

# Assessment of soft profile characteristics in Amazonian youngsters with normal occlusion

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## Abstract

**Objective:** The present study aimed to determine from a sample of Amazonian youngsters, with normal occlusion, the mean values for soft profile characteristics using cephalometric radiographs obtained in lateral norm. **Methods:** The cephalometric radiographs of the 30 youngsters, being 15 males and 15 females, with mean age of 21.6 years old, were assessed. For statistical analysis, central tendencies and dispersion measurements (mean and standard deviation) were used and, for both the comparison of the mean values of males and females and the correlations between the measurements of the soft profile and bony profile, the unpaired Student's t-test was applied. **Results and Conclusion:** After obtaining statistical data, parameters were set based on the cephalometric norms regarding the specialized literature, revealing that all variables presented a normal distribution pattern. There was sexual dimorphism for the following measurements: ANB, NAP, ANS-Me, N-ANS, Sn'-Me', and N'-SN'. Norms were determined for all the assessed measurements. Statistical differences were observed between the norm found in the present study and those found in the specialized literature.

**Keywords:** Soft profile. Normal occlusion. Amazonians.

## INTRODUCTION

Using information extracted from anamnesis, facial analysis, clinical examination of the oral cavity, dental casts and radiographic exams, most importantly the cephalometric radiograph, diagnostic and treatment plan accuracy is enhanced, allowing professionals to set the ideal goals for a given orthodontic condition.

Facial morphology could be evaluated using subjective facial analysis, which might prove sufficient to determine parameters without the need for numerical values.<sup>4</sup> However, not always a good facial balance means excellent occlusion following some numerical parameters of normality.

Major contributions have been proposed over the years in the field of cephalometric analysis

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assisting on the diagnosing and setting numerical values aimed at achieving pleasant aesthetic results.<sup>12,15,17,21,24,25,29</sup>

Most authors understand and respect the relevance of cephalometric analysis in the literature, however they question the use of a set of values disregarding facial variations, ethnic background, cultural aspects, and especially the individual preferences of patients.<sup>9,10,16,18,31</sup>

Facial pattern outcome may fall short of what is desirable if the approach is based only on mean dental and skeletal values obtained from cephalometric analyses without performing a comprehensive facial examination, in which dental and skeletal measurements do not always match the soft tissue parameters.<sup>3</sup>

Given the growing importance of orthodontic diagnosis and the need to set unique standards of normality for each population, the present research aimed to study the characteristics of a sample of Brazil's Amazonas State youths<sup>23</sup> from a lateral cephalometric standpoint by evaluating the values found in this investigation and correlating them with the sagittal occlusal relationship as traditionally defined in mainstream literature.<sup>2</sup>

## OBJECTIVE

Based on the cephalometric assessment of the craniofacial patterns of Brazilians adolescent, from the Amazon State, with normal occlusion, the study sought to examine the following variables:

1. The soft tissue characteristics regarding the standards recommended in the literature.
2. Whether there are correlations regarding some soft tissue measures.
3. Whether there is sexual dimorphism.

## MATERIAL AND METHODS

### Sample

The sample comprised 30 subjects: 15 males and 15 females, all Caucasian, from the Brazilian State of Amazonas, whose parents and

grandparents hailed from the same Brazilian state. They were all students enrolled at UFAM (Federal University of Amazonas) with permanent dentition, normal occlusion<sup>2</sup> and no history of orthodontic treatment. The mean age was 21 years and 6 months, ranging from 17 years and 2 months to 26 years. The sample was selected from young people living in the Amazonas' capital city, Manaus.

## Methods

Lateral radiographs were obtained of each patient as well as a panoramic radiograph, intra- and extraoral photographs and a pair of dental casts.

