correlation between incisor retraction and soft tissue profile was observed in this study. This study confirms that there is a positive correlation between incisor retraction and soft tissue profile seen from changes in inter incisor angle affecting soft tissue profile, although the difference between pre and post treatment measurements of soft tissue profile and inter incisor angle is not significant. This result is similar to other studies.[13,18,19] The response of the soft tissue to tooth changes in alveolar bone is still under debate. Predicting soft tissue responses to incisor movements is unsuccessful because of large soft tissue variability among individuals. The amount of change in lip position after retraction of the anterior teeth may differ among different ethnicities, gender, and/or types of malocclusion.[17,20] According to Kasai, soft tissue does not always follow the profile of dento skeletal because the soft tissue that covers the teeth and bones has varying thickness and tension.[15]

V. Conclusion

Based on the results of the study, Inter incisal angle presented a significant increase with treatment, showing a retrusion of upper incisor. There is a decrease in Holdaway angle, showing retrusion of the soft tissue profile. Upper incisors were significantly retracted. This retraction affects the position of the lips, there is correlation between inter incisal angle with a Holdaway angle. This shows that there is a positive relationship with the soft tissue profile even though it is not significant.

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