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RESEARCH ARTICLE

ANTHROPOMETRIC ANALYSIS OF PALPEBRAL AND INTERPUPILLARY DIMENSION AMONG NORTHERN CROSS RIVER ETHNIC POPULATION

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ABSTRACT

Anthropometric analysis of palpebral and interpupillary dimension is very important to maxillofacial and plastic surgeons, anthropologist, dysmorphologists and in forensic investigations. The study was carried on the Anthropometric analysis of palpebral and interpupillary among Northern Cross River State ethnic population. A total number of five hundred subjects, two hundred and fifty (250) males and two hundred and fifty (250) females between age group 10-49years, were randomly selected from primary and secondary schools, villages and towns within the Northern Cross River extraction. Obtained data was analyzed and there were found statistically significant ($p<0.05$).The results showed that the HPA is significantly higher in males than in females. There was significant difference in IPD between males and females. The near interpupillary distance (NIPD) and far interpupillary distance (FIPD) values were significantly higher ($P<0.05$) in males than in females. There was significant ($p<0.05$) sexual dimorphism. The result drawn from this study could be use immense by maxillofacial and plastic surgeons, anthropologist, dysmorphologists and in forensic investigations.

Key Words: Horizontal palpebral, Interpupillary, Northern, Cross river ethnic.

INTRODUCTION

The periorbital area is one of the most important regions in ophthalmic, reconstructive surgery, plastic surgery, and anthropometric evaluation (Vasanthakumar *et al.,* 2010). The periorbital structures are usually accepted to be the major landmarks in recognition of the sense of beauty and racial descent. This is because an inter-racial variation is usually most prominent in the periorbital area (Kunjur *et al.,* 2006). The bilateral orbital area located in the upper face acts as a key determinant in the perception of facial attractiveness, youthfulness and health.

The eye fissure dimensions, horizontal palpebral aperture and interpupillary distance may be altered in facial deformities. To assess the deformity, the patient's horizontal palpebral aperture and interpupillary measurements have to be compared with the normal values which are specific for a patient's race, age and sex (Vasanthakumar *et al.,* 2010). Palpebraland interpupillary dimensions are important parameters in the assessment of most craniofacial abnormalities, systemic syndromes, and it is data mostly needed in surgical treatments of post-traumatic telecanthus (Farkas *et al.,* 1992a). The knowledge of canthal distances is also use by dentist to predict the maxillary central incisor width by multiplying it by a decreasing functional value of the geometric progression term and then dividing it by a factor of two (Abdullah, 2009). In reconstructive surgery and orthodontic treatment, it is used for accurate knowledge of the values of these dimensions so that deformities of the face which in most cases are often congenital, or due to trauma resulting from burns, neoplasm, or any pathological conditions involving the facial skeleton can be corrected (Esomonu *et al.,* 2011). The objectives of the present study are to determine the normal average values of palpebral and interpupillary distances among the Northern Cross River ethnic population, and also to evaluate the association of sexual dimorphism and the effect of age on these facial dimensions among the ethnic population of Northern Cross River state of Nigeria. Normative palpebral and interpupillary values provided would serve as guide in medical intervention for conditions that may concern the facial canthus among the Northern Cross river ethnic population. The palpebral and interpupillary index recorded would also be of immense use to plastic surgeons and dysmorphologists towards achieving the best functional and aesthetical result inherent in the people of Northern Cross River state on Nigeria.

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MATERIALS AND METHODS

A total number of five hundred subjects were measured (male = 250 and female = 250), in age groups 10-49years. One hundred subjects were selected from each of the five local government areas to make up the 500 subjects. The study cut across the ethnic population of Northern Cross River state of Nigeria; comprising of Bekwarra, Obanliku, Ogoja, Obudu, and Yala local Government Areas. The subjects were recruited from primary and secondary schools, villages and towns within Northern Cross River.

