

To compare the anteroposterior position of maxillary central incisor using soft tissue glabella and forehead inclination in angle's class i and class ii malocclusion patients: A cephalometric study

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Abstract

Introduction: Facial attractiveness plays a crucial role in people's daily social communications. The maxillary central incisor is one of the most important elements of smiling facial profile. To achieve the accurate maxillary incisor position is one of the important goal of orthodontic treatment. Traditional cephalometrics analysis is routinely used in orthodontics to evaluate the position and inclination of the incisor. But this analysis does not give the relative change in soft tissue with respect to

anteroposterior position of maxillary central incisor. Previous studies showed that landmarks on the forehead are stable, repeatable and easy to locate. So we decided to use these landmarks to evaluate the position of maxillary central incisor. Hence the aim of the study was to evaluate and compare the anteroposterior position of maxillary central incisor in Angle's class I and class II malocclusion patients with respect to soft tissue glabella and its relation with inclination and prominence of the forehead.

Materials and Methods: For this study 60 pretreatment

lateral cephalograms of the patients were selected and divided into two groups, group 1 consisted of Angle's class I malocclusion subjects and group 2 consisted Angle's class II malocclusion subjects. To evaluate the position of maxillary central incisor, one horizontal and two vertical reference planes were used. Measurements were made in millimeter from forehead facial plane (FFP) and forehead midpoint plane (FMP) to most facial aspect of the upper central incisor and antero-posterior location was recorded. Forehead inclination plane angle was measured using FFP and inclination plane. Statistical analysis was completed using SPSS software, with significance level set at < 0.05 Descriptive analysis was calculated and unpaired student t- test was used to check the intergroup relation with soft tissue glabella. **Result** - The position of maxillary central incisor with respect to FFP and FMP was 2.53 mm and 3.57 mm respectively. t- test showed statistical significant difference between both groups.

Conclusion - Analysis of upper-incisor position relative to the FFP and FMP can be useful in orthodontic treatment planning for example, in determining whether extraction or non-extraction treatment is indicated for proper horizontal positioning of the upper incisors.

Keywords: Facial esthetics, Forehead, Maxillary incisor, Soft tissue glabella

Introduction

'Facial esthetics' has been of prime importance since prehistoric times. An 'esthetically pleasing face' is one within which various facial expression are well proportioned and balanced from both 'frontal and profile' view [1-3]. In the past, orthodontists used photographs to judge facial esthetics and dental casts to check the occlusion. This changed with the development of cephalometrics. Orthodontists tend to look at a patient in terms of correcting a malocclusion, but sometimes a

patient may simply want improved function and esthetics [4].

Facial attractiveness plays a crucial role in people's daily social communications. The maxillary incisor is one amongst the foremost important elements of smiling facial profile [5]. In modern treatment, one in every of the foremost important treatment goals is to determine an accurate maxillary incisor position, which plays a crucial role in achieving favorable facial profiles. The change of the soft tissue profile during treatment is strongly related to the horizontal movement of the maxillary incisors in patients treated with extraction therapy [6]. Therefore, it is important for orthodontists to establish the proper maxillary incisor position when developing treatment plans for extraction therapy.

Traditional cephalometrics analysis is routinely used to evaluate the position of the incisors [7]. However, position and inclination of the maxillary incisors measured with routine cephalometrics analysis do not predict the soft tissue profile changes directly [8]. The forehead contour, landmarks on the forehead are stable, repeatable and straightforward to locate. Previous studies found that external facial landmarks on the forehead may be used to evaluate the anteroposterior position of the maxillary central incisors. To quantify the facial beauty various facial analyses have attempted by measuring lip position, but only a few authors have used the maxillary incisor as the alpha point in developing an analysis for facial esthetics and most of those studies examined the patient with good esthetic facial profile To evaluate and compare the anteroposterior position of maxillary central incisor in Angle's class I and class II malocclusion patients with respect to soft tissue glabella and its relation with inclination and prominence of the forehead.

Objective

To evaluate the anteroposterior position of maxillary central incisor in Angle's class I malocclusion patients.

To evaluate the anteroposterior position of maxillary central incisor in Angle's class II malocclusion patients.

To compare the anteroposterior position of maxillary central incisor in Angle's class I and class II malocclusion patients.

To correlate the position of maxillary central incisor patients with respect to forehead inclination and prominence of forehead in Angle's class I malocclusion patients.

To correlate the position of maxillary central incisor patients with respect to forehead inclination and prominence of forehead in Angle's class II malocclusion patients.

To provide guideline for orthodontic diagnosis and treatment planning of patient.

Materials and methodology

A Retrospective study was carried out on the 60 pretreatment digital lateral cephalograms from Department of Orthodontics MGV's KBH Dental College and Hospital, Nashik from May 2019 to December 2019. 60 samples were divided into 2 groups, Angle Class I and Class II of 30 samples each. Age group was between 14 to 25 years. They were traced manually by single observer on a laminator to eliminate bias.

