Photogrammteric Analysis of Angular Facial Soft Tissue Profile Parameters in Ijaws of Nigeria

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ABSTRACT

The understanding of soft tissues profile of the face for a given population is essential to medical specialty involved in the treatment of the face. It enables treatment plan to be formulated to normalize or enhance facial traits for patients. Thus, the purpose of this study was to determine the soft tissue norms in Ijaw tribe of Nigeria. 1002 (501 males and 501 females) subjects between the ages of 18 to 30 were randomly selected. The criteria for selection include a pleasing and balance facial profile, normal over-jet bite, competent lip, no craniofacial deformities and no history of orthodontic treatment or rhinoplasty. The frontal and lateral view photographs of the face were obtained in the natural head position using standard photogrammetric techniques. Angular soft tissue parameters were then evaluated by using Pro-image facial software p. The average values of nasofrontal angle, nasofacial angle, nasomental angle, nasolabial angle, mentoncervical angle, angle of facial convexity and angle of total facial convexity were 132.46 ±0.33, 32.67 ±0.18, 130.13 ±0.22, 99.57 ±0.65, 94 ±0.46, 166.27 ±0.31 and 144.04 ±0.25 degrees for males and 136.95 ±0.32, 31.24 ±0.16, 133.68 ±0.23, 97.12 ±0.54, 90.77 ±0.35, 168.06 ±0.25, 145.07 ±0.25 degrees for females respectively. The results showed significant ($p<0.05$) gender difference in all measured parameters. The findings of the present study showed that in aesthetic treatment goal for Nigerian subjects it may be useful to take into account ethnic norms.

INTRODUCTION

The face is the anterior aspect of the head from the forehead to the chin and from one ear to the other [1]. It provides identity for individual human. Soft tissues of the face together with the underlying dentoskeletal tissues define the facial traits of a person. Facial traits are major features in physical appearance, which is well correlated to social acceptance, psychological well-being and self-esteem of an individual [2]. Therefore, defects (malformations, scarring, or other alterations from pathology or trauma) have marked consequences beyond physical effects. One primary goal of all medical specialty concerned with the treatment of the face in addition to restoration of function is to attain and preserve optimal attractiveness. This is done by carrying out thorough facial analysis. It has been reported that most treatment plan based on only dentoskeletal analysis of the face has sometimes led to aesthetic problems. As soft tissue covering the bones and teeth can vary so greatly that dentoskeletal pattern may be an inadequate guide in formulating treatment plan [3-5]. Thus, the understanding of soft tissues and their normal ranges is essential in restoring or enhancing facial traits.

Studies on facial soft tissues have been carried out in Caucasians [6-8], North American Caucasians [9], Brazilllian Caucasians [10], Croatians [11], Turkish [12] and Indians [13]. These studies determined the average linear and angular variables that define the soft tissue of the face. In addition, their application in orthodontic, maxillofacial and facial reconstructive surgeries where also enumerated.

Facial soft tissue norms amongst Sub-Sahara African tribes in general and Nigeria to be specific are not readily available. Although craniofacial dimensions have been widely studied in some African tribes [14-18], they focused mainly on dentoskelatal facial patterns rather than soft tissue analysis. It is well established that a single facial aesthetic is not appropriate for application to diverse race and ethnic populations [19-21], as facial traits are largely influenced by factors such as races, ethnic groups, age, sex, culture, etc. [22-23]. In addition, features of different races and ethnic groups are not randomly distributed but appear in geographical cluster [24]. Thus there is need to study the soft tissues of the face in different ethnic groups to establish norms for populations with different ethnic backgrounds.

MATERIALS AND METHODS

Subjects: The cross-sectional study involved 1002 (501 males and 501 females) subjects between 18-30 years. Stratified random sampling method was used to select the volunteers. For the purpose of this study, an individual is considered an Ijaw if the parent and four grandparents are of Ijaw ethnic group. The criteria of selection include a pleasing and balance profile as judged by two persons. In addition, the subjects would have normal overjet bite, competent lip, no craniofacial deformities and no history of orthodontic treatment or rhinoplasty. A brief questionnaire on name, age, ethnicity of parent and grandparents, and history of maxillofacial or orthodontic treatment was administered to the subjects. Written Informed consent was obtained from volunteers after the procedure has been explained to them. The sample size of 1002 individuals was determined by the Neyman Optimum Allocation Procedure.