Measurement of horizontal palpebral

The subject was comfortably seated and made to look straight ahead while a horizontally placed ruler was held firmly in front of the eye to measure the distance between the medial and lateral canthi of the eye (Fig. 1).

Aperture (HPA)

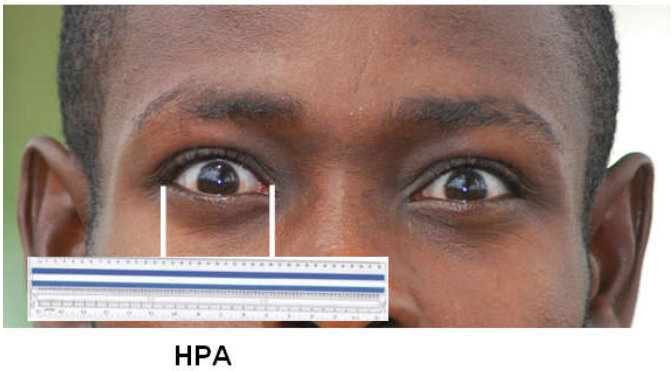

Fig. 1. Showing method of measurement of HPA

Measurement of interpupillary distance

A simple alternative method known as the modified Viktorins method was employed in the measurement of IPD. This method was used in the present study because it was primarily designed to observe the anthropometric variation pattern of the interpupillary distance. The distance between the nasal and lateral limbus of subjects was measured using a centimeter ruler (Fig. 2). The reason for choosing this method is based on the conclusions that inequality in the size of the pupils will not change the measurement results in this modified method because the measurement is made between the inner and outer limbus of each eye (corneoscleral junction), which is a stable point and is not dependent on the pupillary diameter. Each subject was seated comfortably in a chair.

The subject's head was at the same level as, and 40 cm in front of, the examiner's head. The subject's face was well illuminated, and the ruler was held firmly against the subject's nose. The examiner first closed his right eye and asked the subject to look at his opened left eye.

The zero mark on the ruler was placed at the outer limbus margin of the subject's right eye while the examiner sighted with his opened left eye the point of the ruler that corresponded to the inner limbus of the subject's left eye. The examiner then closed his left eye and asked the subject to look at the examiner's opened right eye. While still maintaining the zero mark on the ruler at the outer limbus of the subject's right eye, the examiner sighted the point on the ruler that corresponded to the inner limbus of the subject's left eye, as show in Figure 2 below.

(IPD)

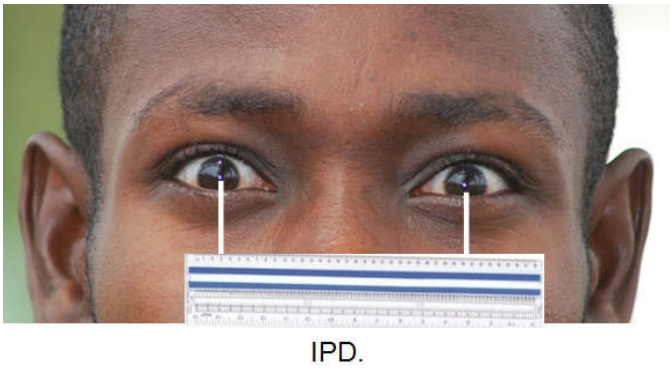

Fig. 2. Showing method of measurement of IPD

RESULTS

The result of this study is presented in the tables below. The subjects were divided into four age groups: 10-19, 20-29, 30-39 and 40-49 years. Tables 1 and 2, shows the mean ±SD for horizontal palpebral aperture and interpupillary (near interpupillary distance (NIPD), far interpupillary (FIPD)), of ethnic population of Northern Cross River state males and females.

