A cephalometric assessment of the nasolabial angle of an adult Nigerian population

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Abstract

Objective: One of the most important components of orthodontic diagnosis and treatment planning is an evaluation of the patient's soft tissue profile. An assessment of the nasolabial angle is a vital component of this evaluation. The purpose of this study was to establish norms for the nasolabial angle of an adult Nigerian population; compare the male and female values and to compare the values obtained for Nigerians with those reported for other populations.
Method: Lateral cephalometric radiographs of one hundred students (44 males and 56 females) of the College of Medicine, University of Lagos, aged 18-25years were taken. Selected subjects were of Nigerian ancestry with normal occlusion. The radiographs were manually traced and the nasolabial angle of each subject measured.
Result: A mean value of $84.35^{o} \pm 13.71^{o}$ was computed for the entire sample. No statistically significant difference was observed between the male and female values ($p>0.05$), although the males recorded a lower nasolabial angle (83.70^{o}) than the females (85.28^{o}).The nasolabial angle recorded in this study was similar to that reported for South African blacks, but much lower than that reported for Caucasian populations.
Conclusion: The mean nasolabial angle of $84.35^{o} \pm 13.71$ was observed in the Nigerian population studied. Sexual differences were not observed; however, the values observed in this study differ from that reported for Caucasians and other racial groups.

Key words: Cephalometrics, nasolabial angle, Nigerian population

Introduction

One of the most important components of orthodontic diagnosis and treatment planning is the evaluation of the patient's soft tissue profile[1]. Although the soft tissue changes, which occur with orthodontic treatment, are variable, the direct effect of orthodontic treatment on the soft tissue profile is usually apparent. Even more dramatic, are the changes in the soft tissue profile that may be induced by orthognathic or plastic surgery[2]. It is for these reasons that the soft tissue profile must be carefully examined before a decision regarding orthodontic treatment and/or orthognathic surgery can be made.

The nasolabial angle is representative of the soft tissue profile and remains an excellent clinical and cephalometric parameter to reveal the anteroposterior position of the maxilla and consequently to establish the treatment planning of dental and skeletal malocclusions[3]. It is one of the most important soft tissue measurements and it measures the protrusion of the upper lip relative to the inferior border of the nose[1, 4, 5].

Different values have been reported for the nasolabial angle by different authors, based on studies carried out in different populations[2, 6-14]. Fitzgerald et al.[6] reported a mean value of $114^{0} \pm 10$, in a population of white adults, while Magnani et al, [2] reported a mean value of $88.14^{0} \pm 12.12$ in a study carried out in black Brazilian adults. With respect to the Nigerian population, several studies have been carried out to establish cephalometric norms for this population [15-20]. However, these studies have been restricted to hard tissue (dentoskeletal) relationships, with no emphasis placed on the soft tissue profile. Bearing in mind that different racial groups must be treated according to their own characteristics; there is an urgent need to establish soft tissue norms for the nasolabial angle of Nigerians, which would serve as a reference point for

Figure 1: Nasolabial Angle (NLA)

diagnosis and treatment planning for both orthodontic treatment and orthognathic surgery.
The purpose of this study was to establish the pattern of nasolabial angle of an adult Nigerian population.