Inclusion criteria

1. Age between 14 to 25 years was included in study.
2. All permanent tooth were present in patient's oral cavity.
3. A good quality lateral cephalogram with adequate contrast.

Exclusion criteria

1. Past History of orthodontic treatment.
2. Cleft lip and palate.

3. Craniofacial abnormalities and syndrome.

4. Trauma to the face.

5. Missing anterior teeth.

Methodology

A 0.003 inch acetate sheet were placed over the X – ray film and hard tissue landmarks of anterior nasal spine, clinoidale, floor of sella, gonion, menton, point A, point B, nasion, roof of the orbit and upper central incisor were traced. Soft tissue forehead was traced from glabella. Patients were divided into two groups according to Angle's classification of malocclusion. Cephalometric measurement Point A–nasion–Point B (ANB) was used to classify the groups. Patients with ANB angle 2 degree were categorized as Angle's class I malocclusion group and patients with ANB angle more than 2 degree were categorized as Angle's class II malocclusion group.

To evaluate the position of maxillary central incisor one horizontal and two vertical references planes were used. The horizontal reference plane is from the point of intersection of mandibular plane and anterior cranial plane to anterior nasal spine. Anterior cranial base plane was constructed by drawing a line from the roof of the orbit to clinoidale and parallel line was drawn through the floor of sella and extended distally [9]. Mandibular plane was drawn using menton and gonion and extended distally until it intersected the anterior cranial-base plane. The two vertical reference plane used in the study was forehead facial plane (FFP) and forehead midpoint plane (FMP). Forehead facial plane is perpendicular to the horizontal plane from the soft tissue glabella. Forehead midpoint plane is perpendicular to the horizontal plane from midpoint of forehead.

Measurements were made in millimeter from forehead facial plane (FFP) and forehead midpoint plane (FMP) to most facial aspect of the upper central incisor and anteroposterior location was recorded in both the groups.

To evaluate the forehead inclination a inclination plane was constructed from glabella to superior point (uppermost point of the forehead), and forehead inclination angle was measured between inclination plane and forehead facial plane in both the groups.

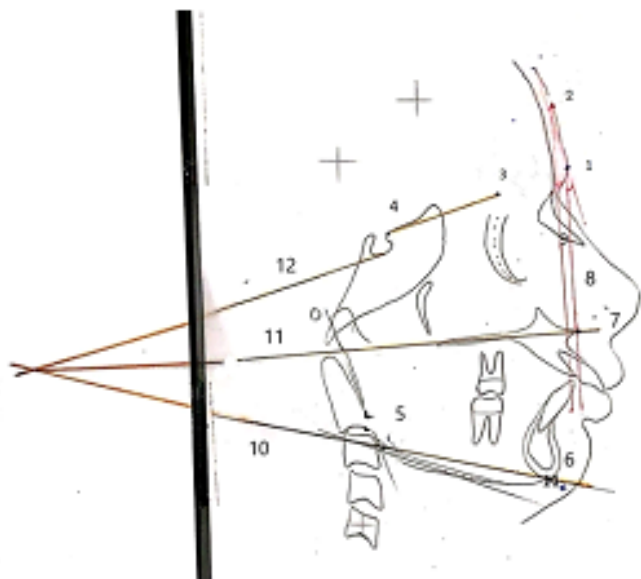


Figure 1: Landmarks and reference planes on lateral cephalogram

Cephalometric landmarks and reference planes

1. Soft tissue glabella
2. Midpoint of forehead
3. Roof of orbit
4. Clenoidale
5. Gonion
6. Menton
7. Anterior nasal spine
8. Forehead facial plane (FFP)
9. Forehead Midpoint plane (FMP)
10. Mandibular plane
11. Horizontal reference plane
12. Anterior cranial base plane

Statistical analysis

Statistical analysis was completed using SPSS software, with significance level set at < 0.05 Descriptive analysis

was calculated and unpaired student t- test was used to check the intergroup relation with soft tissue glabella.

Results

The mean upper incisor position with respect to forehead frontal plane in Angle's class I patients is 2.53 mm and in class II patients is 8 mm, with mean difference of 5.47 mm, Position of upper incisor in relation to forehead midpoint plane in Angle's class I is 3.57 mm and in class II is 11.7 mm with mean difference 8.13 mm. The mean inclination plane angle in Angle's class I patients is 14.86 degree and in class II patients is 16.56 with mean difference of 1.7 degree.

t – test were then used to determine statistical significance for each data with 95% confidence level showed p- value of < 0.001 in all types shows statistically significant difference.

Table 1: Comparing position maxillary central incisor position.

