

Assessment of canthal index among the Nepalese and Indian MBBS students of a Medical College in Eastern Nepal

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ABSTRACT

Introduction: The human face is a symbol of artistic expression and identity, with the orbit being a crucial factor in evaluating facial attractiveness. Various orbital measures, such as interpupillary distance, nasal limbus to temporal limbus, inner intercanthal distance, and outer intercanthal distance, are significant in ophthalmology and can help diagnose naso-orbitoethmoid damage, hypertelorism, and traumatic telecanthism. Hence, this study aimed to determine inner and outer canthal distances, mean canthal index values, and compare these values in the Indian and Nepalese MBBS students of Nobel Medical College Teaching Hospital. **Methods:** A comparative cross-sectional study was conducted among 64 Indian and 128 Nepalese MBBS students aged 18 to 25 years in the Department of Anatomy at Nobel Medical College Teaching Hospital, Biratnagar from April to September 2023. The study used a convenience sample technique and involved measuring the inner canthal distance, outer canthal distance and calculating the canthal index. **Results:** The overall mean canthal index was 17.93 ± 3.13 , the mean outer canthal distance and inner canthal distance were found to be 110.66 ± 12.34 mm and 19.85 ± 4.24 mm respectively. The mean value of the canthal index for Indian and Nepalese students was found to be 18.09 ± 2.99 and 17.85 ± 3.21 respectively. **Conclusions:** The study found no significant differences in canthal distance or index between Nepalese and Indian students, possibly due to race and geographical habitat pattern similarities.

Keywords: Anthropology, canthus, face, orbit.

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INTRODUCTION

The human face stands as the pinnacle of artistic expression, a canvas of emotion and identity. It is the most beautiful and alluring part of the body. One of the most important factors in evaluating facial attractiveness is the orbit, the physical entity in the face.¹

The measuring of the actual body dimensions and forms is the focus of anthropometry. The fields of craniofacial surgery and syndromology depend heavily on craniofacial anthropometry.² The importance of craniofacial anthropometry has grown recently due to the assessment of specific syndromic disorders being aided by the measurement of facial parameters. Furthermore, to accomplish anatomic restitution, repair of the canthus after orbital deformities—whether congenital or acquired—presumes an assessment of the canthal distances.³

Different craniofacial morphologies are seen among people with distinct genetic backgrounds who are exposed to notably distinct environmental influences.² Numerous orbital measures, such as the Interpupillary distance (IPD), Nasal limbus to temporal limbus (NLTL), Inner-outer Intercanthal distance (IOICD), Inner Intercanthal

distance (IICD), and Outer Inter-canthal distance (OICD), are significant for several reasons in the field of ophthalmology. In addition to potentially helping with the treatment of orbitofacial and post-traumatic cranial abnormalities, these characteristics may be changed in craniofacial disorders.⁴

The angle where the upper and lower eyelids meet is known as the canthus. The terms “inner canthus” and “outer canthus” refer to the medial and lateral canthus, respectively. An essential component of craniofacial anthropometry is the canthal index (CI), which comprises the inner canthal distance (ICD) and the outer canthal distance (OCD). Canthal distance measurements have applications in reconstructive technologies as well as in the diagnosis of numerous systemic illnesses. It aids in the diagnosis of naso-orbitoethmoid damage, hypertelorism, and traumatic telecanthism.⁵

Thus, the main purpose of this study was to compare the inner and outer canthal distances, as well as the mean value of the canthal index between the students of Nepalese and Indian nationality studying in a Medical College of Eastern Nepal.

METHODS

This Comparative cross-sectional study was conducted among 192 MBBS students of Nobel Medical College; in the age group of 18 to 25 years from April to September 2023 in the Department of Anatomy, Nobel Medical College Teaching Hospital, Biratnagar. The study was conducted with the approval of the Institutional Review Committee, Nobel Medical College Teaching Hospital, Biratnagar. (Ref. no. IRC-NMCTH 508/2021) Since these canthal measurements often stay consistent following puberty, students in the 18 to 25 years age bracket were included. Before the process, the students were informed about the goal of the study and were given orientation. The inclusion criteria were: MBBS student studying in Nobel Medical College Teaching Hospital and with no history of congenital anomalies, trauma to the craniofacial region, surgery, or clinical indications of telecanthus or epicanthus. Students with systemic diseases that could affect their craniofacial morphology or who had craniofacial malformations were excluded from this study.

Sample size calculation was done using the formula,

$$n = (Z_{\alpha/2} + Z_{\beta})^2 \cdot (2\sigma^2) / (\mu_1 - \mu_2)^2$$

where,

$Z_{\alpha/2}$ is the critical value of the standard normal distribution at $\alpha/2$ (e.g., 1.96 for $\alpha = 0.05$).

Z_{β} is the critical value of the standard normal distribution

at β (e.g., 0.84 for 80% power).