### Radiographic method

Lateral radiographs were obtained at the Center for Dental Radiology Ltda (RADIOCENTER), Manaus (AM) using an Orthotalix X-ray equipment, model 9200, manufactured by Dentsply, attached to a cephalostat, set at 70 kVp, 10 mA and time exposure of 1.2 seconds. The lateral radiographs with true vertical plane were obtained according to the following protocol:

1. Each patient was placed in the cephalostat in a standing position, their body relaxed, looking at the image of their own eyes reflected in a 29 x 34 cm mirror fixed in front of them at a distance of 1.55 m. This mirror was previously set according to their height as they stood with their feet parallel to each other and slightly apart, and teeth in maximum intercuspation (MI).
2. Then the ear-rods were smoothly inserted and positioned at the entrance to the external auditory canals, taking care not to change the head position set in step 1.
3. A thin metal chain with a pendulum weighing 25 g was hung over the edge in front of the patient's nose (1 to 3 cm), serving as a vertical plumb line, perpendicular to the horizontal plane due to gravitational force.

4. The chassis position was adjusted in both the vertical and horizontal planes. The chassis cartridge was moved so that it lightly touched the patient's right shoulder without changing his posture.
5. The radiograph was then obtained.

#### Obtaining the cephalogram

The cephalograms were obtained using tracing paper placed on top of the radiographs. The tracings were performed using 0.5 mm black lead.

#### Anatomical drawing

The following anatomical cranial structures<sup>32</sup> were traced. The point where the ear-rods were positioned was replaced by the porion anatomical landmark when the shadows of the right and left points did not match.

- » Glabella and nasal bones profile;
- » Soft tissue profile;
- » Sella turcica;
- » Maxilla;
- » Mandible, including the condyle;
- » Maxillary and mandibular central incisors;
- » Maxillary and mandibular first molars.

#### Cephalometric measures

##### Angular hard tissue measures

» **ANB** – Angle formed by the intersection of NA (Nasion–point A) and NB (Nasion–point B) lines.<sup>26</sup>

» **NAP** – Depicts the bony profile through the use of the points nasion, A and pogonion (N-A and Pg).<sup>11</sup>

» **I.NA** – Describes upper incisor inclination in relation to the maxilla.<sup>30</sup>

» **I.NB** – Describes lower incisor inclination in relation to the mandible.<sup>30</sup>

##### Linear hard tissue measures

» **I-NA** – Describes the protrusion or retrusion of maxillary incisors.<sup>30</sup>

» **I-NB** – Describes the protrusion or retrusion of mandibular incisors.<sup>30</sup>

» **ANS-Me (ALFH)** – Describes the anterior lower facial height through the distance between the anterior nasal spine (ANS) and the menton (Me).<sup>20</sup>

» **N-ANS** – Distance between the nasion and anterior nasal spine skeletal points; depicts the length of the midface.

» **Overjet** – Greater dental overlap in the horizontal direction, measured from the most anterior point of the labial surface of lower incisors, parallel to the occlusal plane.

» **Overbite** – Greater dental distance in the vertical plane between the incisal edge of the upper incisors and the incisal edge of the lower incisors.

##### Angular soft tissue measures

» **ANB angle in soft tissue** =  $a'n'/n'b'$  – Characterizes the facial discrepancy between maxilla and mandible, as measured through upper and lower lip inclination.

» **Angle of the chin/neck line** =  $sn'/gn'-gn'/c'$  – Characterizes the angle of the lower face.

» **Angle of facial convexity** =  $g'/sn'/pg'$  – Characterizes the kind of soft tissue profile.

» **Labionasal angle** =  $cm'/sn'/Ls'$  – Characterized by upper lip inclination and/or size of nasal prominence.

» **Labiomental angle** =  $Li'/Lm'/pg'$  – Characterized by lower lip inclination and/or mandibular prognathism or retrognathism.

##### Soft tissue linear measures

» **n-subnasale** – Linear length from the soft tissue nasion point to the subnasale angle.

» **Subnasale-me'(ALFH')** – Soft tissue anterior lower facial height.

#### STATISTICAL METHOD

In assessing the data for all cephalometric measures, the central tendency and dispersion measurements were obtained (mean and standard deviation) and for comparing mean values between male and female subjects and correlating soft tissue and hard tissue measures, Student's unpaired t-test was applied.

It was also checked whether or not the sample measurements corroborated the values reported in the literature. In cases of sexual dimorphism verification was performed separately in male and female subjects. However, where dimorphism was not present the comparison was performed using the entire sample, with no gender differentiation.