Parameter	Pair of comparison	Mean	S.D	Standard error	p value	Remark
U 1 – FFP	Class I	2.53	5.86	1.08	< 0.001	Significant
	Class II	8	6.45	1.17	< 0.001	Significant
U 1 – FMP	Class I	3.57	1.66	1.48	< 0.001	Significant
	Class II	11.7	7.76	1.41	< 0.001	Significant
FMP – Inclination plane	Class I	14.86	5.67	1.05	< 0.001	Significant
	Class II	16.56	6.88	1.25	< 0.001	Significant

Discussion

Maxillary incisors play important role in esthetics; orthodontists should evaluate the facial profile always keeping maxillary incisors in mind. In the present study we used a forehead facial plane and forehead midpoint plane to evaluate the position of permanent maxillary central incisor with respect to forehead in Angle's class I and class II malocclusion patients and antero-posterior position was recorded with respect to forehead.

Determination of the correct maxillary incisor position is very important in developing treatment plans for orthodontic patients. For patients undergoing extraction

orthodontic treatment, one of the major contributing factors predicting changes in the soft tissue profile is the movement of maxillary incisor^[10].

Ricketts developed an “esthetic plane” (E-line) to determine the lips in relation to the nose tip and soft-tissue pogonion. The lower lips ideally measured 2 mm and the upper lips 4 mm posterior to the E-line in females and in males lips are more retrusive. Large noses or soft-tissue chins project the esthetic plane anteriorly; smaller or flatter noses or chins project the esthetic plane posteriorly^[11]. Holdaway assessed the profile chin position by using soft-tissue facial plane (facial angle relative to FH). He said that this harmony line (H-line) lies 3-7 mm anterior to subnasale, and that the lower lip should fall 0.5 mm anterior to this plane in patient with good facial profile^[12-13].

Similar to the present study, Spradley and colleagues studied 25 Caucasian males and 25 Caucasian females with esthetically pleasing and normal profile. Lateral cephalograms was taken in natural head position, using a true vertical plumb line lateral to the profile. Lip position, sulcus depth, and soft-tissue pogonion were measured relative to subnasal true vertical. Subnasal true vertical constructed by using true horizontal line was constructed from the true vertical, and a second vertical line was drawn from the true horizontal through subnasal. In females, lips were more procumbent and in front of the subnasal vertical line, than in males^[14].

Bergman designed a soft tissue assessment sheet using 16 soft tissue landmarks. Indicate that the upper lips normally lie 3.5 mm in front of soft-tissue subnasal to pogonion line and lower lip is 2.2 mm in front of soft tissue subnasal to pogonion line. This method evaluated lip position within the soft-tissue envelope, but did not address upper-incisor anteroposterior position within the facial profile^[15].

In the present study, the mean values of position of maxillary central incisor relative to forehead facial plane in class I patients was 2.53 mm and 8 mm for class II patients. While the mean values for forehead inclination were statistically significant in both Angle’s class I and class II malocclusion. This indicates patients with class I malocclusion and with good profile have incisor position close to the forehead facial plane and forehead midpoint plane compared to class II malocclusion patients.

This study confirms the validity of horizontal and vertical reference planes based on soft-tissue glabella and the forehead midpoint in determining the ideal anteroposterior position of the maxillary central incisors for profile esthetics and lip support. Because it relies on internal bony and external soft-tissue landmarks, this technique does not depend on the accuracy of head positioning.

To obtain a balanced smiling profile, the AP position of the maxillary incisors, including jaw position, labiolingual inclination of the maxillary anterior teeth and soft tissue changes, should be considered. Zarif Najafi H et al in his study stated that normal incisor inclination is the best choice for retruded and protruded mandible^[16]. Maxillary incisor with 5 degree of incisor proclination is acceptable in smiling profile. Therefore it is important for the orthodontics to achieve the maxillary incisors in the correct anteroposterior position with favorable inclination. To achieve correct maxillary incisor position and inclination appropriate anchorage and treatment mechanics should be chosen.

Various studies are conducted on position of lip with respect to subnasal, pogonion. Position of maxillary central incisor studied but only on the patients with good esthetics, good profile none of the study had conducted on the position of the maxillary central incisor in different malocclusion with respect to forehead.

Additional studies that would be needed to extend these findings would be to look at other races, specific age groups as well as gender groups. Present study is conducted on 60 numbers of patients, studies like this has to be conducted on large number of population.

Conclusion

The result of the present study revealed maxillary incisor in class I malocclusion positioned close to the forehead plane whereas in class II malocclusion patients maxillary central incisor were positioned ahead and farther to the facial plane.

The present study revealed that in Angle's class II malocclusion patient forehead is posteriorly slopping than Angle's class I malocclusion patients.

These current results indicate that the facial reference lines, forehead facial plane and forehead midpoint plane are stable and practical to use to evaluate the position of the maxillary incisors in orthodontic patients, which can help in developing treatment plans for example, in determining whether extraction or non-extraction treatment is indicated for proper horizontal positioning of the upper incisors.

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