HPA

The mean total value of horizontal palpebral aperture (HPA) for males in Northern Cross River irrespective of LGA are 3.35±.18cm, 3.63±.11cm, 3.63±.10cm, and 3.64±.38cm while that for females are 3.33±.17cm, 3.53±.11cm, 3.59±.10cm, and 3.59±.12cm (Table 3) as observed in the different age groups. The overall HPA value irrespective of age groups (10-19) years in males is 3.58±.27cm while in females is 3.51±.17cm (Table 3). Significant sexual dimorphism exists in all the local government areas except Obanliku in age group 20-29 years, (Table 3). In each instances, the proportion of the HPA is greater in males than in female subjects.

Table1. Comparison of mean and standard deviation of horizontal palpebral aperture (HPA) in male and female subjects of different age groups in Northern Cross River State

Age(yrs)	Sex	Bekwarra	Obanliku	Obudu	Ogoja	Yala	Total
10-19	Male	3.39±.19	3.28±.19	3.39±.20	3.37±.15	3.34±.16	3.35±.18
	Female	3.35±.14	3.34±.17	3.36±.18	3.28±.19	3.31±.15	3.33±.17
20-29	Male	3.60±.12*	3.60±.13	3.68±.11*	3.65±.10*	3.63±.06*	3.63±.11*
	Female	3.57±.09*	3.53±.12	3.59±.11*	3.53±.12*	3.49±.15*	3.53±.11*
30-39	Male	3.67±.16	3.62±.07	3.64±.13	3.65±.07	3.60±.06	3.63±.10*
	Female	3.56±.16	3.60±.10	3.60±.07	3.63±.05	3.56±.08	3.59±.10*
40-49	Male	3.64±.10	3.65±.10	3.69±.10	3.69±.83	3.64±.09	3.64±.38
	Female	3.59±.13	3.59±.09	3.61±.08	3.59±.05	3.56±.15	3.59±.12
10-49	Male	3.57±.18	3.53±.20	3.59±.19	3.62±.47*	3.55±.16*	3.58±.27*
	Female	3.50±.16	3.51±.16	3.54±.16	3.50±.18*	3.49±.17*	3.51±.17*

Values with asterisk (*) are significant at $p<0.05$

IPD

Table 2 (a & b) shows detailed statistical comparison of near interpupillary distance (NIPD) and far interpupillary distance (FIPD) for male and female subjects across all age groups among the Northern Cross river ethnic population respectively. The mean total value of far interpupillary distance (FIPD) for Northern Cross River males are 6.50±.42cm, 6.76±.23cm, 6.82±.22cm, and 6.71±44cm while that of females are

6.48±.15cm, 6.56±.12cm, 6.67±.41cm, and 6.64±.14cm respectively as observed in all the age groups (table 2b).The overall near interpupillary distance (NIPD) value irrespective of age (10-49) years are 6.54±.18cm in males and 6.47±.25cm in females while the value for far interpupillary distance (FIPD) are 6.69±.37cm in males and 6.59±.23cm in females respectively (Table 4a & b). These values are significantly higher in males than in females (P<0.05). The difference in IPD between males and females are only significant in age group 20-29 and 30-39 years and in NIPD and FIPD. Significant sexual dimorphisms are observed mainly in age groups 20-29 years 30-39 years in all the local government areas, (Table 2a & b). In each of these instances, the proportion of IPD is greater in males than females.

Although in separate studies, it was documented that HPA is shortened by age as a result of lit laxity (Bosch *et al.,* 1999; Erbagci *et al.,* 2005), the present study detected slight shortening in age group 40-49 years that was not found to be statistically significant. The horizontal palpebral aperture (HPA) being one of the most variable periocular measurements, the values of the present study was comparable to that found among Turkish, Saudi Arabian, Indian, and Japanese populations. A study of central Saudi males of age group 16-25 years, revealed HPA of between 26.7mm and 29.7mm (Osuobeni and AL-Gharni, 1994). In another study of the Saudis by Bukhari, 2011, found a mean HPA of 30.8mm among the same matched age groups in the western part of the country.

