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# Quantifying the Soft Tissue Profile by Two Different Methods in Iraqi Adults: A Comparative Study

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**ABSTRACT**

*Patient's soft tissue profile plays a prominent role in orthodontic diagnosis and treatment planning, many researchers have defined various facial soft tissue parameters based on lateral cephalometric radiographs by using either anatomic point method or tangent line method, however, these methods differ in the way of constructing straight lines along the soft tissue profile. This study aimed to compare the reliability of the two drawing methods (anatomic point and tangent line method). The sample consists of 100 true lateral cephalometric radiographs of patients with normal occlusion and accepted facial profile aged (18-30) years, ten angular measurements along the soft tissue contour were measured by the 2 drawing methods by 3 orthodontist examiners and analyzed statistically to fined means and standard deviation and to be compared by intra-class correlation coefficient. The results showed the non-significant difference between the measurements of the two drawing methods, and both methods were reliable and consistence in soft tissue profile analysis.*

**Keywords:** Soft tissue profile, Anatomic point method, Tangent line method

## INTRODUCTION

Soft tissue profile analysis had been used by many authors as a dependable guide for occlusal treatment and associated soft tissue changes [1,2]. It should be taken into consideration for precise evaluation of underlying skeletal differences because of individual variation in soft tissue thickness. However an aesthetic and well- proportioned face is one of the aims of orthodontic treatment, so understanding the soft tissue and their normal ranges can help the treatment plan to be constructed to normalize the facial characteristics for the individuals [3-11].

For many years, the orthodontics have been using cephalometric radiograph to help them in hard tissue diagnosis and treatment planning, after limitation was established for using only hard tissue measurement in orthodontic treatment planning, soft tissue measurements were developed [4,5]. However, the curved surfaces of the soft tissue profile also should be reduced into angles, distance, and ratios, which is a less accurate method than the process of connecting the hard tissue landmarks [6,8,10]. A review of the literature demonstrates that there was no consistency in the construction of straight lines which analyze the soft tissue contours [7,11,12], to measure an angle in the analysis of the soft tissue profile contour, the construction of two straight lines is made in several ways, including connecting the landmarks that were pointed along the contour of the soft tissue profile (anatomic point method), and by drawing straight lines tangent to the curved surfaces (tangent line method), or a combination of the 2 drawing methods [9-12].

The aim of the current study was to compare the measurements obtained from the 2 methods of soft tissue analysis made by 3 Iraqi orthodontists and identify the most accurate method of soft tissue analysis.

## PATIENTS AND METHODS

### Sample

The sample consisted of 100 true lateral cephalometric radiographs collected from the files of the patients attending the orthodontic clinic in the College of Dentistry, University of Baghdad, Iraq. The inclusion criteria for the sample were the entire sample was of Iraqi origin with an average age of 18-30 years, having class I normal occlusion, accepted

facial profile, none of these individuals had a history of orthodontic treatment, and all had complete permanent dentition regardless of third molars. We assess the intraobserver and interobserver reproducibility for both methods.

Total 10 variables were selected to quantify the soft tissue according to the method presented by McNamara, et al., [8,10]. The regions analyzed were: forehead angle (FHA) angle, frontonasal angle (FNA), nasal depth angle (NDA), dorsum-nasion perpendicular (dorsum-NP), nasal tip angle (NTA), nasiolabial angle (NLA), upper lip-nasion perpendicular (UL-NP), lower lip-nasion perpendicular (LL-NP), mentolabial angle (MLA), and pogonion-menton angle (PMA).

The following landmarks were selected to construct the former angles using the anatomic point method Figure 1:

- O: Intersection of the nasion perpendicular with the forehead
- G' (soft tissue glabella): the most prominent point in the midsagittal plane of the forehead
- N' (soft tissue nasion): The most concave point in the tissue overlying the area of the frontonasal suture
- Prn (pronasale): The most prominent point of the nose
- Cm (columella): The most anterior soft tissue point on the columella (nasal septum) of the nose
- Sn (subnasale): The point at which the columella merges with the upper lip in the midsagittal plane
- Ls (labrale superius): The most anterior point on the upper lip
- Li (labrale inferious): The most anterior point of the lower lip
- Sm (supramentale): The point of greatest concavity in the midline of the lower lip between labrale inferious and soft tissue pogonion
- Pog' (soft tissue pogonion): The most anterior point in the soft tissue chin
- Me' (soft tissue menton): The most inferior point on the soft tissue chin
- Th (throat): The intersection between the sub mental area and the tangent line of the neck

