



Soft tissue measurements of Iraqi individuals with Cl I and Cl III skeletal pattern: a comparative cephalometric study

Dr. Yassir A. Yassir, B.D.S., M.Sc. (Ortho.)

Dr. Ammar S. Kadhum, B.D.S., M.Sc. (Ortho.)

Dr. Shahbaa A. Al-Ajwadi B.D.S., M.Sc. (Ortho.)

Abstract

This study was planned to compare some of the soft tissue measurements in individuals with skeletal Cl I and Cl III, to find out the measurements which may be used as a clinical diagnostic aid to discriminate between both skeletal classes.

Seventy three digital true lateral cephalometric radiographs of Iraqi adults were divided according to the ANB angle into 38 skeletal Cl I and 35 Cl III. The soft tissue measurements were analyzed using AutoCAD (2007) software computer program. Descriptive statistics were used to describe the measurements, while independent samples t-test was used to rule out gender differences and skeletal class differences.

Gender differences were found significantly in skeletal Cl I for all linear measurements; while in Cl III the significant differences were limited to the anteroposterior measurements only (modified profile thickness at upper lip, modified profile thickness at lower lip, upper lip thickness, and lower lip thickness), with non significant difference for vertical linear measurements (upper and lower Lip height and Mouth height). All angular measurements showed non-significant gender differences. Independent samples t-test revealed that the main differences between classes were found in the labiomental and soft tissue profile angles, which were significantly higher in Cl III than Cl I, while the modified profile thickness at upper lip was significantly higher in Cl I than Cl III, for both genders and for the total sample. Lower lip height, mouth height, and the upper lip height also showed significant differences between classes but with less importance.

The labiomental angle and modified profile thickness at upper lip can be used as diagnostic aids to discriminate whether the subject has a Cl I or Cl III skeletal relation.

Key words: Labiomental angle, profile thickness, skeletal Cl III

Introduction

The goal of treatment in soft tissue paradigm is no longer just to correct malocclusion, but to correct it while also bringing the dentition and facial skeleton into normal relationships with the facial and intra-oral soft tissues, which means that a more thorough

analysis of dentofacial traits is required. The process of orthodontic diagnosis and treatment planning lends itself well to the problem-oriented approach, for which diagnostic aids are invaluable. In its early years, cephalometric analysis was correctly

criticized as being just a "numbers game," leading to orthodontic treatment aimed at producing certain numbers on a cephalometric radiograph. That might or might not represent the best treatment result for that patient.¹

Holdaway emphasized on the soft-tissue approach to treatment planning, considering that there is additional information which can be taken from a study of the structures in the integumental covering of those hard tissues that we should recognize as being even more meaningful.²

Burstone found that the soft tissue of the face is quite irregular and variable and does not readily suggest planes of reference within the soft tissue itself and, therefore, if such planes are to be established, they must utilize dental or skeletal landmarks. Malocclusions exhibit not only malrelations of teeth but also facial disharmony. In part, this disharmony may be produced by variation in the soft tissue mass. In many instances, the reverse will occur; soft tissue variation masks a dentoskeletal discrepancy.³ However, Subtelny stated that although it does not seem possible to devise a "prescription" for differentiating a desirable from an undesirable soft tissue facial profile, this should not prohibit the presentation of some reference information to guide the thinking and practice, so that it may be offered for diagnostic purposes.⁴ Fields et al considered that it is highly desirable to come up with other reliable methods of initial clinical evaluation, since routine cephalometric radiography for screening purposes is not justified.⁵

This study aimed to identify clinical feature(s) related to the lower facial third that can be used to diagnose and discriminate patients with CI III skeletal relation, through the

cephalometric study of 11 soft tissue facial measurements.

Materials and Method

The data of this research was obtained from 73 digital true lateral cephalometric radiographs (table1), classified according to sagittal skeletal patterns using ANB angle⁶⁻⁹ into 38 skeletal class I ($2^\circ \leq \text{ANB} \leq 4^\circ$) and 35 skeletal class III ($\text{ANB} < 2^\circ$). The radiographs of CI I sample were taken for volunteers from the staff and students of the College of Dentistry, University of Baghdad, while that of CI III were obtained from the records of the patients who attended the Orthodontic Department at the College of Dentistry seeking for orthodontic treatment. The mean age of the sample was 22.4 ± 3 years. Other inclusion criteria were:

1. All individuals were Iraqi Arabs in origin.
2. All having complete permanent dentition regardless the third molars.
3. They were clinically healthy with no syndromes, cleft lip and palate, or other facial malformations.
4. No history of previous orthodontic, orthopedic or surgical treatment was recorded.

