A Lateral cephalometric evaluation of soft tissue facial profile of skeletal class I and class III adults

Hadeel Ali Hussein Al-Hashimi B.D.S., M.Sc.*

Abstract

Class III malocclusions are considered one of the most complex and difficult orthodontic problems to diagnose and treat. The aim of this study was to quantify the facial profile deviation of class III from almost norms cases**.** A comparative study of 26 class I and 31 class III subjects at age range of 18-26 years was performed using a lateral cephalometric radiograph.

The results revealed that the facial height (upper, lower and total) in female is not affected by skeletal pattern of class III than class I. While in male, a significant decrease in upper facial height and a significant increase in lower facial height in class III adults with a non-significant differences in total facial height than class I samples. In addition, class III subject exhibited significant increase in both skeletal and soft tissue convexity angles. Furthermore, longer and thinner chin with a more flattened labiomental fold angle and a more flat feature of chin in the patient with class III than class I patient, except for female in class III who show a non-significant decrease in chin thickness than class I.

Keywords: Cephalometric, class III, facial profile.

Introduction

Cephalometric classification of class III malocclusion.

Class III sagittal relationship can categorized as [(1)]: 1. Class III malocclusion due to dentoaleveolar mal relationship. 2. Class III malocclusion with a long mandibular base. 3. Class III malocclusion with an underdeveloped maxilla. 4. Class III skeletal malocclusion with a combination of underdeveloped maxilla and a prominent mandible. 5. Class III skeletal malocclusion with tooth guidance (a pseudo-forced bite).

Class III malocclusions was divided into two basic morphologic types: divergent and convergent facial types. [(2,3)] The hyper divergent class III pattern was not typically present in early childhood.[(4,5)]

Etiology of class III malocclusion.

There is a definite familial and racial tendency toward prognathism, [(6)] in addition to a role of environmental influences, such as habits and mouth breathing in etiology of the class III malocclusion. [(7)]

In class III cases, the prognathic pattern began in the cranial base area. It was not possible to localize the class III malocclusion in craniofacial area alone. The sella angle and articular angle were smaller in class III problem moving the mandible anteriorly in relation to the cranial base. [(1)] In addition; the middle cranial fossa had a posterior and superior alignment. This alignment positions the nasomaxillary complex in a more retrusive relationship and contributes to a forward rotation of the mandible.

*Assistant lecture, Department of orthodontics, College of Dentistry, University of Baghdad

The total increase in posterior cranial base in patient with prognathic mandibles was less than that in class I group. The ascending ramus tends to be shorter with a steeper mandibular plane angle. Generally, gonial angle was more obtuse in skeletal class III sample but was similar to class I sample in pseudo class III, making this measurement a key diagnostic feature between pseudo and skeletal class III malocclusion. [8] The larger gonial angle could contribute to the increase in total mandibular length in patient with class III malocclusion. [9] A short hypotonic upper lip is often seen in combination with a heavy, redundant, averted lower lip. [1] In fact, with continued growth, the mandible would outgrow the maxilla producing maxillo-mandibular disharmony later. [9]

The research aims to determine soft tissue facial profile analysis of class III Iraqi adult subjects and compare them with norms of class I Iraqi adult subjects.

Materials and Methods

Sample 1, consist of 26 class I Iraqi subjects (13 females and 13 males), selected according to following criteria. 1. Complete permanent dentition, third molars were excluded. 2. Class I buccal segments"Molar and canine" with normal over jet and over bite (2-4 mm). 3. Open bite cases were excluded. 4. No history of orthodontic treatment. 5. Skeletal class I jaw relationship according to ANB angle (2-4 degree). 6. Acceptable facial esthetic, no crowding and bimaxillary protrusion cases were excluded.

Sample 2, consist of 31 class III Iraqi subjects (16 females and 15 males), selected according to the following criteria: 1.Complete

permanent dentition, third molars were excluded. 2. Class III buccal segments"Molar and canine" with a reversed over jet or edge to edge. 3. Open bite cases were excluded. 4. No history of orthodontic treatment. 5. Skeletal class III jaw relationship according to ANB angle (ANB <2 degree).

