

Effect of anterior teeth inclination on soft tissue facial profile in Class II division 1 malocclusion

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ABSTRACT

The purpose of this study was to investigate soft tissue adaptability to hard tissue; in other words, to evaluate the relation between the inclination of upper and lower anterior teeth with the upper and lower lips, and how this relation affect the soft tissue profile in Class II division 1 malocclusion subject for both genders (males and females).

The sample of this study comprised lateral cephalograms from 40 Class II division 1 malocclusion subjects (20 males and 20 females) aged 18–25 years. Two dental [upper and lower incisor inclination {the angle formed between the long axis of the upper central incisor (U1) and the palatal plane (PP) and the angle formed between the long axis of the lower central incisor (L1) and the mandibular plane (MP)}] and three soft tissue [nasolabial (nla), labiomental (lma) and soft tissue facial convexity (n–sn–pog)] angular measurements were analyzed. The results showed no significant difference between males and females concerning the proclination of upper anterior teeth and the prominency of upper lip, while the females exhibited more proclined lower anterior teeth and more protrusive lower lip than males. The males tend to have more convex facial profile than females.

Key Words: Facial profile, teeth inclination, soft tissue, Class II division 1 malocclusion.

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INTRODUCTION

Subject with Class II division 1 malocclusion characterized by protruding upper incisors,⁽¹⁾ and those make a relatively high percentage of subjects attending orthodontic clinic. In Iraq, 21% of persons who attended the orthodontic department were of Class II division 1.⁽²⁾

The dentoskeletal morphology of Class II malocclusion has been analyzed in number of cephalometric investigations.⁽³⁻⁵⁾ The soft tissue primarily determines the facial appearance of any given individual,⁽⁶⁾ relying only on skeletal analysis assuming that the face will balance if the skeletal/dental cephalometric values are normalized, may not yield the desired outcome.⁽⁷⁾

Orthodontic patient seeks treatment primarily for esthetic reasons, and the res-

ulting soft tissue profile is one measure of esthetic success.^(8,9) Orthodontists for years have studied the soft tissue contour for facial profiles in patients and realized the significance of changes in that contour induced by tooth movement.⁽¹⁰⁾

Many reports have demonstrated that the movements of soft tissue surface landmark do not follow the movement of underlying hard tissue structures on a one-to-one basis.^(8,9) More recently, various methods of soft tissue assessment have evolved and many studies have been published as to how movement of teeth and supporting bone may effect the position of the facial soft tissue.^(10,11)

So, the treatment plan could vary considerably depending on weather treatment is directed at the actual deficiency/excess

present or whether it is camouflaging normal adjacent structures that are only relatively over or under sized.⁽¹²⁾

It is important to remember that soft tissue morphology and behavior have a genetic component and they have a significant influence on the dentoalveolar morphology. This concept was described by Van der Linden,⁽¹³⁾ as the balance between the internal and external functional matrices. For example, in Class II division 1 malocclusion, a short upper lip and low lip level with flaccid lip tone will reduce the external influence and the balance. This will favor proclination of the upper incisors.

This study was carried out to determine the relation between the inclination of upper and lower anterior teeth with the upper and lower lips and how this relation may affect the soft tissue profile of Class II division 1 malocclusion subject by which this effect could interfere in planning the orthodontic treatment.

MATERIAL AND METHODS

The sample of this study was selected from students (Iraqi in origin) of Mosul University, College of Dentistry. The total sample was 40 individuals (20 males and 20 females) with age range between 18–25 years, the criteria of sample selection included:

- Bilateral distal lower molar and canine relationship of at least one-half cusp width.^(14, 15)
- Overjet more than 5 mm.^(2, 15–17)
- No history of orthodontic treatment.
- Complete permanent dentition in both jaws excluding 3rd molars.
- No caries, restorations, congenital missing, supernumerary and no traumatized or fractured anterior teeth.

A lateral cephalometric radiograph for each individual was taken using SS white cephalometric machine (BF, Whemer, Franklin Park, Ill, USA) with a Wehmer cephalostate (Mode W-105 A) (BF, Whemer, Franklin Park, Ill, USA). The machine was set at 90 KV and 15 mA power, with 45–55 impulses. A double emulsion film (AGFA, Gevaert NV, Belgium) and one cassette of the same size (8×10 inch) with a pair of highly sensitive intensif-

ying screens were used and a lead foil taken from occlusal films 6x2.25 inch (Kodak, France) were used.