σ is the pooled standard deviation, calculated as:

$$\sigma = \sqrt{(\sigma_1^2 + \sigma_2^2)/2}$$

$$\mu_1 = 33.29 \text{ (mean value of CI in Nepali population)}^5$$

$$\mu_2 = 25.23 \text{ (mean value of CI in Indian population)}^1$$

$\sigma_1 = 2.37$ (value of standard deviation of CI in Nepali population)⁵

$\sigma_2 = 6.71$ (value of standard deviation of CI in Nepali population)¹

Putting all the values together, the sample size was calculated

$$\begin{aligned} n &= (Z_{\alpha/2} + Z_{\beta})^2 \cdot (2\sigma^2) / (\mu_1 - \mu_2)^2 \\ &= 12.21 \end{aligned}$$

Since the sample size should be a whole number, round up to the next whole number 13. So, a minimum of 13 samples should be taken from each group to detect a significant difference in this case. A convenience sampling technique was used to include 192 undergraduate medical students from Nepal and India who pursued MBBS at Nobel Medical College Teaching Hospital, Biratnagar, Nepal. With their heads up and gaze focused forward, the students were propped up on the chair and facing forward. The palpebral fissure, or elliptical spaces between the upper and lower eyelids, terminates at the canthi. The students were given clear instructions on how to take measurements and were cautioned not to move their heads while doing so. The measurement was done in a room with good lighting. Using a straight vernier caliper, ICD was measured in millimeters from the medial angle of the palpebral fissure in one eye to the other. From one eye's lateral angle to the other eye's lateral angle, OCD was measured.

Then, CI was determined using the formula:

$$CI = ICD/OCD \times 100$$

The Statistical Package for social sciences (SPSS) 20.0 version was used to enter the data. Descriptive analysis was used in the computations to obtain the means, percentages, and numbers.

RESULTS

Out of the 192 students, 84 were female and 108 male students. 64 students who participated in the study were from India and 128 from Nepal. Out of the total Indian students, 32 were male and 32 female subjects, and among the Nepali students, 72 were male individuals and 52 females.

The mean canthal index was found to be 17.93 ± 3.13 . The mean OCD and ICD were found to be 110.66 ± 12.34 and 19.85 ± 4.24 respectively (Table 1).

Table 1: Mean and SD of OCD, ICD and CI in total participants

Parameters	Mean \pm SD
OCD	110.66 ± 12.34
ICD	19.85 ± 4.24
CI	17.93 ± 3.13

Table 2 depicts the mean value of craniofacial anthropometric parameters amongst males and females. The mean value of the canthal index for male students was found to be 17.73 ± 2.82 and that for the females was found to be 18.19 ± 3.50 . The OCD and the ICD for male students were found to be 113.11 ± 13.15 and 20.06 ± 4.00 respectively. The OCD and the ICD for female students were found to be 107.50 ± 10.46 and 19.60 ± 4.54 respectively.

Table 2: Mean and SD of OCD, ICD and CI in male and female students

Parameters	Male	Female	p-value
OCD	113.11 ± 13.15	107.50 ± 10.46	0.00*
ICD	20.06 ± 4.00	19.60 ± 4.54	0.45
CI	17.73 ± 2.82	18.19 ± 3.50	0.32

* $p < 0.05$ denotes statistical significance

Table 3 shows the mean value of craniofacial anthropometric parameters amongst Nepali and Indian students. It was found that the CI for the Nepalese students was 17.85 ± 3.21 and that for the students with Indian nationality was 18.09 ± 2.99 . Furthermore, the OCD and ICD for the students with Indian nationality was found to be 109.28 ± 11.57 and 19.84 ± 4.28 respectively and the OCD and ICD for the students with Nepalese nationality were found to be 111.34 ± 12.69 and 19.86 ± 4.23 respectively.

Table 3: Mean and SD of OCD, ICD and CI in Nepalese and Indian students

Parameters	Nepali students	Indian students	p-value
OCD	109.28 ± 11.57	111.34 ± 12.69	0.27
ICD	19.84 ± 4.28	19.86 ± 4.23	0.98
CI	17.85 ± 3.21	18.09 ± 2.99	0.61

DISCUSSION

The physical dimensions and forms of the human body are measured in anthropometry. Numerous factors, including genetics, age, sex, and environmental conditions influence it. This aids in understanding the variations in racial biological makeup. Any indigenous ethnic group's standard value can be helpful in the assessment and identification of craniofacial deformities. Additionally, congenital or post-traumatic abnormalities of the craniofacial regions can be treated and rebuilt with this. From the present study, it was observed that the overall canthal index was 17.93 ± 3.13 . In a similar study carried out by Manandhar B., they reported

that the overall canthal index was found to be 33.29 ± 2.37 which was very high when compared with the findings of the present study.⁵

The canthal index of the male subjects was found to be comparatively lower than that for the female subjects. The present study showed that the inner canthal distance for the males were found to be greater than the female subjects. These findings were quite comparable with the findings of Jaja et al.³. Authors like Shah et al., and Radha et al. from their study reported slightly higher values of inner canthal distance whereas some authors like Oladipo et al., Manandhar B, Oyinbo et al., Anibor et al., and Ogoun TR reported relatively very high values of inner canthal distance in male subjects from their studies while comparing their findings with the findings of the present study.^{1,2,4-8}