Every radiograph was analyzed by AutoCAD 2007 software computer program to calculate the angular and linear measurements. After importing the picture to the AutoCAD program, points and planes were determined, and then the angular and linear measurements were obtained. Angular measurement were done directly as they are not affected by magnification. The linear measurements, on the other hand, were divided by a scale for each picture to correct magnification. The scale was obtained depending on the measurement from the ruler provided with the cephalostat. The

measurements used in this study¹⁰⁻¹⁷ were illustrated in figure 1 and table 2.

Statistical analyses

The data were subjected to computerized statistical analysis using SPSS version 15 (2006) computer program. The statistical analyses included:

1. *Descriptive Statistics*
 - a) Mean.
 - b) Standard deviation (S.D.).
2. *Inferential Statistics*
Independent-samples t-test: to compare between means for gender and class differences.

In the statistical evaluation, the following levels of significance were used:

Non-significant	NS	$P > 0.05$
Significant	*	$0.05 \geq P > 0.01$
Highly significant	**	$0.01 \geq P > 0.001$
Very highly significant	***	$P \leq 0.001$

P= probability value.

Results

Table 3 shows the descriptive statistics and gender differences (independent samples t-test) for the measurements of skeletal CI I and CI III. The angular measurements -except for the interlabial angle- were higher in females than males in both classes, but with non-significant differences. The linear measurements in both classes were higher in males reaching a significant level in CI I sample for all of them, while in CI III the significant differences were found in modified profile thickness at upper lip, modified profile thickness at lower lip, upper lip thickness, and lower lip thickness.

When independent samples t-test was used to identify differences between classes according to gender and the total sample (table 4), we noticed that the main significant differences were found in the labiomental and soft tissue profile angles which were significantly higher

in CI III than CI I, while the modified profile thickness at upper lip was significantly higher in CI I than CI III for both genders and for the total sample.

Lower lip height was significantly higher in CI III for females and the total sample. The mouth height was significantly higher in CI III only for females, while the upper lip height showed significant difference between classes for males only with higher mean value in CI I.

Discussion

The sample was selected in a way that all of the patients were borderline CI III, with a profile indistinguishable from that of CI I and an average ANB angle of (- 0.65). The variables were selected to search for differences between subjects with CI III and those with CI I skeletal relation in regard of their lower facial third. Soft tissue profile angle was taken as a control to verify the CI III profile, as it is known that it increases in patients with CI III skeletal relation.¹⁸

Statistical analysis of the differences between males and females and between classes was done with *independent samples t-test*. Table 3 showed that males have greater linear dimensions than females although it may not be statistically significant. This may follow the general rule that females are slightly smaller than males in all dimensions.¹⁹

Table 4 demonstrated the results of t-test between classes according to gender and for the total sample. Three out of the tested variables showed highly significant differences when comparing males, females and the total sample between CI I and CI III, namely: soft tissue profile angle, labiomental angle and modified profile thickness at upper lip. The first two angles were larger in dimension in CI

III as compared to CI I subjects, while modified profile thickness at upper lip was greater in CI I as compared to class III subjects.

The findings for the soft tissue profile angle coincide with that of Subtelny¹² who gave a mean value of 159 for CI I and 168 for CI III. The increase in soft tissue profile angle can be explained by the fact that when the mandible is positioned further anteriorly it will make the angle more obtuse.

The more obtuse the labiomental angle the more suggestive it is that the subject has a CI III skeletal relationship this can be related to that patients with CI III skeletal relation have a lower jaw in occlusion is positioned further forward than in skeletal CI I⁷, this will lead to flattening of the labiomental fold, in other words, the labiomental angle will be more obtuse.

On the other hand an increase in modified profile thickness at upper lip would be more suggestive of CI I skeletal relation rather than CI III, even though it may not be possible to evaluate precisely on clinical basis.

Conclusions

The labiomental angle and modified profile thickness at upper lip can be used as diagnostic aids to discriminate whether the subject has a CI I or CI III skeletal relation.

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Table 1: Sample distribution

Skeletal class	Females	Males	Total
CI I	21	17	38
CI III	18	17	35
Total	39	34	73

Table 2: Measurements used in this study

Variables	Description
Nasolabial°	The angle formed by a line tangent to the lower border of the columella of the nose (cm) from subnasale point (sn) with the line from labrale superius to subnasale point (sn). ¹⁰
Interlabial°	The intersection angle at stomion (sto) of lines extending from labrale superius (ls) and labrale inferius (li) respectively. ¹¹
Labiomental°	The intersection angle at point submentale (sm) of the lines extending from the labrale inferius (li) and the tangent to the chin. ¹⁰
Soft tissue profile°	Constructed between soft tissue nasion (n), subnasale (sn), and soft tissue pogonion (pog). ¹²
U lip height	The vertical distance between the horizontal levels of subnasle (sn) to stomion superius (sto ^s). ¹⁰
L lip height	The vertical distance between the horizontal levels of stomion inferius (sto ⁱ) and submentale (sm). ¹⁰
Mouth height	The vertical distance between the horizontal levels of labrale superius (ls) and labrale inferius (li) points. ¹³
Modified profile thickness at U lip	From the Nasion-Pogonion line to labrale superius(ls). ^{14,15}
Modified profile thickness at L lip	From the Nasion-Pogonion line to labrale inferius (li). ^{14,15}
U lip thickness	Upper incisor point (UIP) and labrale superius(ls). ^{16,17}
L lip thickness	Lower incisor point (LIP) and labrale inferius (li). ^{16,17}

