Anatomical study of canthal index: The morphometrical study

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Abstract

Background: Anthropometry is the hallmark technique for biological anthropology and has become increasingly important in health assessment across this century. Craniofacial anthropometry is study of face and skull. The local data on inner canthal distance, outer canthal distance and canthal index may signify the differential developmental pattern resulting from various factors such as gender, age, genetic and climate and may help in craniofacial surgery, orthodontists, congenital anomalies and forensic science.

Objectives: The objective of the study is to compare anthropometric dimension related to inner canthal distance, outer canthal distance and canthal index.

Methodology: The outer and inner canthal measurements of Nepali population were observed in 318 normal male and female. Out of total samples, 156 male and 162 female of age 17 – 25 years were taken for study since study was done in medical college preclinical students. The inner and outer canthal distances were measured by using a digital sliding caliper graduated in millimeters. The Canthal index was calculated.

Results: There was statistically significant difference in inner canthal distance among female (31.84± 2.22)mm and male (34.48 ±3.35)mm (P < 0.001). We found statistically significant difference in the outer canthal distance among female 94.30±3.42 mm and male 96.54±4.77mm (P < 0.001); moreover, there was significance difference in mean canthal index among female and male (33.77±2.42 and 35.79±3.76; P < 0.001) respectively.

Conclusion: This work has generated normative values for canthal dimensions of Nepali population. The study would be of benefit not only to anthropometrist, oral and maxillofacial surgeons, plastic surgeons, forensic medicine, but also to orthodontists and dysmorphologists.

Key words: Anthropometry; Canthal index; Dysmorphologist; Inner canthal distance; Orthodontist; Outer canthal distance.

INTRODUCTION

Craniofacial anthropometry is defined as the measurements of medial (inner), lateral (outer) canthal distance and canthal index. It is very important for the study of human growth, variation in different races for clinical diagnosis and treatment as described by Poswillo¹. Anthropometry is concerned with measurement of physical size and shape of human body². Craniofacial anthropometry is an integral part of craniofacial surgery and syndromology³. It is a technique used in both physical and clinical anthropology comprising precise and systematic measurements of the human skull. It is important for the study of human growth and variations in different races and also for clinical diagnosis and treatment as described by Poswillo¹. Craniofacial anthropometry is an integral part of craniofacial surgery and syndromology. It is a technique used in both physical and clinical anthropology comprising precise and systematic measurements of the human skull. It is important for the study of human growth and variations in different races and also for clinical diagnosis and treatment that people with different genetic background subjected to significantly different environmental influences have different craniofacial morphology⁴.

The face is a complex anatomic unit. It is best to evaluate each distinct region of the face separately.

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taking care to relate the various parts to the whole. Canthal dimensions are important anthropometric data of clinical significance. Though facial measurements have been performed since Greek era, only recently its significance has been appreciated. Inner canthal and outer canthal dimensions are important measurements in the evaluation of several systemic syndromes, craniofacial abnormalities and surgical treatments of post-traumatic canthus. Dysmorphologist employs canthal measurements in evaluating the degree of hypertelorism. Accurate values of these distances are essential guide to both constructive surgery and orthodontic treatment. Deformities of the face are most often congenital but may result from trauma, burns, neoplasm or any pathology involving the facial skeleton.

By implication, it may not be unlikely that it may vary with climatic conditions or ecological habitat of one human population to another. Normative canthal values that serve as guide in medical intervention for conditions that may concern the facial canthus are available for Mexicans and Japanese. It is also known that in a given individual, canthal values vary with age, and tend to become constant in the mid to late twenties. The aim of the study is to find out the anthropometric variation in inner canthal distance, outer canthal distance and canthal index among male and female of age group 17-25 years old in Nepali population.

CLINICAL SIGNIFICANCE OF CANTHAL PARAMETERS

The evaluations of canthal parameters is helpful for the craniofacial dimorphic in individual with syndromic conditions. The report on canthal parameter is significant for the unaffected family requiring genetic counseling as requirement for screening procedure and also has importance for craniofacial assessment, surgery and forensic science in the Nepali population.

METHODOLOGY

The cross-sectional study was conducted in the department of Anatomy of Kathmandu Medical College, Duwakot, Bhaktapur, Nepal from August 2018 to December 2018. Preclinical medical students attending KMCH were taken for the study. A total number of 318 medical students of both sexes were taken, out of which 156 were male and 162 were female. Ethical clearance was taken from the IRC of Kathmandu Medical College. Healthy individuals were taken for sample and individuals with chronic, debilitating diseases, congenital and acquired deformities, participants having family history of intercaste marriage (due to possibility of change in face morphology) and foreign students were excluded from study. All parameters were measured by digital Vernier calliper. All canthal parameters were taken in millimeter (mm).

The different parameters in the study are Inner canthal distance (ICD) and Outer canthal distance (OCD). ICD is the distance measured from the medial angle of the palpebral fissure to median angle palpebral fissure while OCD is the distance measured from the outer edge of the bony orbit to outer edge as shown fig.1.

Mathematically, Canthal index is the ratio of inner canthal distance to outer canthal distance multiplied by 100.

For statistical analysis, mean, standard deviation, standard error and p-value were calculated by using Statistical Package for Social Science (SPSS) version 22 as statistical software and using t-test for calculation of canthal parameters.