Table 2a. Comparison of mean and standard deviation of near interpupillary distance (NIPD) in male and female subjects of different age groups in Northern Cross River State

Age(yrs)	Sex	Bekwarra	Obanliku	Obudu	Ogoja	Yala	Total
10-19	Male	6.29±.21	6.45±.09	6.42±.18	6.46±.33	6.39±.16	6.40±.21
	Female	6.39±.10	6.09±.88	6.35±.12	6.42±.15	6.36±.15	6.32±.42
20-29	Male	6.55±.16	6.55±.12	6.71±.14*	6.60±.14*	6.51±.09*	6.58±.15*
	Female	6.47±.21	6.53±.11	6.51±.11*	6.46±.07*	6.43±.09*	6.48±.13*
30-39	Male	6.57±.12*	6.64±.15	6.67±.18*	6.59±.12	6.55±.09	6.61±.14*
	Female	6.49±.07*	6.61±.11	6.53±.05*	6.58±.11	6.55±.11	6.55±.10*
40-49	Male	6.54±.17	6.60±.12	6.56±.21	6.54±.10	6.57±.12	6.56±.15
	Female	6.55±.11	6.55±.05	6.52±.11	6.50±.04	6.51±.14	6.52±.10
10-49	Male	6.49±.20	6.56±.14	6.58±.21*	6.54±.20*	6.51±.14	6.54±.18*
	Female	6.47±.14	6.44±.49	6.48±.13*	6.49±.11*	6.47±.14	6.47±.25*

Values with asterisk (*) are significant at p<0.05

Table 2b. Comparison of mean and standard deviation of far interpupillary distance (FIPD) in male and female subjects of different age groups in Northern Cross River State

Age(yrs)	Sex	Bekwarra	Obanliku	Obudu	Ogoja	Yala	Total
10-19	Male	6.52±.19	6.30±.74	6.52±.15	6.61±.51	6.52±.18	6.50±.42
	Female	6.53±.19	6.42±.16	6.49±.04	6.50±.17	6.49±.11	6.48±.15
20-29	Male	6.70±.19*	6.72±.20*	6.99±.25*	6.76±.20*	6.62±.09*	6.76±.23*
	Female	6.55±.07*	6.59±.15*	6.62±.19*	6.54±.07*	6.51±.05*	6.56±.12*
30-39	Male	6.75±.18	6.86±.18	6.98±.27*	6.81±.24	6.72±.16	6.82±.22*
	Female	6.64±.17	6.53±.81	6.77±.16*	6.79±.17	6.66±.16	6.67±.41*
40-49	Male	6.71±.19	6.78±.20	6.57±.94	6.70±.19*	6.77±.17	6.71±.44
	Female	6.64±.09	6.69±.16	6.61±.10	6.60±.08*	6.67±.21	6.64±.14
10-49	Male	6.67±.20*	6.66±.46	6.75±.56	6.71±.32*	6.66±.18*	6.69±.37*
	Female	6.59±.14*	6.55±.43	6.62±.16	6.60±.17*	6.58±.17*	6.59±.24*

Values with asterisk (*) are significant at p<0.05

DISCUSSION

Horizontal Palpebral aperture and interpupillary dimension are very importantto both clinical geneticists and reconstructive surgeons in the diagnosis of genetic conditions such as ocular adnexal changes and somatometric traits of the face such as epicanthus, telecanthus, widely spaced eyebrows, and blepharophimosis which do present a false error in the detection of certain craniofacial syndromes (Farkas *et al.,* 1992a; DeMyer, 1967; Pryor, 1969). The study has shown that sexual dimorphism was found to be statistically significant (p<0.05) in all the measured parameters. The values of horizontal palpebral aperture (HPA) for Northern Cross River irrespective of age groups (10-19) years indicate 3.58±.27cm in males and 3.51±.17cm females. Horizontal palpebral aperture (HPA) as revealed in the present study shows significant higher values in male than that of the female subjects (p<0.05) in adults. The mean value of HPA in both male and female subjects showed a significant increase from 3.35±.18cm male and 3.33±.17cm female in age group 10-19 years to 3.63±.10cm male and 3.59±.10cm female in age group 30-39 years.