Materials and method

The subjects were made up of second year to final year medical, dental and pharmacy students of the College of Medicine, University of Lagos, Idi-Araba, Lagos, Nigeria. The first step of the selection process involved clinical examinations and interviews to determine those who met the selection criteria: Nigerians with Nigerian grandparents; 18 to 25 years; presence of all permanent teeth except third molars; Class I canine and molar relationships, normal overjet and overbite; symmetrical face, no previous orthodontic or prosthodontic treatment and no craniofacial deformities or history of trauma. Female subjects who were pregnant or likely to be pregnant were excluded from the study.
The sample comprised 100 subjects (56males and 44 females); mean age 21.63 years) who met the selection criteria. Ethical approval for the study was obtained from the ethical committees of the College of Medicine, University of Lagos and the Lagos University Teaching Hospital, Idi-araba, Lagos. In addition, informed written consent was obtained from each subject after the nature and purpose of the radiographs had been explained to them.
Lateral cephalometric radiographs were taken of all subjects in natural head position with the eyes straight ahead, the teeth in centric occlusion and the lips in relaxed contact. The radiographs were taken using a Planmeca Publication Part Number 10014593 revision 7, digital Orthopantomograph/Cephalostat machine (Planmeca OY, Helsinki, Finland 2009-06) at 68.0Kv, 5.0 mA for 17secs at 18.5mGy/cm2; at the Lagos University Teaching Hospital Dental Clinic, Idi-araba, Lagos, Nigeria. The same operator took all the radiographs.
The lateral cephalometric radiographs were manually traced on 0.003-mm matte acetate sheets (MASEL, 2034-007, AR-MED Ltd, UK), with a 0.5mm lead pencil.
The nasolabial angle, described as an angle formed by the intersection of a line originating at the subnasale, tangent to the mean of the lower border of the nose and a line from the subnasale to the labrale superius. The nasolabial angular measurements were made with a protractor and recorded to the nearest 0.5^0 **(Figure 1).**
Definition of landmarks, necessary for drawing the nasolabial angle:
· Subnasale (Sn): The point at which the columella (nasal septum) merges with the upper lip in the mid sagital plane.
· Labrale superius (Ls): The most anterior point of the upper lip
Statistical Analysis
The Statistical package for social sciences (SPSS) version 17, Chicago III, was used for analyzing data. Descriptive statistics of mean and standard deviation were obtained. Students't-test was used to determine the gender differences at a significance level of $p<0.05$.
To assess errors in the cephalometric tracing, 20 randomly selected lateral cephalograms were retraced after an interval of 7 days. The error was then calculated by using Dahlberg's equation[21]. Paired t-tests were also carried out between the initial and repeat measurements to determine the significance of any error. The level of significance was also set at $p<0.05$.
The methodological cephalometric tracing error calculated using Dahlberg's equation was found to be 3.53^0 and this falls within the normal range reported by Baumrind and Frantz[22] for angular measurement errors in cephalometric studies. In addition, a paired t -test between the initial sample and twenty randomly selected radiographs showed no statistically significant difference between the first and second tracings ($p>0.05$).

Results

A total of 100 subjects, 44% males and 56% females, aged 18-25 years with a mean age of 21.63 ± 2.04 years were seen **(Table 1).**
The nasolabial angle measured for the study population was between 52° and 126°, with a mean value of 84.35° ± 13.71. Mean values obtained for females was 85.28°±13.98 and males 83.70° ± 13.43. There were no statistically significant differences between both sexes ($p>0.05$).
Thus, male and female data were pooled together, in comparing the mean nasolabial angle obtained in this study, with that reported for other populations from other studies **(Table 2).**

Table 1. Gender and age distribution of the subjects and a comparison of the male and female nasolabial angle values.

Age (years)	Gender of subjects				Total	
	Male		Female			
	No.	(%)	No.	(%)	No.	(%)
18-19	4	(9.1)	13	(23.2)	17	(17)
20-21	18	(40.9)	18	(32.1)	36	(36)
22-23	8	(18.2)	15	(26.8)	23	(23)
24-25	14	(31.8)	10	(17.8)	24	(24)
Total	**44**		**56**		**100**	**100**
NLA	**Mean**		**Mean**		**t-value**	**p-value**
	83.70°±13.43		85.28°±13.98		-0.761	0.449

Table 2. A comparison of the nasolabial angle recorded in this study With that reported for other populations by different authors

Author(s)	Year of publication	Population studied	Nasolabial angle (degs)
Shalhoub et al	(1986) [7]	Saudi Arabians	115.90^0
Flynn et al	(1992) [8]	Black Americans	91.30^0
Lew et al	(1992) [9]	Chinese	95.00^0
Zylinski et al	(1992) [5]	Adult white males	111.5^0
Fitzgerald et al	(1992) [6]	Caucasians	114.0^0
Naidoo and Miles	(1997) [10]	Black South Africans	82.6^0
Alcalde et al	(2000)[11]	Japanese	102.34^0
Magnani et al	(2004)[2]	Brazilian Blacks	88.14^0
Al Gunaid et al	(2007)[12]	Yemeni males	106.4^0
Al Azemi et al	(2008)[13]	Kuwaitis	107.24^0
Dua et al	(2010)[14]	Indians	96.1^0
Present Study	**2011**	**Nigerians**	**84.35^0**

Discussion

In orthodontic diagnosis and treatment planning, the transition now is toward what is called the 'soft tissue paradigm', in which the primary goal of treatment is to obtain the best possible adaptation and proportion of the soft tissues of the face and mouth, and the secondary goal is functional dental occlusion. This paradigm emphasizes a treatment approach, which seeks to determine ideal soft tissue relationships and then to place the teeth and jaws as needed to obtain these ideal relationships[23].