Two layers made from four lead foils were fixed on the cassette in order to reduce the radiation reaching the film after penetrating the soft tissue, so that the soft tissue appears more clearly in the radiograph.

Each cephalogram was taken in centric occlusion for each subject with lips in relaxed perioral musculature,^(18, 19) processed in a dark room in the x-ray Department, Dentistry College, Mosul University. The film was placed on the viewer with the image facing to the right.⁽²⁰⁾ A tracing paper was fixed on the radiograph by taping and the subject's name, sex and date of radiograph were written on the film and on the tracing paper.

Tracing was done including the maxilla and related structures, mandible and its outline, upper and lower central incisors and finally the soft tissue profile was traced. All the radiographs were traced; the landmarks were identified and placed directly on the tracing paper and the intended angles were determined and measured.

Cephalometric Landmarks:

As describe by many researchers,^(21–25) the following landmarks were used in this research :

A. Skeletal landmarks (Figure 1):

- 1- Anterior nasal spine (ANS): The tip of the bony anterior nasal spine in the median plane.
- 2- Posterior nasal spine (PNS): The posterior spine of the palatine bone constituting the hard palate coincides with the lowest point of the pterygomaxillary fissure.
- 3- Menton (Me): The most caudal point in the outline of the symphysis, it is regarded as the lowest point of the mandible.
- 4- Gonion (Go): The most inferior and posterior point at the angle of the mandible, formed by the junction of the tangent to the posterior border of the ramus and inferior border of the mandible meets the mandibular outline.

B. Soft tissue landmarks (Figure 1):

- 1- Soft tissue nasion (n): The point of maximum convexity between the nose and forehead.
- 2- Subnasal (sn): The point at which the nasal septum merges with the upper cutaneous lip in the midsagittal plane.
- 3- Laberale superius (ls): The most anterior point of the upper lip.
- 4- Laberale inferius (li): The most anterior point of the lower lip.
- 5- Soft tissue pogonion (pog): The most anterior point of the soft tissue profile over the mandibular symphysis.

- 6- Submental (sm): The point of the greatest concavity of the soft tissue profile on the mandibular alveolar area.

Cephalometric Planes (Figure 1):

- 1- Palatal plane (PP): Formed by a line extend from anterior nasal spine to posterior nasal spine.^(24, 26)
- 2- Mandibular plane (MP): Formed by a line tangent to the lower border of the mandible extends from gonion to menton.⁽²⁰⁾

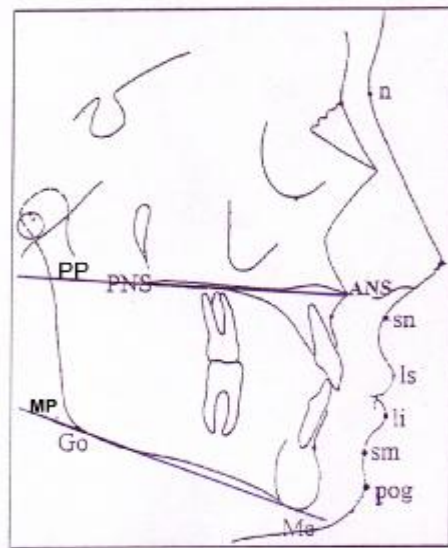


Figure (1): Cephalometric landmarks and planes

n: Soft tissue nasion; sn: Subnasal; ls: Laberale superius; li: Laberale inferius; sm: Submental; pog: Soft tissue pogonion; ANS: Anterior nasal spine; PNS: Posterior nasal spine; Me: Menton; Go: Gonion; PP: Palatal plane; MP: Mandibular plane.

Angular Measurement:

The angular measurements used in this study include the following:

A. Dental angular measurements (Figure 2):

- 1- U1-PP angle: The angle formed between the long axis of upper central incisor and the palatal plane.⁽²³⁾
- 2- L1-MP angle: The angle formed between the long axis of lower central incisor and the mandibular plane.⁽²³⁾

B. Soft tissue angular measurements (Figure 2):

- 1- Nasolabial angle (nla): The angle for-

med by a line tangent to the lower border of the nose from subnasal point (sn) with the line from laberale superius (ls) to subnasal point (sn).⁽²⁷⁻²⁹⁾

- 2- Labiomental angle (lma): The angle formed by a line tangent to the chin from point (sm) with the line extend from laberale inferius (li) to submental point (sm). This angle represents the deeping of the mental fold.^(29, 30)
- 3- Soft tissue facial convexity angle (n-sn-pog): The angle formed between soft tissue nasion (n), subnasal (sn) and soft tissue pogonion (pog).⁽³¹⁾