The mean age of the total samples ranged between 18 and 26 years.

Lateral cephalograms had been taken for each subject. Tracing paper was fixed on the radiograph by taping placed on the viewer with image facing to the right. After completing tracing, the landmarks (small letters for soft tissue and capital letters for hard tissue landmarks) are identified and placed directly on the tracing and various lines and angles were made and measured by millimeter ruler and protractor.

Landmarks and planes

Based on the principles set by. [10,11]

- Hard tissue landmarks (figure 1)
  Nasion (N)
  Subspinale Point (A)
  Supramentale Point (B)
  Pogonion(Pog)
- Soft tissue landmarks (figure 1)
  Soft tissue nasion (n)
  Pronasale (no)
  Subnasale (sn)
  Laberale inferius (li)
  Submentale (sm)
  Soft tissue pogonion (pog)
- Planes
  Skeletal facial plane (N-Pog)
  Frankfort horizontal plane (FH) (Or-Po)

Angular Measurements

1. Skeletal angles
   a. ANB angle
   b. Angle of convexity (N-A-Pog)

2. Soft tissue angles
   a. Soft tissue profile angle (n-sn-pog)
   b. Total profile angle (n-no-pog)
   c. Labio-mental angle (li-sm-chin)

3. Skeleto-soft tissue angles
   Chin angle (N-Pog-pog)

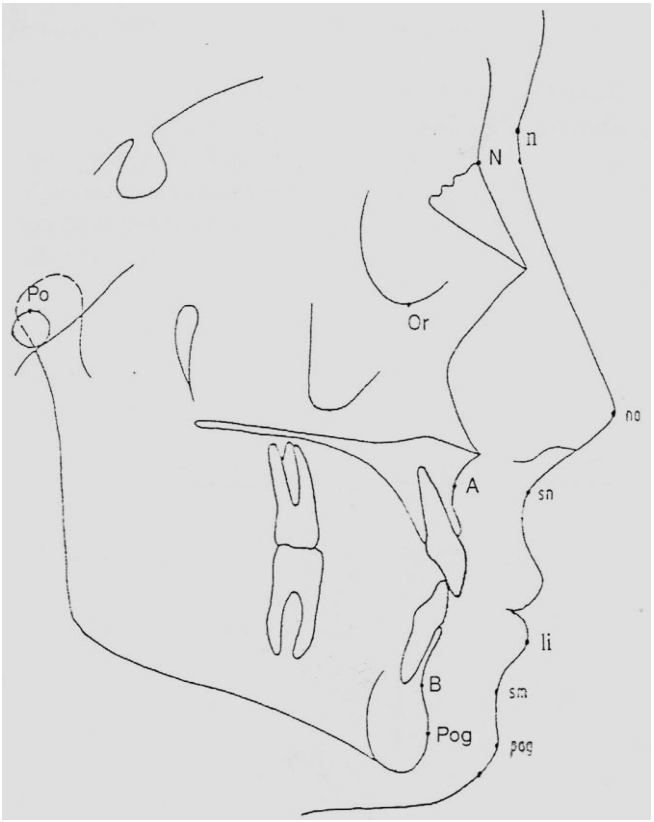

Figure 1: Hard and soft tissue landmarks

Linear measurements

1.Horizontal measurements, used to measure thickness of soft tissue profile overlying hard tissue structure.
   a. NPog-pog, linear distance from soft tissue pogonion perpendicular to skeletal facial plane. [10,12]
   b. B-sm, linear distance between supramentale and submentale. [13]

2. Vertical measurements, all vertical measurements measured perpendicular to FH.
   a. Total facial height (n-pog)
   b. Upper facial height (n-sn)
   c. Lower facial height (sn-pog)
   d. Length of chin (sm-pog)

Result and Discussion

Upper facial height (n-sn), lower facial height (sn-pog) and total facial height (n-pog).

Non significant difference was found between class I and class III concerning upper, lower and total facial height in female subjects.