Photographic Set-Up: The photographic set up and Pro-image software usage as described by Oghenemavwe *et al.* [25]. The photographic setup consist of Model FCL- 9201 photo tripod stand, a scaled graph paper background, Metre rule, Sony DSC-W570 digital camera (16.1 mega pixel, 5X optical zoom and 2.7 inch LCD screen), a mirror and light sources (especially for indoors). The height of the tripod stand supporting the digital camera was adjusted to the ear level of the subject. This adjustment allows the optical axis of the lens to be maintained at a horizontal position during recording. In addition, it confers stability on the camera when the "snap button" is pressed. To capture the photograph in the Natural Head Position (NHP), each subject was asked to relax the lip, place the hands beside the trunk and look at their eyes in a mirror, which was placed between 100 and 120 cm from the subject on the opposite side. The scaled graph sheet, which is place behind the subject as a background was used as a guide to scale all photographic records to life size. Photographs captured at a higher resolution were "resized" to a resolution of 1300 × 760 pixel, which is slightly lower than the computer screen resolution. This will eliminate any indirect effect of the computer screen resolution on the image. This process was carried by using Microsoft office Picture Manager.
The angular parameters measure were

(i) Nasofrontal angle (G-N-Prn): It is formed by drawing a line tangent to the glabella through the nasion that will intersect a line drawn tangent to nasal dorsum.
(ii) Nasofacial angle (G-Pg/N-Nd): It is formed by drawing a vertical line tangent to the forehead at the glabella (G) and tangent to the chin at pogonion (Pg) so that a line drawn along the nasal dorsum (Nd) intersects it
(iii) Nasomental angle (N-Prn-Pg): It is formed by a line drawn from the nasion through the nasal dorsum intersecting a line drawn from the soft tissue chin pogonion at the pronasale

(iv) Mentocervical angle (G-Pg/C-Me): A vertical line tangent to the forehead passing through the glabella and pogonion intersecting a second line tangent to the menton
(v) Angle of total facial convexity (G-Prn-Pg): Thisis the angle formed at the intersection of two lines th are drawn from the glabella to the pronasale and from the pronasale to the gnathat ion
(vi) Angle of facial convexity (G-Sn-Pg): It is the angle formed between the glabella, subnasale and gnathion.
(vii) Nasolabial angle (Cm-Sn-Ls): This is the angle formed at the subnasale by the intersection of the line passing through columellar and another line passing through labial superius oris line.

Reliability of Procedure: All research assistants were adequately trained for 3 weeks on the procedure for taking the photograph. After which a pre-test was conducted for another week. The accuracy of the software tool was tested by carefully taking direct and photographic measurements of 30 volunteers. In addition, the photographs were subjected to manual and computer based analysis. The reproducibility and reliability of the results were tested by Dalhberg's formula [26]. All measurements were taken three times by the same operator and the average was recorded as the final value.

Ethical Considerations: The Ethics Committee of the College of Health Sciences University of Port Harcourt gave ethical clearance for the study. The written consent of the subjects was sought after the purpose of the research was explained to them. To achieve this, a questionnaire was completed either directly by the subject of through the research assistant. Where the subject photographs will be made public to communicate procedure or results, their consent was specially requested in written form.

Exclusion criteria: The under listed subjects were excluded from the study
1   Subjects above the age of 30: These were excluded to minimize the effect of aging on facial proportions
2   Subjects below 18: These were excluded because of developmental changes associated with craniofacial parameters associated with these groups. In addition to this, children were not part of the targeted subjects for this study.

Statistical Analysis: The data obtained were processed by using 2007 Microsoft Excel Data Analysis Programme. Z-test was used for comparison of differences in the mean of males and females at a significant level of 95%. The reproducibility and reliability of the measurements were also analyzed using the Dalhberg's formula [26] that determined the method of error (ME).

RESULTS

The total mean for angular measurements of soft tissue parameters of the face in Ijaws is presented in table 1. The average values of nasofrontal angle, nasofacial angle, nasomental angle, nasolabial angle, mentoncervical angle, angle of facial convexity and angle of total facial convexity were 132.46 ±0.33, 32.67 ±0.18, 130.13 ±0.22, 99.57 ±0.65, 94 ±0.46, 166.27 ±0.31 and 144.04 ±0.25 degrees for males and 136.95 ±0.32, 31.24 ±0.16, 133.68 ±0.23, 97.12 ±0.54, 90.77 ±0.35, 168.06 ±0.25, 145.07 ±0.25 degrees for females respectively. All measured parameters differ significantly ($p < 0.05$) in males and females.

Table 1: Mean, Standard Error of Mean And Comparison of Mean Values of Angular Measurements of Facial Soft Tissue Parameters on Ijaw Subjects by Gender.