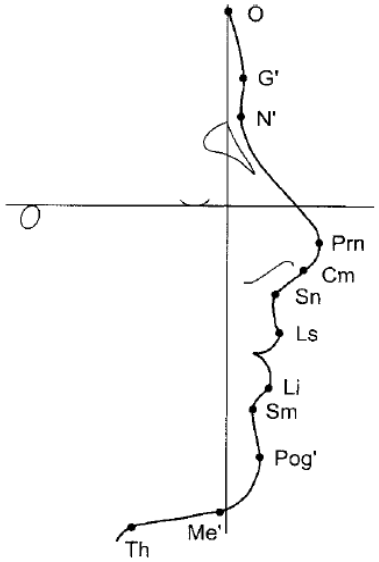


**Figure 1 Soft tissue landmarks used in this study. O' indicates the intersection of the NP with the forehead; G' (soft tissue glabella), N' (soft tissue nasion), Prn (pronasale),Cm (columella), Sn (subnasale), Ls (labrale superius), Li (labrale inferius), Sm (supramentale), Pog' (soft tissue pogonion, Me' (soft tissue menton) and Th (throat)**

To construct the same 10 angular measurements using the tangent line method, tangential lines were drawn on the contour of the soft tissue profile according to the method of McNamara, et al., Figure 2 [8].

- Forehead tangent

- Nose dorsum tangent
- Inferior contour tangent of the nose
- Upper lip tangent
- Lower lip tangent
- Anterior contour tangent of the chin
- Inferior contour tangent of the chin

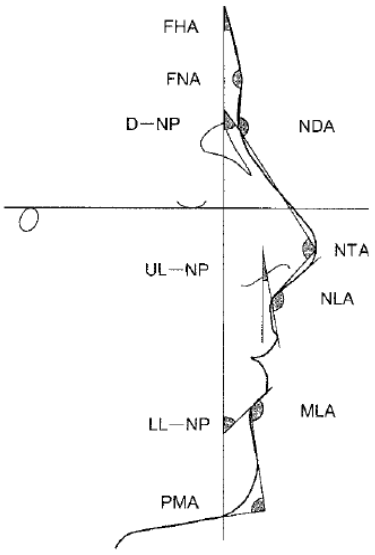


**Figure 2 Angular measurements for the facial form used in this study. FHA (forehead angle) indicates NP-OG'; FNA (frontonasal angle), O-G'-N'; NDA (nasal depth angle), G'-N'-Prn; D-NP (dorsum-NP angle), N'Prn-NP; NTA (nasal tip angle), N'-Prn-Sn; NLA (nasolabial angle), Cm-Sn-Ls; UL-NP (upper lip-NP angle), SnLs-NP; LL-NP (lower lip-NP angle), LiSm-NP; MLA (mentolabial angle): Li-Sm- Pog'; and PMA (pogonion-menton angle), SmPog'-ThMe'**

Each true lateral cephalometric radiograph was analyzed by AutoCAD computer program, and the 10 angular measurements were computed in each tracing. To assess intraobserver reproducibility, 3 orthodontists examiners would construct each drawing analysis using the anatomic point method and tangent line method, the orthodontic examiners were:

- S: Referred to the first orthodontist examiner Dr. Shahbaa
- I: Referred to the second orthodontist examiner Dr. Israa
- H: Referred to the third orthodontist examiner Dr. Hiba

The measurements obtained by the 3 examiners have been used to assess intracalibration and intercalibration reproducibility. The means of the difference between the first, second and third measurements were calculated for both methods, and the intra-class correlation coefficient was used to assess intracalibration and intercalibration reproducibility.

## RESULTS

Table 1 shows the means and standard deviation of the angular measurements obtained by anatomic point method and the tangent line method for each examiner. All the variables showed non-significant differences between the 2 analysis methods for each examiner.