There are a significant decrease in upper facial height and a significant increase in lower facial height in male and total samples with class III which finally lead to non-significant difference in total facial height of them than class I samples (table 2).

This result was proved by [9] who showed that the deficient development of the mid face in both the sagittal and vertical planes may be attributed to an inherited skeletal pattern and certain environmental and local factors, including naso-respiratory difficulties, compulsive habits, and abnormally positioned tongue in patient with class III malocclusion. Furthermore, [5,14] believe that maxillary facial height is usually deficient in certain type of class III malocclusion.

Excessive lower facial height was a rather frequent finding in adult patients with class III malocclusion as proved by, [15] but disagree with, [9] who found lower anterior facial height was smaller in patient with class III than class I. This finding may be due to a larger gonial angle which mostly associated with class III associated with ascending ramus which tend to be shorter with a steeper mandibular plane angle. [8]

The difference in the results between female and male may be due to different sexual facial growth changes with class III malocclusion (table 2 and 3). [8]

Skeletal profile convexity angle (N-A-Pog).

A significant difference had been noticed between class I and class III for both gender and total samples (table 2). The larger angle was associated with class III, while the smaller angle was associated with class I samples (table 1).

Individual with class III malocclusion exhibits an increased length of the mandible, whereas the mandibular articulation is more anteriorly positioned, resulting in a more prominent lower jaw. The mandibular prominence along with the decreased length of maxillary complex may accentuate the typical concave profile in these cases. [8]

Soft tissue convexity angle (n-sn-pog) and (n-no-pog).

For both angles, the difference between class I and class III was significant (table 2). However, larger angle was exhibited in class III sample, while the smaller angle exhibited in class I sample (table 1). These emphasize on the strong relationship between hard and soft tissue convexity profile angle in which the hard tissue convexity angle (N-A-Pog) showed the same result previously revealed.

Furthermore, all these angles were larger in female sample; as female patients with class III malocclusion possessed a more prominent mandible and an increased proclination of the maxillary incisors when compared to male patient. [8]

Chin length (sm-pog).

Very high significant increase in chin length was noticed in class III samples in both gender and total samples (table 2).

The class III patient with a long face has a tendency to have a flat labio-mental sulcus because of the flattening of mentalis muscles to attain lip

closure result in excessively long chin. [16]

Chin thickness (NPog-pog).

The male samples exhibited significant decrease in chin thickness in class III samples than class I (table 2). This result can discussed according to Rakosi, [10] who showed independent of soft tissue chin about the bony profile, or due to excessive increase in lower facial height as shown in table 1 and 3, which result in decrease in thickness of chin. While female samples exhibit a non-significant decrease in chin thickness. The soft tissue chin follows the bony contour in females more closely than males. [17]

Labio-mental fold thickness (sm-B).

No significant difference was found in the thickness of soft tissue at this area between class I and class III (table 2). A local increased in size around supramentale, but this expansion was accompanied by a reduction in size in the incisor alveolus and menton regions in class III subjects. [18] In addition to that, the minor effect of lower lip and soft tissue chin thickness on the thickness of this area. [19]

Labio-mental fold angle (li-sm-chin).

The labio-mental fold angle significantly increased in class III samples in both gender and in total samples (table 2).

This fact could attribute to retroclination or retrusive of lower incisors that exhibited in most adult subjects with class III. [20] Furthermore class III patient mostly with along face, so had a tendency to have a flat labio-mental sulcus because of the flattened of the mentalis muscles to attain lip closure. [16,20]

This angle was varying in form and depth in all samples and this come in accordance with, [20] and this variation could be responsible about high standard deviation.

Chin angle (N-Pog-pog).

A significant increase in angle of chin in class III samples in both gender and total samples. i.e. more flat feature of chin area associated with class III subjects (table 2). The more flat labio-mental sulcus and the flattened mentalis muscles associated with most class III subjects may attribute to this feature. [16]

Finally, I have not found any studies in available literatures used the same method to compare my results with them.