Subsequently, the correlation between the hard tissue measures was assessed using Pearson's<sup>6</sup> correlation and other tests to verify if this correlation was different from zero.

## RESULTS

After the cephalometric tracings were performed

TABLE 1 - Central tendency and dispersion measures. t-test and significance. Variables compared between males and females.

Variables	Gender	Mean	Standard Deviation	t	p-value	Significance																																																																																																																																																		
ANB	Female	3.23	1.25	3.99	0.04%	**																																																																																																																																																		
	Male	1.53	1.08				NAP	Female	4.00	3.57	2.95	0.63%	**	Male	1.13	1.19	1.NA	Female	26.50	4.30	-0.99	33.00%	ns	Male	28.20	5.10	1.NB	Female	27.13	6.25	1.91	6.60%	ns	Male	23.17	5.04	1-NA	Female	5.57	1.80	0.20	7.70%	ns	Male	6.60	2.28	1-NB	Female	7.00	2.37	0.17	20.40%	ns	Male	5.73	2.50	ANS-Me	Female	69.40	5.21	-2.88	0.76%	**	Male	74.80	5.06	N-ANS	Female	54.03	4.53	-2.78	0.96%	**	Male	58.53	4.34	ANB'	Female	7.63	1.64	-0.11	91.00%	ns	Male	7.70	1.57	G'/Sn'/Pg'	Female	12.57	3.48	0.41	68.00%	ns	Male	11.93	4.85	ÂNL	Female	100.17	13.76	-0.97	34.00%	ns	Male	104.97	13.27	ÂLM	Female	120.40	13.03	-1.24	23.00%	ns	Male	125.50	9.21	Sn'-Me	Female	72.33	3.94	-3.57	0.13%	**	Male	79.80	7.08	N'-SN'	Female	55.57	4.85	-3.07	0.47%	**	Male	60.13	3.12	Overjet	Female	2.60	1.20	0.24	81.00%	ns	Male	2.50	1.07	Overbite	Female	2.40	0.89	-0.71	48.00%
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ns= nonsignificant; \* = significant at  $p \geq 1\%$ ; \*\* significant at  $p < 1\%$ .

and the measurements obtained, Table 1 was formulated to depict the means, standard deviations and Student's t-test with their respective significance, aiming to verify similarities of means between genders. Table 2 presents the means, standard deviations, and t-test results with their respective significance used to assess the similarities of means between the values found by

the present study, for males and females, and those found in the literature after comparing the means between the two groups (male and female). Correlations between cephalometric and soft tissue examinations are shown in Table 3. Figures 1 to 12 present the measures for which correlations were assessed, showing significance in Figs 6, 8, 9, 11 and 12.

TABLE 2 - Central tendency and dispersion measures. t-test and significance. Variables compared between male and female with the means reported in the literature.

Variables	Gender	Observed means	Authors' values	t	p-value	Significance
ANB	Female	3.23	2.00	3.82	0.19%	**
	Male	1.53	2.00	-1.68	12.00%	ns
NAP	Female	4.00	0.00	4.34	0.07%	**
	Male	1.13	0.00	3.70	0.24%	**
1-NA	Female	27.35	22.00	6.22	0.00%	**
	Male					
1-NB	Female	25.15	25.00	0.14	89.0%	ns
	Male					
1-NA	Female	6.08	4.00	7.01	9.76%	ns
	Male					
1-NB	Female	6.36	4.00	2.31	11.32%	ns
	Male					
ANS-Me	Female	69.40	74.00	-3.42	0.41%	**
	Male	74.80	74.00	0.61	55.00%	ns
N-ANS	Female	54.03	53.70	0.29	78.00%	ns
	Male	58.53	53.70	4.31	0.07%	**
ANB'	Female	7.67	5.30	8.22	0.00%	**
	Male					
G'/Sn'/Pg'	Female	12.25	12.00	0.33	74.00%	ns
	Male					
ÂNL	Female	102.57	110.00	-3.02	0.53%	**
	Male					
ÂLM	Female	122.95	124.00	-0.51	62.00%	ns
	Male					
Sn'-Me	Female	72.33	72.50	-0.16	87.00%	ns
	Male	79.80	72.50	3.99	0.13%	**
N'-SN'	Female	55.57	57.80	1.78	9.60%	ns
	Male	60.13	57.80	2.90	1.20%	*
Overjet	Female	2.55	2.50	0.25	81.00%	ns
	Male					
Overbite	Female	2.53	2.50	0.18	86.00%	ns
	Male					