Parameters	Sex	Ijaw Mean ±SEM
Nasofrontal	M	132.46 ±0.33*
	F	136.95 ±0.32
Nasofacial	M	32.67 ±0.18*
	F	31.24 ±0.16
Nasomental	M	130.13 ±0.22*
	F	133.68 ±0.23
Nasolabial	M	99.57 ±0.65*
	F	97.12 ±0.54
Mentocervical	M	94 ±0.46*
	F	90.77 ±0.35
Angle of facial convexity	M	166.27 ±0.31*
	F	168.06 ±0.25
Angle of total facial convexity	M	144.04 ±0.25*

Z-test- Significantly different from females ($p < 0.05$)
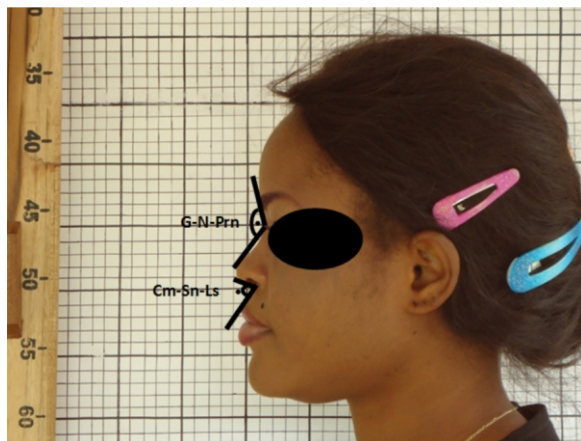

Figure 3.10: INasofrontal angle(G-N-Prn), Nasolabial angle(Cm-Sn-Ls)
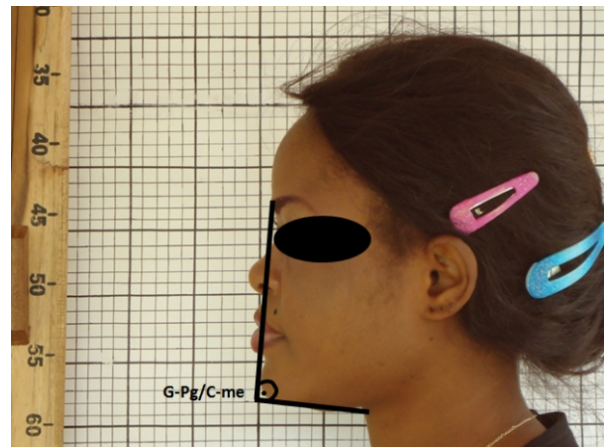
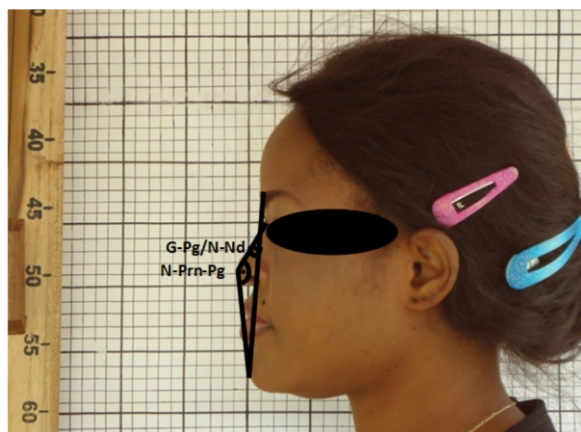**Figure 3.**12: Mentocervical angle (G-Pg/C-Me)

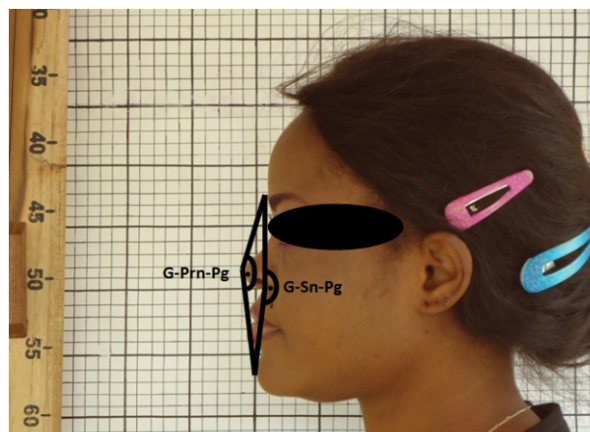**Figure 1:** Nafosofacial angle (G-Pg/N-Nd), Nasomental (N-Prn-Pg)