In order to, effectively apply the soft tissue paradigm to orthodontic treatment planning; a very thorough and detailed assessment of the patient's soft tissue profile is required. The nasolabial angle forms an important component of this soft tissue profile.

Capeloza[24], showed that the nasolabial angle indicates the actual saggital position of the maxilla; thus further highlighting its great clinical significance. Indeed, the nasolabial angle is an important auxiliary parameter in the diagnosis of maxillary discrepancies[2]. An acute nasolabial angle (which reflects a prognathic maxilla) may indicate the need for surgical retraction of the maxilla, orthodontic retraction of the maxillary incisors or both; while an obtuse angle suggests a degree of maxillary hypoplasia and calls for maxillary advancement or orthodontic proclination of the maxillary incisors[25].

The lower age limit for this study was set at 18years in order to ensure that facial skeletal maturity had been achieved in both males and females[8]. This age range was chosen based on the fact that most patients seeking orthodontic treatment and orthognathic surgery are young adults[7, 10, 12]. daCosta and Utomi[26], in a retrospective study of orthodontic patients visiting the Lagos University Teaching Hospital , Lagos, Nigeria, between 2000 and 2005; reported that 30.7% of the orthodontic patients were adults aged 18years and above, with young adults (18-25years) constituting almost three-quarters of this adult population.

A comparison of the male and female nasolabial angle values showed no statistically significant gender difference. Thus, indicating the absence of sexual dimorphism in the nasolabial angle of the Nigerian population studied. Similar findings were also reported in studies carried out in Black American[8], Caucasian[6] and Indian populations[14]. However, Magnani et al[2], in a study carried out in a Brazilian black population reported marked sexual dimorphism, with the females recording a significantly lower nasolabial angle than the males. This finding may be as a result of the younger age group of the subjects (10-14years) used in that study, as compared to the present study. This is because there is a tendency for the nasolabial angle to decrease with age, especially until adolescence, when the growth of the nose, chin and lips are more fully expressed[27].

The mean value of the nasolabial angle recorded in this study reflects a prognathic maxilla in the population studied. Bimaxillary prognathism has previously been reported in the Nigerian population by Isiekwe and Sowemimo[15], Durosinmi-Etti[18], and Ajayi[20]. Thus, this study further confirms these previous findings by the acute nasolabial angle obtained.

A comparison of the nasolabial angle recorded in this study with that reported for Caucasian populations by Fitgerald et al[2], ($111.4^{o}\pm10$) and Legan and Burstone[22], ($102.0^{o}\pm8.0$) shows that the nasolabial angle recorded for this Nigerian population is much more acute than that previously reported for Caucasians. Thus, reinforcing previous findings that Nigerians have a more prognathic maxilla compared to Caucasians [15, 18].

The fact that the nasolabial angle reported for Nigerians in this study, was quite similar to that reported for South African blacks, by Naidoo and Miles[10] ($82.6^{o}\pm10.0$) , may be attributed to the fact that both populations are Negroid in origin. This finding underlines the fact that cephalometric norms are specific for each racial or ethnic group. However, a relatively more obtuse nasolabial angle ($91.3^{o}\pm14.8$) was observed in Black Americans as reported by Flynn et al[8]. In the opinion of these authors, this may be as a result of inter-racial breeding of Black Americans with other races such as Caucasians, which has occurred over time resulting in a more obtuse nasolabial angle.

The nasolabial angle values reported for Chinese[9], Japanese[11] and Yemeni[12] populations ($95.0^{o}\pm3.0$, $102.34^{o}\pm11.02$ and $106.4^{o}\pm9.7$, respectively) are all more obtuse than that recorded for the Nigerian population studied. Thus, indicating a relative maxillary retrognathism in these populations in comparison to the Nigerian sample studied. These findings highlight the fact that each racial or ethnic group should be treated bearing in mind the cephalometric characteristics of that group.

Conclusion

Based on the results obtained in this study, the mean nasolabial angle of $84.35^{o}\pm13.71$ was observed in the Nigerian population studied and there was no sexual differences observed; however, the values observed in this study differ from that reported for Caucasians and other racial groups.

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