ns= nonsignificant; \* = significant at  $p \geq 1\%$ ; \*\* significant at  $p < 1\%$ .

TABLE 3 - Correlations and significance between soft tissue and hard tissue variables.

Variables	Correlation	p-value	Significance
ANB x ANB'	0.393	3.20%	*
NAP x G'/Sn'/Pg'	0.178	34.70%	ns
$\underline{1.NA} \times \hat{A}NL$	0.027	88.80%	ns
$1.NB \times \hat{A}LM$	0.005	97.70%	ns
ANS-Me x Sn'-Me'	0.748	0.00%	**
N-ANS x N'-SN'	0.614	0.00%	**
Overbite x $\underline{1.NA}$	0.034	86.10%	ns
Overbite x 1.NB	-0.458	1.10%	*
Overjet x $\underline{1.NA}$	-0.110	56.30%	ns
Overjet x 1.NB	-0.505	0.40%	**
$\underline{1.NA} \times \hat{A}NL$	-0.328	7.70%	ns
$1.NB \times \hat{A}LM$	0.239	20.40%	ns

ns= nonsignificant; \* = significant at  $p \geq 1\%$ ; \*\* significant at  $p < 1\%$ .

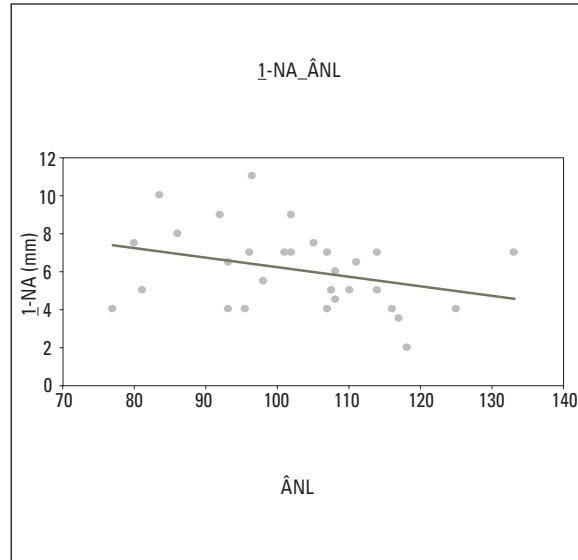


FIGURE 1 - Correlation between  $\hat{A}NL$  and  $\underline{1.NA}$  (mm).

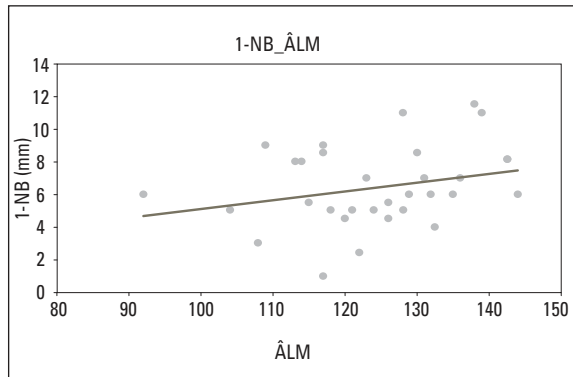


FIGURE 2 - Correlation between  $\hat{A}LM$  and 1-NB (mm).