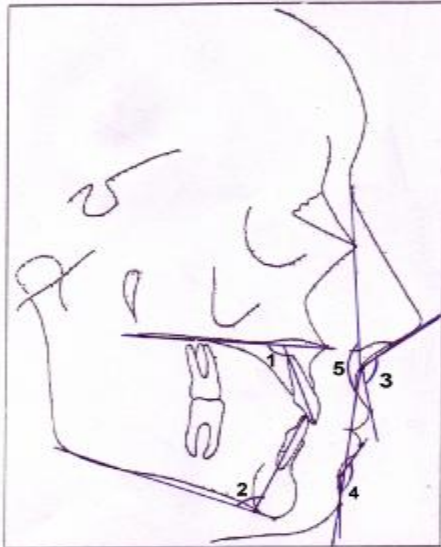


Figure (2): Dental and soft tissue angular measurements

1. U1-PP (the angle formed between the long axis of upper central incisor and the palatal plane);
2. L1-MP (the angle formed between the long axis of lower central incisor and the mandibular plane);
3. nla (nasolabial angle);
4. lma (labiomentalar angle);
5. n-sn-pog (soft tissue facial convexity angle).

All the data of the present study were analyzed using Minitab statistical program which include the following: Descriptive statistics (mean, standard deviation, minimum and maximum), Student's t-test to differentiate between males and females at $p < 0.05$ level of significance, and Pearson's Correlation Coefficient of the variable for males and females at $p < 0.05$ level of significance.

RESULTS

After analyzing the data of this study, Table (1) showed the descriptive statistics for the angular dental and soft tissue meas-

urements for the Class II division 1 malocclusion subject. Table (2) illustrated the comparison between males and females using Student's t-test at $p < 0.05$. It was found that females had significant larger mean value than males for the angle formed between the L1-MP angle and n-sn-pog angle.

As shown in Table (3), the correlation between the variables in males was significant between the nla and the n-sn-pog angle at $p < 0.05$. While in Table (4), the correlation between the variables in females was significant between the L1-MP angle and lma at $p < 0.05$.

Table (1): Descriptive statistics of the variables for males and females

Variable	Sex	No.	Mean	± SD	Minimum	Maximum
U1-PP	Male	20	115.40	8.48	105	143
	Female	20	113.70	8.73	96	127
	Total	40	114.55	8.54	96	143
L1-MP	Male	20	101.40	4.72	91	109
	Female	20	106.35	9.85	91	124
	Total	40	103.87	8.02	91	124
nla	Male	20	106.40	14.80	75	131
	Female	20	105.95	8.47	89	120
	Total	40	106.15	11.93	75	131
lma	Male	20	110.40	14.90	74	143
	Female	20	112.20	17.09	78	146
	Total	40	111.28	15.85	74	146
n-sn-pog	Male	20	152.90	4.99	143	166
	Female	20	157.10	4.80	150	168
	Total	40	155.00	5.28	143	168

U1-PP: The angle formed between the long axis of upper central incisor and the palatal plane; L1-MP: The angle formed between the long axis of lower central incisor and the mandibular plane; nla: Nasolabial angle; lma: Labiomentalar angle; n-sn-pog: Soft tissue facial convexity angle; SD: Standard deviation.

Table (2): Student's t-test of variables between males and females

Variable	Sex	Mean	± SD	t-value	p-value
U1-PP	Male	115.40	8.48	0.62	0.54
	Female	113.70	8.73		
L1-MP	Male	101.40	4.72	-2.03	0.05*
	Female	106.35	9.85		
nla	Male	106.40	14.80	0.10	0.92
	Female	105.95	8.47		
lma	Male	110.40	14.90	-0.36	0.72
	Female	112.20	17.10		
n-sn-pog	Male	152.90	4.99	-2.71	0.01*
	Female	157.10	4.80		

U1-PP: The angle formed between the long axis of upper central incisor and the palatal plane; L1-MP: The angle formed between the long axis of lower central incisor and the mandibular plane; nla: Nasolabial angle; lma: Labiomenal angle; n-sn-pog: Soft tissue facial convexity angle; SD: Standard deviation.

*Significant difference at $p < 0.05$.