**Table 1 Descriptive and statistical test intracalibration of angles among examiners**

| Angles | Statistics | Pair 1 | | Pair 2 | | Pair 3 | |
|---|---|---|---|---|---|---|---|
| | | SA | ST | IA | IT | HA | HT |
| ANB | Mean | 3.00[a] | 3.00[a] | 3.00[a] | 3.00[a] | 3.00[a] | 3.00[a] |
| | SD | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 |
| FHA | Mean | 14.23 | 10.83 | 13.83 | 11.67 | 13.83 | 11.67 |
| | SD | 2.39 | 3.67 | 2.93 | 5.13 | 2.93 | 5.13 |
| | Paired t test | 4.818 | | 3.629 | | 3.629 | |
| | Adj. p-value | 0.000 | | 0.000 | | 0.003 | |
| FNA | Mean | 146.07 | 145.87 | 146.57 | 146.03 | 146.87 | 146 |
| | SD | 16.86 | 15.35 | 17.85 | 12.08 | 18.04 | 12.3 |
| | Paired t test | 0.052 | | 0.149 | | 0.237 | |
| | Adj. p-value | 1.000 | | 1.000 | | 1.000 | |
| NDA | Mean | 133.80 | 124.87 | 133.47 | 124.60 | 133.73 | 124.77 |
| | SD | 8.41 | 10.04 | 8.31 | 10.39 | 8.12 | 10.41 |
| | Paired t test | 7.945 | | 8.112 | | 7.569 | |
| | Adj. p-value | 0.000 | | 0.000 | | 0.000 | |
| DNP | Mean | 31.47 | 32.50 | 30.80 | 33.03 | 30.93 | 33.40 |
| | SD | 5.58 | 5.81 | 4.81 | 5.6 | 4.88 | 5.49 |
| | Paired t test | 0.759 | | 4.531 | | 4.911 | |
| | Adj. p-value | 1.000 | | 0.000 | | 0.000 | |
| NLA | Mean | 105.3 | 76.4 | 104.47 | 76.3 | 104.83 | 76.83 |
| | SD | 11.47 | 8.83 | 11.54 | 9.88 | 11.46 | 10.06 |
| | Paired t test | 12.033 | | 19.420 | | 18.828 | |
| | Adj. p-value | 0.000 | | 0.000 | | 0.000 | |
| ULNP | Mean | 9.43 | 26.07 | 7.67 | 25.67 | 7.73 | 26.33 |
| | SD | 3.65 | 9.59 | 5.53 | 10.17 | 5.64 | 8.74 |
| | Paired t test | 9.419 | | 9.121 | | 11.334 | |
| | Adj. p-value | 0.000 | | 0.000 | | 0.000 | |
| ILNP | Mean | 44.70 | 64.60 | 47.73 | 64.00 | 47.60 | 64.47 |
| | SD | 5.66 | 15.29 | 12.2 | 16.98 | 11.83 | 16.49 |
| | Paired t test | 7.410 | | 11.720 | | 12.317 | |
| | Adj. p-value | 0.000 | | 0.000 | | 0.000 | |
| MLA | Mean | 118.13 | 109.13 | 121.77 | 109.17 | 121.90 | 109.50 |
| | SD | 10.69 | 14.98 | 13.25 | 15.71 | 13.61 | 15.88 |
| | Paired t test | 3.850 | | 8.831 | | 8.111 | |
| | Adj. p-value | 0.003 | | 0.000 | | 0.000 | |
| PMA | Mean | 86.57 | 89.43 | 85.57 | 89.87 | 85.83 | 90.20 |
| | SD | 8.17 | 11.44 | 10.08 | 11.05 | 10.12 | 11.01 |
| | Paired t test | 1.565 | | 4.807 | | 5.219 | |
| | Adj. p-value | 0.384 | | 0.000 | | 0.000 | |

Tables 2 and 3 showed that the intra-class correlation coefficient (ICC) demonstrated an excellent intracalibration and intercalibration agreement of the angles measured by anatomic point method and tangent line method of the soft tissue profile analysis among the 3 examiners.

**Table 2 Descriptive and statistical test of intercalibration of angles (anatomical view) among examiners**

| Angles | Statistics | Examiners | | | ICC | F | p-value |
|---|---|---|---|---|---|---|---|
| | | IS | Hi | SA | | | |
| ANB | Mean | 3.00 | 3.00 | 3.00 | - | 1.000 | - |
| | SD | 0.83 | 0.83 | 0.83 | | | |
| FHA | Mean | 13.83 | 13.83 | 14.23 | 0.959 | 24.398 | 0.000 |
| | SD | 2.93 | 2.93 | 2.39 | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| FNA | Mean | 146.57 | 146.87 | 146.07 | 0.994 | 164.417 | 0.000 |
| | SD | 17.85 | 18.04 | 16.86 | | | |
| NDA | Mean | 133.47 | 133.73 | 133.80 | 0.989 | 86.958 | 0.000 |
| | SD | 8.31 | 8.12 | 8.41 | | | |
| DNP | Mean | 30.8 | 30.93 | 31.47 | 0.985 | 65.444 | 0.000 |
| | SD | 4.81 | 4.88 | 5.58 | | | |
| NLA | Mean | 104.47 | 104.83 | 105.30 | 0.959 | 24.253 | 0.000 |
| | SD | 11.54 | 11.46 | 11.47 | | | |
| ULNP | Mean | 7.67 | 7.73 | 9.43 | 0.788 | 4.717 | 0.000 |
| | SD | 5.53 | 5.64 | 3.65 | | | |
| ILNP | Mean | 47.73 | 47.60 | 44.70 | 0.860 | 7.144 | 0.000 |
| | SD | 12.20 | 11.83 | 5.66 | | | |
| MLA | Mean | 121.77 | 121.90 | 118.13 | 0.932 | 14.600 | 0.000 |
| | SD | 13.25 | 13.61 | 10.69 | | | |
| PMA | Mean | 85.57 | 85.83 | 86.57 | 0.901 | 10.064 | 0.000 |
| | SD | 10.08 | 10.12 | 8.17 | | | |