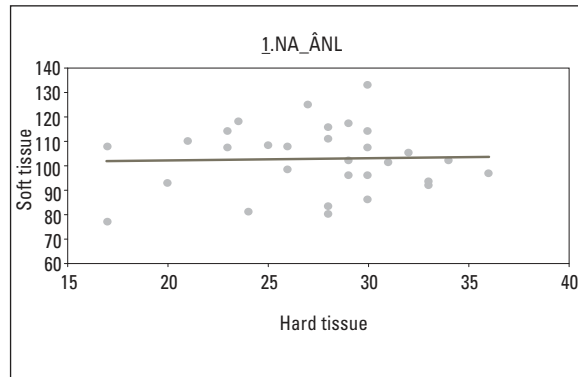


FIGURE 3 - Correlation between  $\underline{1.NA}$  and  $\hat{A}NL$ .

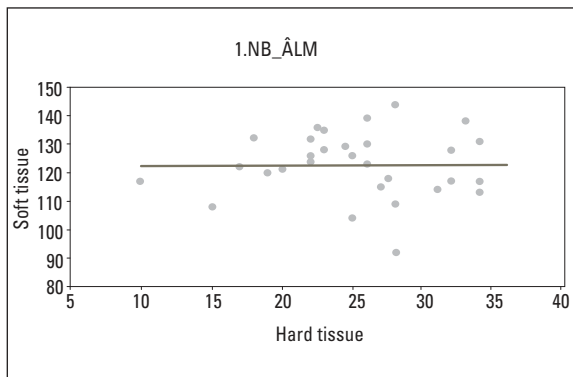


FIGURE 4 - Correlation between 1.NB and  $\hat{A}LM$ .

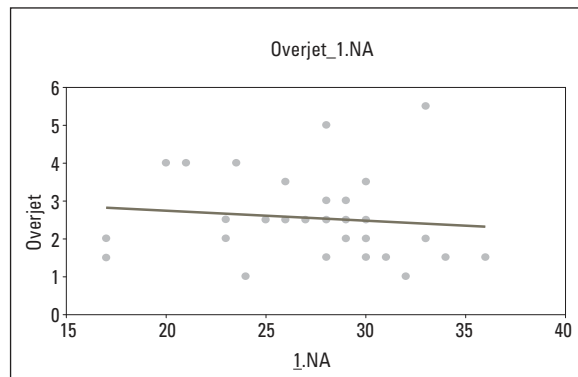


FIGURE 5 - Correlation between overjet and  $\underline{1.NA}$ .

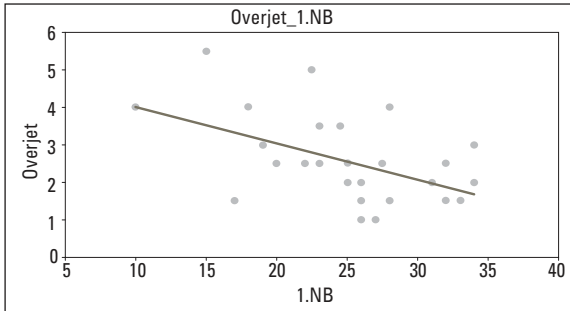


FIGURE 6 - Correlation between overjet and 1.NB.

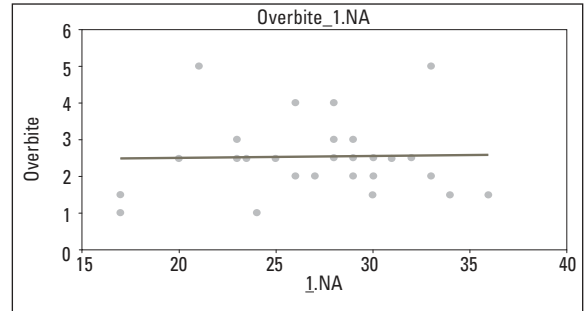


FIGURE 7 - Correlation between overbite and 1.NA.

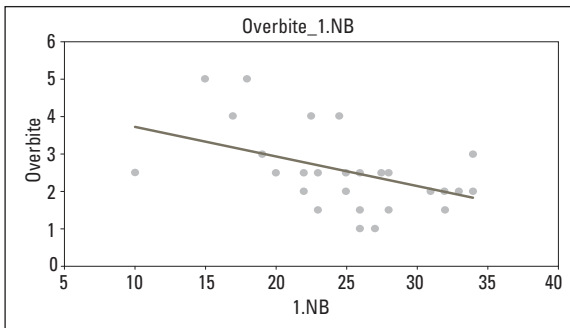


FIGURE 8 - Correlation between overbite and 1.NB.