Figure 2: Angle of total facial convexity (G-Prn-Pg), Angle of facial convexity (G-Sn-Pg)

DISCUSSION

This study has determined the average variables that define the profile of the soft tissue of the face in young adult Ijaws of Nigeria. Soft tissues profile for what constitute a normal face has become a major subject of debate in recent times in facial aesthetics. This is so as reliance on dentoskeletal analysis for treatment planning has sometimes led to aesthetic problems, especially when the outcome of soft tissue is predicted using normal values of hard tissues [3, 27-32]. The soft tissue covering the teeth and bones can vary so greatly that the dentoskeletal pattern may be an inadequate guide in evaluating facial disharmony [33-34]. Thus by knowing the soft tissue trait and their normal ranges, a treatment plan can be designed to normalize the facial traits for a given individual. Allowance can then be made for facial attractiveness while maintaining the familiar and ethnic characteristics that make a person unique. It is desirable to ascertain normal ranges standards based on local data, since they reflect potentially different pattern of facial growth resulting from racial, ethnic, sexual and dietary differences.

The relationship of the nose with the facial plane is a facial parameter of aesthetic importance determined by the nasofacial angle. An average of 35 degrees and 33.26 degrees has been reported for North American Caucasians and Himachalis population of Indian respectively [9,13]. The value obtained in this study is low when compared to the Caucasian samples and it suggests the nose in Nigerians is flatter than those of the Himachalis and North American population. The result further supports the previous studies that Nigerians are platyrrhine [35-37]. Furthermore, while the mean for males and females showed significant gender difference.

The nasomental angle correlates chin, nasal tip and forehead projection and has been reported to have a normal range of 120-132 degrees [38] and it can clearly be obscured if the chin or lip position is in facial disharmony [29]. The average value for the Ijaws falls within this range. However some subjects with a pleasing facial profile recorded value that were below and above this values. Studies by Powell and Humphries [9] and Jain *et al*., [13] established an average value of 126 and 128 degrees respectively. The difference in the mean for male and female subjects was statistically significant (p<0.05) indicating that this parameter is sexually dimorphic in Ijaws.

The relationship between the nasal base and upper lip, analyzed by the nasolabial angle is one of the facial profile parameter with great clinical uncertainty. It is used in diagnosis of anteroposterior maxillary discrepancies; it contributes to the differential diagnosis of skeletal malocclusions, particularly class 11 malocclusion. Burstone [40] defined the nasolabial angle as representative of maxillary inclination, suggesting that when this variable is increased it reflects maxillary retrusion and when decreased, a maxillary protrusion. In the present study, the average value is smaller than those reported for Caucasians. This suggest that Nigerians presents more biprotruded profile and a reduced interincisive angle, which is in agreement with other studies whose authors compared Caucasians and blacks subjects [41-43]. However, some authors have advised that caution should be taken in interpreting this angle due to large variation [8, 11]. Malkoc *et al*. [12] also made the same observation in his study of 100 Turkish between the age of 19-25 where he found that the average value for male and female were 101.09±10.19 and 102.94±10.43 degrees respectively.

The mentocervical angle was significantly more acute in females than in males. This agrees with studies on Spanish and Turkish populations [8, 12]. The average values for male and female subjects were significantly different from the populations earlier mentioned. Sexual dimorphism was found this study.

For facial examination, the angle of facial convexity (AFC) assesses the convexity/concavity of the profile.

AFC has been described in various type of malocclusion [3]. The average value obtain from this investigation differ significantly from those of Spanish, Croatian and Turkish population [8,11]. Yuen and Hiranaka [44] reported an average AFC of 162 ±5 degrees in females and 161 ±6 degrees in males for Asian adolescent sample studied by using photographic records. In a study of 102 Tswanis of South Africa between the age of 15-20 using photogrammetric technique the AFC was 168.31 degrees for males and 171.27 degrees for females [45]. The AFC is more convex in Ijaws and showed sexual dimorphism.

The measurement for total facial angle (TFA) in the current study was 144.02 ±7.41 degrees for males and 143.90 ±9.31 degrees for females. This value differs significantly from those reported in the studies of Caucasian Sample [8, 11, 12], and no sexual dimorphism was found in these studies. The findings of the present study disagree with this.

CONCLUSION

The study has shown that Ijaws of Nigeria have more protrusive features than Caucasians subjects do. There is less nasal depth and projection, less bony chin depth and a smaller nasolabial angle. Thus, the study indicates that soft tissue facial profile values established for Caucasians and Asians cannot be used as guide in rejuvenative or cosmetic procedures in the Ijaw tribe of Nigeria.

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