Table (3): Pearson's Correlation Coefficient of the variable for males

	U1-PP	L1-MP	nla	lma
L1-MP	0.304			
nla	-0.262	-0.176		
lma	0.039	-0.013	-0.051	
n-sn-pog	-0.049	-0.009	-0.571*	-0.154

U1-PP: The angle formed between the long axis of upper central incisor and the palatal plane; L1-MP: The angle formed between the long axis of lower central incisor and the mandibular plane; nla: Nasolabial angle; lma: Labiomenal angle; n-sn-pog: Soft tissue facial convexity angle.

*Correlation is significant at $p < 0.05$.

Table (4): Pearson's Correlation Coefficient of the variables for females

	U1-PP	L1-MP	nla	lma
L1-MP	0.361			
nla	0.072	-0.147		
lma	-0.363	-0.471*	-0.088	
n-sn-pog	-0.224	-0.102	-0.329	0.240

U1-PP: The angle formed between the long axis of upper central incisor and the palatal plane; L1-MP: The angle formed between the long axis of lower central incisor and the mandibular plane; nla: Nasolabial angle; lma: Labiomenal angle; n-sn-pog: Soft tissue facial convexity angle.

*Correlation is significant at $p < 0.05$.

DISCUSSION

Although analysis of the data showed larger mean value in males than females for the U1-PP angle, but this difference was insignificant, as mentioned in Table

(2). This finding came in agreement with other studies,^(15, 32, 33) which found no significant gender difference in the proclination of the upper anterior teeth for Class II division 1 malocclusion subject. While the

disagreement was with other studies,⁽³⁴⁻³⁶⁾ which stated that males have more forward position of the jaws and more maxillary incisors proclination than females.

Accordingly, this study showed no significant gender difference in the mean value of nla in Class II division 1 malocclusion subjects (Table 2). This could be attributed to the fact that "the lips show a strong tendency to follow the underlying hard tissue"⁽³⁷⁾ and as mentioned previously that there was no significant difference between males and females in the proclination of the upper anterior teeth so the upper lip position and the nla were not affected.

In the other hand, this study found significant gender difference in the mean value of the L1-MP angle, as shown in Table (2). The mean value of the angle was greater in females than males that is mean the females have more proclined lower anterior teeth than males. This finding disagreed with that observed by Rothstein and Phan,⁽³⁸⁾ who stated that Class II division 1 malocclusion females showed more proclination of upper but not lower incisors.

Although the females in this study showed more proclined lower anterior teeth than males but interestingly there was no significant gender difference in the mean value of the lma (Table 2). As the females chins do not appear to be as prominent as the males,⁽³⁹⁾ so more anteriorly positioned soft tissue pog in males and more proclined lower anterior teeth in females may be related with this insignificant difference between the Class II division 1 malocclusion males and females in the mean value of the lma.

Despite this insignificant difference, more proclined lower anterior teeth in females means more prominent lower lip than males. This result came in agreement with that of Spradley *et al.*,⁽³⁹⁾ who found that Class II division 1 females exhibited more fuller and prominent lower lip region than males.

Concerning the n-sn-pog angle, the females showed greater mean value than males. This difference was significant (Table 2) indicating that the Class II division 1 malocclusion males exhibited more convex facial profile than males (narrower n-sn-pog angle). This may be attributed to the gender difference in the proclination of

the upper anterior teeth despite of that difference was insignificant. This result came in agreement with that observed by Mahmood,⁽⁴⁰⁾ but disagreed with the study of Skinazi *et al.*,⁽¹²⁾ who found Class II division 1 malocclusion females with more convex face than males, and also disagreed with the study of Bishara *et al.*,⁽⁴¹⁾ who observed no significant difference between males and females regarding the facial convexity.

The Pearson's Correlation Coefficient analysis of the males variable (Table 3) revealed high significant negative correlation between the nla and n-sn-pog angles indicating that more prominent upper lip will decrease the nla and increase the facial convexity of the Class II division 1 malocclusion males.

In Class II division 1 malocclusion females (Table 4), high significant negative correlation was found between the L1-Mp angle and lma. This is obviously true that is mean more proclined lower incisors will decrease the lma and increase the lower lip prominence.

CONCLUSIONS

From the present study, it could be concluded that no significant difference found between the Class II division 1 malocclusion males and females for proclination of upper anterior teeth and upper lip prominence. Besides that, the Class II division 1 malocclusion females showed significant more proclined lower anterior teeth than males. While, the Class II division 1 malocclusion males showed more convex facial profile than females.

In Class II division 1 malocclusion males, significant negative correlation found between the nla and n-sn-pog angle, whereas in Class II division 1 malocclusion females, significant negative correlation found between the angle formed between the L1-MP and lma.

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