Conclusions

1- A significant increase in lower and total facial height in male than female in class III subjects.
2- A significant difference between class I and class III for upper and lower facial height in male, while a non-significant difference in upper and lower facial height in female and total facial height in male and female.
3- More concave profile was exhibited in class III subjects.
4- The chin length was significantly increased in class III subjects.
5- The chin thickness was significantly decreased in class III male than class I, while female did not.
6- More flat labio-mental sulcus in class III subjects.
7- More flat feature of the chin in class III than class I subjects.

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Table 1: Mean and standard deviation of the variables in class I and class III female, male and total samples

	Class I						Class III					
Gender Variables	Female		Male		Total		Female		Male		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
n-sn	63.77	4.117	66.923	3.427	65.346	4.127	61.00	6.66	62.07	7.22	61.52	6.84
sn-pog	54.23	2.862	56.231	2.127	55.231	2.673	56.06	6.48	64.53	9.66	60.16	9.11
n-pog	117.2	4.456	123.15	4.913	120.19	5.499	117.00	10.46	126.60	14.14	121.65	13.10
N-A-Pog	175.5	3.55	176.15	3.134	175.81	3.359	186.00	6.40	183.73	8.41	184.94	7.411
n-sn-pog	162.6	4.369	160.85	4.638	161.73	4.601	171.00	7.46	168.53	5.32	169.81	6.52
n-no-pog	126.4	3.99	124.31	3.517	125.35	3.898	134.88	7.44	132.00	5.74	133.48	6.72
sm-pog	12.77	2.048	12.462	2.876	12.615	2.451	18.81	3.37	19.67	4.17	19.23	3.74
NPog-pog	14.15	2.34	15.00	2.236	14.577	2.283	13.13	2.85	11.40	2.77	12.29	2.90
sm-B	12.85	2.193	13.077	2.871	12.906	2.506	12.50	1.63	14.67	2.35	13.55	2.26
li-sm-chin	123.5	10.27	120.00	7.394	121.73	8.942	146.13	13.26	151.00	17.18	148.48	15.22
N-Pog-pog	75.31	4.289	74.308	3.25	74.808	3.763	87.25	15.71	90.40	13.61	88.77	14.57

Table 2: Differences between variables of class I and class III.

	T-test (I v. III)					
Gender Variable	Female		Male		Total	
	t-value	significance	t-value	significance	t-value	significance
n-sn	1.372	NS	2.319	*	2.601	*
sn-pog	1.014	NS	3.238	**	2.869	**
n-pog	0.069	NS	0.885	NS	0.564	NS
N-A-Pog	5.589	***	3.241	**	6.148	***
n-sn-pog	3.777	**	4.081	***	5.466	***
n-no-pog	3.918	***	4.334	***	-8.691	***
sm-pog	5.944	***	5.379	***	-8.009	***
NPog-pog	1.58	NS	3.803	**	3.330	**
sm-B	0.478	NS	1.591	NS	-1.010	NS
li-sm-chin	5.178	***	6.343	***	-8.236	***
N-Pog-pog	2.910	**	4.436	***	-5.135	***

NS= not-significant=P>0.05
* =significant=P<0.05
** =high significant=P<0.01
*** =very high significant=P<0.00

Table 3: Differences in variables between female and male of class I and class III.

	T-test (female v. male)			
Class Variable	Class I		Class III	
	t-value	significance	t-value	significance
n-sn	2.122	NS	0.51	NS
sn-pog	2.023	NS	0.99	**
n-pog	3.234	**	0.97	*
N-A-Pog	0.495	NS	0.77	NS
n-sn-pog	0.990	NS	0.77	NS
n-no-pog	1.417	NS	0.81	NS
sm-pog	0.315	NS	0.60	NS
NPog-pog	0.947	NS	0.92	NS
sm-B	0.227	NS	1.00	**
li-sm-chin	0.997	NS	0.71	NS
N-Pog-pog	0.671	NS	0.58	NS

NS= not-significant=P>0.05
* =significant=P<0.05
** =high significant=P<0.01
*** =very high significant=P<0.001