In all these variations, the HPA values for the Northern Cross river population were found to be closely related to that of the Saudi population. The present study also indicates that the overall interpupillary distance (IPD) for the northern cross river ethnic population obtained in male and female subjects are 6.54±.18cm and 6.47±.25cm respectively for NIPD, and 6.69±.37cm and 6.59±.24cm respectively for FIPD (table 2a&b). There was significant sexual dimorphism observed among age group 20-29 and 30-39 in NIPD and FIPD values, these values are significantly higher in males than females (p<0.05) in both NIPD and FIPD.

On analysis the difference between the NIPD and FIPD was statistically significant in all particular age groups in either sex. It is also observed that the overall anatomical far interpupillary distance (FIPD) was, on the average, wider than the near interpupillary distance (NIPD), with a difference of 2.1mm in males and 1.2mm in females. The values in the present study are lower than the reported values by Esomonu *et al.*, 2012, for the Igbo ethnic group which they revealed to be 7.81±71cm and 7.10±.63cm for males and females respectively. The values for Northern Cross River are similar to the reported values for

the Hausa ethnic group (male 6.88cm and female 6.89cm) and for the Yoruba ethnic group (male 6.76cm and female 6.72cm) Anas, (2009). However the values are higher than those reported by Waardenberg, (1951), for a mixed European population, 65.3 mm and 62.7 mm for men and women, respectively. In the 10- to 49-year-old age group, the average mean interpupillary distance of 6.56cm to 6.66cm, reported for the Northern Cross river ethnic population in the present study is slightly lower than reported average for the Igbo ethnic group, 6.72cm as reported by Esomonu *et al.*, 2012. However the values are higher than the reported averages for the blacks, 5.31cm to 5.75 cm by Lucas and Pryor, (1935), and for the Caucasian children, 5.2cm to 5.6 cm as revealed by Pryor, (1969).

The reported values for Northern Cross River are also not similar to those reported for Hong Kong population (5.4 to 5.9 cm) by Quant and Woo, (1992), and British children (5.5 to 6.0 cm) by Kaye and Obsfeld, (1989). Hofstetter, (1972), also reported that the IPD of adult white males from the United States of America has a mean IPD which lie between 65 and 66 mm and that 90% of his subjects has an IPD between 60 and 70 mm, while 99.8% between 55 and 75 mm. The values of IPD for Northern Cross River as revealed in the present study fall within the range reported by Hofstetter, (1972). Osuobeni and AL-Gharni, (1994), evaluated gender differences in IPD among Arabs and found that male subjects have mean IPD 2mm greater than female counterparts in individuals aged 5 to 55 years while in the present study the male value was higher than the female value by a difference of 1mm.The mean value of FIPD for Northern Cross River showed a significant increase from age group 10-19 years through 30-39 years while a decrease was noted in age group 40-49 years.

It is therefore evident that the absolute value of IPD increases with age, at least until the third decade of life. As reported in previous studies, there is also a statistically significant difference between mean FIPD of male and female subjects in this study among the various age groups which also agrees with findings of Maclachlan and Howland, (2002). Murphy and Laskin, (1999) and Pivnick *et al*., 1999, reported larger IPD in male subjects in an African population which agree with the higher significant values noted in males in the present study.

Conclusion

The results from this study have shown that there is a statistically significant gender difference in horizontal palpebral aperture and interpupillary distances between males and females. This study has also generated normative values of the measured parameters for the ethnic population of Northern Cross River state of Nigeria for the various age groups. When the data of the present study were compared with the previous reports, the measured parameters showed variations and similarities (racial and sexual) with other populations. The results of this study will be of immense use to the maxillofacial and plastic surgeons and in surgical procedures like ocular prosthetics, blepharoplasty and in forensic science to trace missing individuals by applying facial reconstruction techniques, dentistry, genetics and paleoanthropological studies.

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