**Table 3 Descriptive and statistical test of intercalibration of angles (tangent view) among examiners**

| Angles | Statistics | Examiners | | | ICC | F | p-value |
|---|---|---|---|---|---|---|---|
| | | IS | Hi | SA | | | |
| ANB | Mean | 3.00 | 3.00 | 3.00 | 1.000 | - | - |
| | SD | 0.83 | 0.83 | 0.83 | | | |
| FHA | Mean | 11.67 | 11.67 | 10.83 | 0.895 | 9.489 | 0.000 |
| | SD | 5.13 | 5.13 | 3.67 | | | |
| FNA | Mean | 146.03 | 146.00 | 145.87 | 0.867 | 7.496 | 0.000 |
| | SD | 12.08 | 12.3 | 15.35 | | | |
| NDA | Mean | 124.6 | 124.77 | 124.87 | 0.997 | 317.569 | 0.000 |
| | SD | 10.39 | 10.41 | 10.04 | | | |
| DNP | Mean | 33.03 | 33.4 | 32.5 | 0.948 | 3.971 | 0.000 |
| | SD | 5.60 | 5.49 | 5.81 | | | |
| NLA | Mean | 76.30 | 76.83 | 76.40 | 0.805 | 5.120 | 0.000 |
| | SD | 9.88 | 10.06 | 8.83 | | | |
| ULNP | Mean | 25.67 | 26.33 | 26.07 | 0.971 | 34.731 | 0.000 |
| | SD | 10.17 | 8.74 | 9.59 | | | |
| ILNP | Mean | 64.00 | 64.47 | 64.60 | 0.900 | 10.046 | 0.000 |
| | SD | 16.98 | 16.49 | 15.29 | | | |
| MLA | Mean | 109.17 | 109.50 | 109.13 | 0.892 | 9.295 | 0.000 |
| | SD | 15.71 | 15.88 | 14.98 | | | |
| PMA | Mean | 89.87 | 90.2 | 89.43 | 0.985 | 66.580 | 0.000 |
| | SD | 11.05 | 11.01 | 11.44 | | | |

## DISCUSSION

Soft tissue profile analysis was considered as a reliable radiographic instrument aids in orthodontic diagnosis and treatment planning and it is of great importance in assessing the facial easthetic and determining the stability and success of orthodontic treatment results [13-18].

However, an accurate analysis of the soft tissue profile on the lateral cephalometric radiograph is a complicated task, because the soft tissue profile is composed of multiple curved lines that should be converted into straight lines which is less consistent and reproducible [10,19]. Those lines can be drawn in several methods, including anatomic point method by simply connecting the landmarks identified along the soft tissue profile contour, and by drawing straight lines tangent to the curved soft tissue profile surfaces.

This study compared the reliability of the 2 analysis methods, the results showed an excellent intracalibration reproducibility of all angular measurements obtained by anatomic point method and tangent line methods among the 3 orthodontist examiners. Also the intra class correlation coefficient (ICC), showed an excellent agreement of all

angular measurements obtained by the tangent line method and those obtained by anatomic point method among the 3 orthodontic measurements, these findings disagree with the findings of Grag and Hwang, et al., who demonstrated higher interobserver reproducibility of anatomic point method than tangent line method [10,19]. And agree with Giri, et al., who found an excellent reproducibility of both anatomic point method and tangent line method in nasolabial angle construction and measurement of soft tissue profile analysis. However, the disagreement and discrepancy of results with that of Grag and Hwang, et al., may be attributed to the drawing method of constructing the straight lines used by the examiners in terms of their precise direction and inclination, due to their skill, expertise and familiarity with the tangent line method that gives nearly the same angular measurements obtained by anatomic point method among the 3 examiners or may be due to the large sample size used in this study compared with small sample size of only 40 samples used in Grags study and Hwang, et al., study [10,19,20].

## CONCLUSION

This study concluded that the tangent line method is as reliable as the anatomic point method and both of them could be used in cephalometric soft tissue analysis.

## DECLARATIONS

### Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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