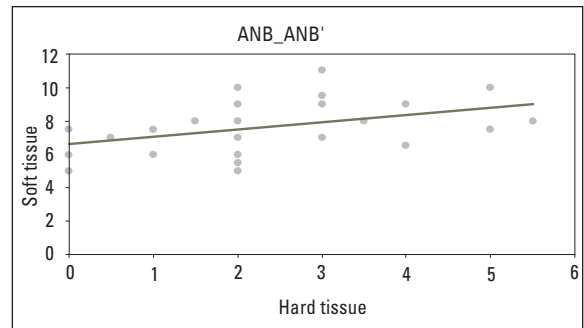


FIGURE 9 - Correlation between ANB and ANB'.

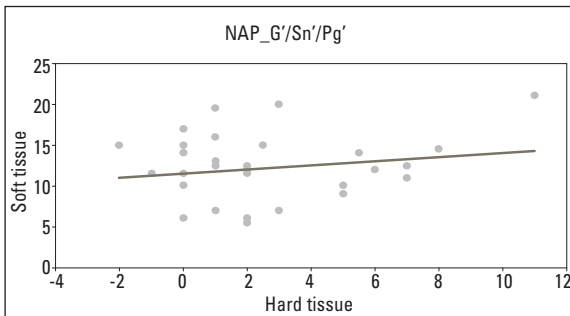


FIGURE 10 - Correlation between NAP and G'/Sn'/Pg'.

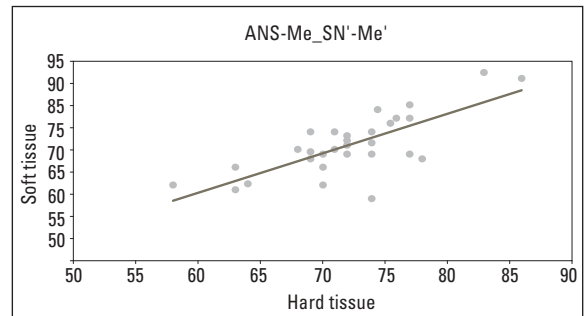


FIGURE 11 - Correlation between ANS-Me and SN'-Me'.

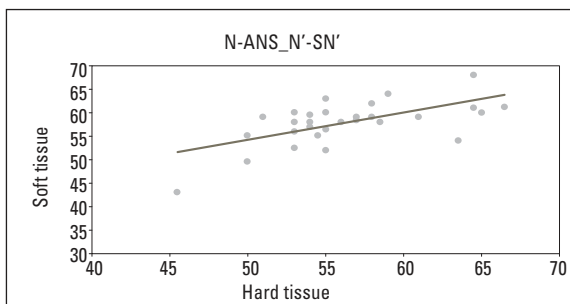


FIGURE 12 - Correlation between N-ANS and N'-SN'.

## DISCUSSION

### ANB

The mean and standard deviation of angle ANB were  $3.23 \pm 1.25^\circ$  for females and  $1.53 \pm 1.08^\circ$  for males (Table 1), with significant differences between the genders. Significant statistical differences were also found when comparing the male and female groups using the values reported in the literature (Table 2),

which was indicative of greater convexity in young Amazonian youths.<sup>1,7,14,19,22,30</sup>

Sexual dimorphism was found in the female group, who exhibited a mean value of 3.23.<sup>23</sup>

#### NAP

The mean and standard deviation of NAP angle were  $4\pm 3.5^\circ$  for females and  $1.13\pm 1.8^\circ$  for males (Table 2), which showed statistically significant differences, indicating sexual dimorphism with greater convexity in females. On the other hand, the mean value of  $2.57^\circ$  found for the whole sample showed no significant difference when compared with literature values. However, the values detected in Caucasians, i.e.,  $1.6^\circ$  (adults) and  $4.2^\circ$  (children), point to lower convexity than in Amazonians, while regional studies have found  $9.8^\circ$ , suggesting greater convexity in this ethnic group.<sup>11,22,23,26</sup>