RESULTS

The results obtained after the statistical analysis among male and female of Nepali population. On comparing mean values of all parameters among male and female, result showed that values of ICD, OCD and CI were higher in male than female and observed statistically significant (p < 0.001) as shown in table 1.
Table 1: Canthal parameters among Nepali people

| Parameters            | Male Mean ±SD | Female Mean ±SD | P-Value |
|-----------------------|---------------|-----------------|---------|
| Inner Canthal Distance| 34.48 ± 3.36 mm | 31.84 ± 2.22 mm | 0.001   |
| Outer Canthal Distance| 96.54 ± 4.78 mm | 94.30 ± 3.42 mm | 0.001   |
| Canthal Index         | 35.79 ± 3.76   | 33.78 ± 2.42    | 0.001   |

Table 2: Comparisons of canthal parameters with other study

| Study by             | Sex | ICD (Mean ±SD) mm | OCD (Mean ±SD) mm | CI (Mean ±SD) |
|----------------------|-----|-------------------|-------------------|---------------|
| Juberg et al. (1975) | Male | 28.33             | 81.74             | 34.66         |
| Singh & Banerjee (1983) | Male | 28.14             | 81.17             | 34.60         |
| Cem et al. (2001)    | Male | 28.33             | 81.74             | 34.66         |
| Erika et al. (2005)  | Male | 28.14             | 81.17             | 34.60         |
| Oladipo et al. (2008) | Male | 35.2 ± 0.27       | 111.5 ± 0.51      | 31.64 ± 2.57  |
| Oladipo et al. (2008) | Male | 33.6 ± 0.30       | 107.3 ± 0.63      | 31.47 ± 4.62  |
| Osunwoke EA (2012)   | Male | 33.68 ± 4.18      | 97.86 ± 4.41      | 34.25 ± 3.57  |
| Osunwoke EA (2012)   | Female | 31.14 ± 3.30     | 97.20 ± 3.62      | 32.02 ± 3.24  |
| Anibor. E. (2014)    | Male | 36.98 ± 1.96      | 106.17 ± 3.73     | 35.58 ± 0.96  |
| Adhikari et al. (2016) | Male | 33.37 ± 0.33      | 93.5 ± 0.66       | 36.62 ± 5.65  |
| Present Study (2018) | Male | 34.48 ± 3.36      | 96.54 ± 4.78      | 35.79 ± 3.76  |

DISCUSSION

Craniofacial anthropometry is important tool for clinician, genetics and reconstructive surgeon. Somatometric traits of face such as telecanthus, epicanthus, widely separated eyebrows and ocular adnexal may create some illusion during the diagnosis of craniofacial syndromes and may required appropriate method of identification of some facial anomalies 7-9.

In the present study, overall innercanthal distance, outercanthal distance and canthal index were found to higher in male than female at P-Value < 0.001. Osunwoke EA (2012) observed and tabulated that ICD, OCD and CI among male and female were 33.68 ± 4.18mm, 97.86 ± 4.41mm, 34.25 ± 3.57 mm and 31.14 ± 3.30 mm, 97.20 ± 3.62, 32.02 ± 3.24 respectively 17. In compare to present study the values of canthal measurements were significantly higher in Nepali populations as shown in
Our study is consistent with studies done by Osunwoke EA and Anibor E17,18. The various studies showed that mean values of ICD, OCD and CI were higher in male than female. The present study also showed male had greater values of ICD, OCD and CI than female and our study was consistent with majority of studies.

Cem et al., (2001) in Turkey, reported that the inner canthal distance, outer canthal distance and canthal index for Turkish male was greater than those of female13. In the present study values of the inner, outer canthal distance and canthal index male is greater than female. We were found again significantly higher in all parameters.

Oladipo et al., 2011 observed similar parameter in Ibibio, Nigeria and found ICD, OCD and CI to be greater in males as compared to female population. The value of canthal parameters was higher in ICD, OCD and lesser CI than present study. Adhikari et al., (2016) reported that ICD, OCD and CI observed among male and female respectively and were found higher in ICD and CI but lesser OCD. CI can be influenced by OCD if value of OCD is greater the canthal index is lesser. These variations were found to be due climate, environment, ethnicity and genetics of facial development.

Oladipo et al., (2008) reported that the mean value of canthal index in male Ijaws and Igbo were the greater than female Ijaws and Igbo’s. Oladipo et al., (2009) in population Urhobo found that canthal index – in male was greater than female. Oladipo et al., (2009) Itsekiri also did similar studies and found canthal index of males was less than female population. In both the studies the values of canthal index was higher in female than in male individual.

The studies conducted by Oladipo et al., in 2008 and 2009 in different places showed that the canthal index among male and female were lesser than our study which showed the canthal index value for male and female population as 35.79±3.76 and 33.77±2.42 respectively. In present study canthal index was higher in male than female and canthal index in both sexes were higher in Nepali populations than Urhobo and Itsekiri. The present study was contrary to studies done by Oladipo et al., (2009) among Urhobo and Itsekiri of Nigeria and also Juberg et al., in African- American (1975) CI: 38.38 male and 38.50 female and Singh and Banerjee (1983) CI: 37.23 male and 37.82 female in Indian. The values canthal parameters and other craniofacial indices are influenced by environment, geographical and genetically between and within the populations14.

CONCLUSION

We concluded that environment, geographical, gender, ethnicity and genetic are responsible for variation in different parameter of craniofacial anthropometry. The present study is of high relevance to genetic anthropology, forensic anthropology, medical anthropology and also valuable in canthal anthropometry for formulation of normal data in the Nepal. The study is of immense value for further investigation in different domains of Nepal like clinical practice, ophthalmology, forensic anthropology, genetic developmental anatomy for facial anomaly and paleo-anthropological studies.

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