From the present study, it was found that the outer canthal distance for the male and female students was 113.11 ± 13.15 and 107.50 ± 10.46 respectively. These findings were similar to the findings of Jaja et al., Oyinbo et al., Anibor et al. whereas Ogoun et al.^{3,6-8} from their study reported comparatively higher mean outer canthal distance for male and female subjects. Higher mean outer canthal distance might be a sign of particular evolutionary features in some populations, providing information about genetic drift, adaptation to environmental conditions, and ancestral migration patterns. It can be used in surgery to help achieve aesthetic goals for facial attractiveness.

The results of the current investigation were not as high as those published by Osunwoke et al. for the male students, who had an OCD of 92.49 ± 6.30 mm, and for the female students, 91.96 ± 5.81 mm.⁹ This was supported by the findings of various other researchers like Vasanta et al., Nausheen et al., Manandhar B, Yadav et al., Cem et al., Osunwoke et al, Adhikari et al.^{5,9-14}

The present investigation yielded an overall CI of 17.93 ± 3.13 , whereas the corresponding values for the male and female students were 17.73 ± 2.82 and 18.19 ± 3.50 , respectively. Our results were corroborated by those of Jaja et al., who found that the male and female subjects' CI were 17.84 ± 2.74 and 20.04 ± 5.92 , respectively.³ In contrast, most other researchers found significantly higher values of CI when compared to the results of this study.³ Genetic and environmental variables can be attributed to gender disparities in canthal measures.²

The values of ICD, OCD, and CI for the Nepalese and Indian students were quite comparable and no significant difference was noted in the values of these variables. The reason behind this might be because most of the Indian

and Nepalese students who have participated in the study belongs to the same Aryan race. When comparing these findings with the findings of other tribes; it was interesting to see that the CI for various tribes was much higher than the findings of this study.

A study carried out in the Ikwerre tribe showed that the ICD, OCD, and CI for the male subjects were found to be 33.9 ± 3.0 , 91.18 ± 6.5 , and 37.00 ± 2.48 respectively.⁴ The findings of this study were supported by the findings of the study carried out among the Isokos, Ijaws, and the Australoid tribe.^{7,9,10} The findings of the study carried out by Cem et al. in Turkish were comparatively lower than these studies.¹³ However, these findings were comparatively much higher than the findings of the current study.

From a study done in the Ikwerre tribe, it was found that the ICD, OCD and CI for the female students were 33.8 ± 3.3 , 93.1 ± 7.5 and 36.46 ± 3.11 .⁴ These findings were supported by the findings obtained from various studies carried among the other tribes such as the Isokos, Ijaws and the Australoid.^{7,9,10} All these findings were comparatively very high when comparing the findings of the present study done in the Nepalese and Indian students. Also in contrast to the findings of these studies, we found that the CI in female subjects was comparatively higher than the male subjects. The discrepancy in the findings of our study and the other studies might be due to the geographic variations and genetic composition of the population involved in the study.

The canthal Index for both male and female subjects was found to be highest in the African- American population; 38.38 and 38.50 respectively, followed by the Indians, Caucasian, Ijaws, Igbos, Ibibios, Mongoloids and Ejaghams.¹⁵⁻²¹ These findings were very much higher than the findings of the present study whereas the findings of the studies done among the Urhobos, Itekiris and Latvians were quite comparable to the findings of the present study.²²⁻²³

Across several domains, the CI is an important metric that offers insightful data. Medical diagnosis, comprehension of human variation and evolution, surgical intervention planning and evaluation, and the manipulation of facial beauty and communication judgments are all aided by it.

The differences in CI and other craniofacial indices between and within populations can be attributed to gender, hereditary, and environmental causes. The findings of this study will be highly helpful in the fields of anthropology, forensic medicine, surgery, and ophthalmology. They will also provide a foundation for future estimates of the Nepalese population's CI.

The shortcoming of the present study remained that though the subjects of different nationalities were included in this study, their race and geographical habitat were moreover similar. So, it is recommended to conduct a similar kind of study among the population of this region with a higher sample size and classify the population based on race and geographical habitat.

CONCLUSIONS

The present study shows that there were no any significant differences in the ICD and OCD as well as the CI of the students of Nepalese and Indian nationality. The similarity of race and geographical habitat patterns among the Nepalese and Indian participants of this study might have contributed to such findings.

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AUTHORS' CONTRIBUTION

DKS contributed to the conceptualization of the study, data collection, manuscript preparation, and editing. SB contributed to data analysis and manuscript preparation. SK contributed conceptualization and editing. SM contributed to conceptualization and data collection. MJ contributed to data collection and editing. NS contributed to manuscript preparation and editing. Final editing and confirmation have been given by all authors.

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