It is known that the NAP angle varies in the different ethnic groups and this fact should be considered when diagnosing and planning treatment.<sup>23</sup>

#### 1.NA

The mean and standard deviation for 1.NA angle were  $27.35\pm 4.7^\circ$  (Table 2). Statistically significant differences were found in the dentofacial pattern between the axial inclination in the upper central incisors and the NA line, indicating a more anterior dental inclination in Amazonian patients when compared with the values found in the literature.<sup>22</sup>

#### 1.NB

A value of  $25.25^\circ$  (Table 2) was found in the Amazonian sample, indicating more proclined lower incisors.<sup>1,7,19,23,30</sup>

#### 1-NA

The mean and standard deviation for the maxillary central incisor distance were  $6.08\pm 2.04$  mm (Table 2). No statistically significant differences were found, however a tendency of greater pro-

clination was observed in Amazonians' maxillary central incisors when compared to the values reported in the literature.<sup>30</sup>

#### 1-NB

The mean found for the Amazonians was 6.36mm. This finding indicates that this group's protrusion is higher than the values reported in the literature.<sup>1,7,19,23</sup>

#### ANS-Me

It seems reasonable to accept as desirable the mean value obtained for this measure (72.8mm) when comparing the two groups (male and female). However, in separating the groups there were no statistically significant differences in males, but there were statistical differences in the female group.<sup>20</sup>

#### Nasolabial angle

The mean and standard deviation of the nasolabial angle were  $102.57\pm 13.5^\circ$  (Table 2), showing significant difference for this variable in comparison to mean values found in the literature.<sup>3,13,28</sup>

There was no significant difference between genders for this variable (Table 1).

#### Labiomental angle

The mean and standard deviations found for this angle were  $122.95\pm 11.12^\circ$  (Table 2), ranging between  $110^\circ$  and  $152^\circ$ . The mean values and standard deviations observed for males and females were respectively  $120.4\pm 13.03^\circ$  and  $125.5\pm 9.21^\circ$  (Table 1) and when these values were statistically compared to the values described in the literature, no difference was found.<sup>27,33</sup>

#### Facial convexity angle

The mean and standard deviation observed in this sample were  $12.25\pm 4.16^\circ$  (Table 2). The values of this angle for females ( $12.57\pm 3.48^\circ$ ) and males ( $11.93\pm 4.85^\circ$ ) were not statistically different (Table 1).



Based on what has hitherto been described, it can be seen that there is reasonable consistency between exams. This was predictable and supports the key objective of this investigation, which is precisely to determine how and when these measures correlate.<sup>7,17</sup>

The results showed no significance for the following measures:  $\perp$ -NA X  $\hat{A}$ NL; 1-NB X  $\hat{A}$ LM;  $\perp$ .NA X  $\hat{A}$ NL; 1.NB X ALM; Overjet X  $\perp$ .NA; Overbite X  $\perp$ .NA; NAP X G'/Sn'/Pg'.

Moderate correlation was found for angles ANB X ANB' ( $r=0.39$ ), significant at 3.20%, in a direct relationship, i.e., the greater the hard tissue ANB angle, the greater the soft tissue ANB' angle, showing that skeletal discrepancy strongly reflects facial morphology.

Moderate correlation was also found for measures Overbite X 1.NB ( $r=-0.45$ ), significant at 1.1%, in an inverse relationship, i.e., the greater the overbite, the smaller the 1.NB angle.

High correlations were found for the following measures:

» ANS-Me X Sn'-Me' ( $r=0.74$ ), significant at 0%, in a direct relationship, i.e., the greater the anterior lower facial height measured in the hard tissue, the greater the soft tissue measure of the anterior lower facial height.

» N-ANS X N'-SN' ( $r=0.61$ ), significant at 0%, in a direct relationship, i.e., the greater the anterior midfacial height measured in the hard tissue, the greater the anterior midfacial height measured in the soft tissue of the radiographic image.