Table 3: Descriptive statistics and gender differences for CI I and CI III sample

Variables	Classes	Females		Males		Total		Gender differences	
		Mean	S.D.	Mean	S.D.	Mean	S.D.	t	p
Nasolabial°	CI I	106.428	10.230	100.529	9.830	103.789	10.353	1.798	0.081
	CI III	100.888	12.237	96.823	12.355	98.914	12.286	0.978	0.335
Interlabial°	CI I	98.619	8.851	100.470	9.925	99.447	9.263	- 0.607	0.547
	CI III	101.166	8.542	105.176	10.525	103.114	9.630	- 1.241	0.223
Labiomental°	CI I	121.285	13.012	120.588	14.168	120.973	13.358	0.158	0.875
	CI III	138.666	13.826	132.941	17.530	135.885	15.768	1.076	0.290
Soft tissue profile°	CI I	160.381	3.323	159.000	4.924	159.763	4.116	1.029	0.310
	CI III	167.277	4.799	165.235	3.992	166.285	4.482	1.364	0.182
U lip height	CI I	18.575	2.065	21.734	1.371	19.988	2.378	- 5.407	0.000***
	CI III	19.607	2.209	19.958	3.066	19.778	2.626	- 0.390	0.699
L lip height	CI I	16.706	1.894	19.150	2.303	17.799	2.398	- 3.592	.001***
	CI III	19.693	3.125	20.596	2.785	20.131	2.957	- -9.00	0.375
Mouth height	CI I	15.004	1.476	16.679	1.887	15.753	1.852	- 3.071	0.004**
	CI III	16.261	2.084	16.830	3.258	16.538	2.693	- 0.619	0.540
Modified profile thickness at U lip	CI I	18.072	2.258	21.758	2.970	19.721	3.165	- 4.347	0.000***
	CI III	15.428	2.724	18.456	2.801	16.899	3.124	- 3.242	0.003**
Modified profile thickness at L lip	CI I	15.884	2.314	19.300	2.282	17.412	2.847	- 4.553	0.000***
	CI III	15.741	3.029	17.715	2.671	16.700	2.991	- 2.041	0.049*
U lip thickness	CI I	11.270	1.445	13.668	2.040	12.343	2.095	- 4.236	0.000***
	CI III	11.138	1.257	13.908	2.078	12.483	2.189	- 4.802	0.000***
L lip thickness	CI I	12.634	1.287	15.038	1.168	13.710	1.718	- 5.962	0.000***
	CI III	12.154	1.480	14.221	1.754	13.158	1.908	- 3.774	0.001***

S.D.: standard deviation, degree of freedom= 36 (CI I), 33 (CI III)

Millimeters for linear measurements and degrees for angular measurements

Table 4: T-test between CI I and CI III in males, females, and total sample

Variables	Females CI I and CI III (df=37)		Males CI I and CI III (df=32)		Total CI I and CI III (df=71)	
	t	p	t	p	t	p
Nasolabial°	1.540	0.132	0.968	0.340	1.838	0.070
Interlabial°	-0.911	0.368	-1.341	0.189	-1.658	0.102
Labiomental°	-4.040	0.000***	-2.260	0.031*	-4.371	0.000***
Soft tissue profile°	-5.277	0.000***	-4.055	0.000***	-6.481	0.000***
U lip height	-1.507	0.140	2.180	0.037*	0.359	0.720
L lip height	-3.668	0.001***	-1.649	0.109	-3.713	0.000***
Mouth height	-2.197	0.034*	-0.166	0.869	-1.459	0.149
Modified profile thickness at U lip	3.315	0.002**	3.335	0.002**	3.829	0.000***
Modified profile thickness at L lip	0.167	0.869	1.859	0.072	1.042	0.301
U lip thickness	0.302	0.764	-0.339	0.737	-0.279	0.781
L lip thickness	1.083	0.286	1.599	0.120	1.300	0.198

Figure 1: Measurements used in this study:

1: nasolabial angle. 2: interlabial angle. 3: labiomental angle. 4: soft tissue profile angle. 5: upper lip height. 6: lower lip height. 7: mouth height. 8: Modified profile thickness at U lip. 9: Modified profile thickness at L lip. 10: upper lip thickness. 11: lower lip thickness.