» Overjet X 1.NB ( $r=0.5$ ), significant at 0.4%, in a direct relationship, i.e., the greater the overjet, the greater the 1.NB angle measured in the teeth and hard tissue respectively.

In checking the correlation between skeletal and soft tissue values for the measures described in Table 3, it was observed that skeletal and facial convexity NAP X G'/Sn'/Pg' ( $r=0.17$ ) showed no correlation, probably because the NAP angle is measured by its supplement, i.e., measured using the AP line's superior elongation, which helps to

define the degree of convexity, and/or due to the facial convexity angle reading, which is measured inferiorly, justifying the lack of correlation owing to the tendency toward mandibular retrusion that characterizes the Amazonian sample.

At first it was expected that a correlation between the values for inclination and protrusion of upper incisors and the nasolabial angle  $\perp$ .NA X ANL ( $r=0.02$ ) and  $\perp$ -NA X  $\hat{A}$ NL ( $r=-0.32$ ) would be found, which did not occur. This was probably caused by the fact that the composition of the  $\hat{A}$ NL angle is dependent on the shape of the nose, which, in fact, means that one may on occasion find significant incisor inclination, and given the nose shape, the measurements of the nasolabial angle may vary, i.e., even in the presence of different tooth inclinations one can still find the same nasolabial angle, since the latter holds no significant correlation with the upper incisors and, by inference, must exhibit high dependence on the position and shape of the base of the nose (columella).

The linear distances from the skeletal nasion to the anterior nasal spine and from the soft tissue nasion to the subnasale (middle third), as well as from the skeletal anterior nasal spine to the menton and from the subnasale to the soft tissue menton (lower third), all measured with cephalometry, showed statistically significant correlations of 0.01% N-ANS X N'-SN' ( $r=0.6$ ) and ANS-Me X Sn'-Me' ( $r=0.74$ ), precisely because the two measurement methods have similar designs.

Probably the best test for orthodontic diagnosis is subjective facial analysis. However, further research is necessary, acquiring practice and experience, as well as clinical judgment to define balance, harmony, beauty; observing the correlations present in each type of malocclusion, exercising caution and patience to manage the diagnosis and appropriate treatment plan, keeping in mind that distinct facial and aesthetic features are bound to emerge depending on the region in which one lives. Therefore, orthodontics has a vast research

field, that requires further study methods in order to establish an evidence-based orthodontics.

### FINAL CONSIDERATIONS

Several studies have demonstrated the clinical importance of individualizing cephalometric analyses in terms of dental and skeletal patterns of Brazilians and their influence on soft tissue profile. From a genetic standpoint, the mixing of races in Brazil accentuates the difficulty in finding cephalometric measurements capable of epitomizing a "Brazilian pattern." Faced with these efforts to standardize measures, orthodontists should treat each case by taking into account the patient's individual characteristics as well as their own clinical experience in correctly interpreting the data.

Although Brazilians born in the Amazon State, southern Brazil, São Paulo State and São Paulo City share the same nationality, it is understandable that values change from region to region since Brazil is a country with continental dimensions inhabited by a diverse ethnic, cultural and religious population, in contrast to other nations. Therefore, it affords fertile ground for investigations of this nature.

### CONCLUSIONS

In determining the mean values of normality for skeletal, dental and soft tissue cephalometric measures for young Amazonians with normal occlusion and a mean age of 21 years and 5 months, it was concluded that:

1. The facial soft tissue characteristics relative to the values advocated by other authors showed statistical differences in the following cephalometric measures: Angular measures ANB', G'/Sn'/Pg', nasolabial angle, and mentolabial angle; and linear measures Sn'-Me and N'-SN', indicating a more convex profile in young Amazonians.

2. Significant results were observed in the following correlations: ANB X ANB', ANS-Me X Sn'-Me', N-ANS X N'-SN', and Overjet X I.NB. No statistically significant values were found for other correlations.

3. Sexual dimorphism was found in the following cephalometric measures: ANB, NAP, ANS-Me, N-ANS, Sn'-Me and N'-SN', characterizing greater convexity in young Amazonian females compared to males with normal occlusion.

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