The shapes of the eyebrow and upper eyelid are distinctive facial landmarks. In cosmetic and reconstructive procedures, maintenance of the anatomical relations of these landmarks ensures a pleasing postoperative appearance. However, there are significant differences in the structure and anatomy of eyelids according to age and race. Numerous studies have gathered data on normal values for various dimensions of the eyelid and palpebral fissure. Establishing a range of normal values is important in formulating a preoperative plan for an aesthetic oculoplastic procedure, as well as in diagnosing and treating abnormalities related to globe projection, trauma, and congenital deformities such as telecanthus and hypertelorism. Furthermore, the normal values for interpupillary distance (IPD) are useful in the diagnosis of various syndromes and in surgeries after craniofacial trauma.

The majority of previously-published work has concentrated on establishing normal values for globe appearance and position in the Caucasian and African (or African-American) populations. Farkas studied patients from various races and ages to establish norms, which he published in his textbook on anthropometry. There are several reports regarding anthropometry of the Asian eyelid, but the articles published so far are concerned with measurements for only a specific age group or anatomical area.

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Furthermore, these cases of “Asian eyelids” were referring to patients from the Oriental population.

Our experience suggests that aesthetic procedures of the periorbital region have gained tremendous popularity in the last few years, and India has seen an upsurge in the demand for aesthetic surgery procedures over the past decade. A growing economy and an increasing awareness have contributed to this growth in demand. However, no specific data are available for Indian patients, and the current standards are largely influenced by Western studies. As a result, there has been inevitable reference to the Western statistics for blepharoplasty, including double-eyelid surgery and ptosis correction. Although they may not be important for unilateral ptosis surgery, the normal anthropometric values for Indian eyelids assume significance for bilateral surgeries, including blepharoplasty and reconstruction.

In this study, we attempt to establish normal values for eyelid anthropometry in the Indian population, in the hope that this data will provide norms specific to this ethnic population and serve as a reference for similar studies in the future.

METHODS

This prospective study included 216 volunteers (110 men, 106 women) between the ages of 16 and 60 years. Patients who had a history of orbital disease, trauma, facial surgery, or congenital deformities were excluded from the study. Participants were divided into three groups by age: Group A, 16 to 30 years; Group B, 31 to 45 years; and Group C, 46 to 60 years.

All patients were photographed on frontal view by a digital camera (Cannon SX120 IS). A 15-cm clear plastic ruler was placed just below the eye before the photograph was captured. Special care was taken to align the camera with the axial plane of the eye. Participants were instructed to keep their heads level and eyes straight ahead. They were also instructed to avoid any voluntary or involuntary facial movement that might compromise the periorbital area. Each participant gave informed consent, but for the purpose of this study, only patients’ eyes were captured in the photographs rather than the full faces (to protect the participants’ identities). The standardized experimental procedure previously described by Astley and Clarren5 was followed to measure the required parameters—namely,

- the distance between the medial canthus and the lateral canthus (ie, the horizontal dimension, or width, of the palpebral fissure),
- the distance between the open upper eyelid margin and the lower eyelid margin (ie, the vertical dimension of the palpebral fissure),
- the intercanthal distance (ICD),
- the IPD, and
- the height of the open upper lid (ie, the perpendicular distance between the highest point of the open upper eyelid margin and the lower margin of the eyebrow) (see Figure 1).

All measured values were calculated by mean and standard deviation for statistical analysis. An independent t-test was performed between adjacent age groups to determine any significant difference ($p < .05$). Each parameter of the upper eyelid was also analyzed by age group and sex.

RESULTS

Palpebral Fissure Width

The mean value for the horizontal dimension of the eyelid was less in men than women ($32.3 \pm 2.2\, \text{mm}$ vs $33.7 \pm 1.8\, \text{mm}$) (see Figure 2). Among the age groups, there was a significant increase in value from Group B (31-45 years) to Group C (45-60 years) ($p < .05$).

Vertical Dimension of the Palpebral Fissure

The mean value of the vertical dimension was $12.3 \pm 1.7\, \text{mm}$ for men and $11.7 \pm 1.6\, \text{mm}$ for women (see Figure 3). There was no significant decline in value among the age groups.
Intercanthal Distance

The ICD was 32.8 ± 1.7 mm for men and 32.7 ± 1.5 mm for women (see Figure 4). The ICD showed a significant decrease from Group A (16 to 30 years) to Group B ($p < .05$). A significant increase was observed as patients’ age progressed beyond 45 years ($p < .05$).

Interpupillary Distance

The IPD was 64.2 ± 2.2 mm for men and 63.1 ± 1.8 mm for women (see Figure 5). There was a significant decrease in the IPD as the participants’ age increased, from Group A to Group B and from Group B to Group C ($p < .05$).

Height of the Open Upper Eyelid

Eyelid height was 10.5 ± 0.8 mm for men and 9.3 ± 1.1 mm for women (see Figure 6). There was a significant increase in the height on comparison of all three Groups, from Group A to Group B and from Group B to Group C ($p < .05$).

DISCUSSION

There are few reference books and sparse literature regarding anthropometry of the Asian eyelid. Moreover, the studies conducted in Asia have been limited to the Oriental population. This dearth of literature reveals an urgent need to establish reference values for the eyelid in the Indian population. We believe that the present study serves not only to establish normal values but also to provide a denominator for any future study of this topic.

Nunes et al. compared the various methods for measurements of the palpebral fissure. They found no significant difference between measurements done manually and digitally and thus concluded that results obtained by photogrammetry of digital images are as reliable as direct measurement. Astley and Clarren standardized the method for such measurements, as used in the present study.

Palpebral fissure width (PFW) is important for the overall size and appearance of the eye. Adler reported a mean value of 25 mm in a heterogenous population. Farkas et al. reported a mean value of 31.0 mm in Caucasian adults of both sexes. Numerous studies have been reported from Korea regarding such anthropometric measurements; these studies have been largely referred to as “prototype studies” in the Asian population. Baek et al. reported a mean value of 29.1 mm in adults. Park et al. reported mean values of 29.7 mm in men and 28.4 mm in women. Cho et al. reported values of 34.2 mm in men and 33.4 mm in women. Park et al. found slightly lower values, 27 mm in men and 26.8 mm in women. Their data suggest that the PFW reaches its peak level of growth by 10 to 13 years of age.

![Figure 3. Vertical dimension of the palpebral fissure by age group and sex.](image1)

![Figure 4. Intercanthal distance by age group and sex.](image2)

![Figure 5. Interpupillary distance by age group and sex.](image3)

![Figure 6. Height of the open upper lid by age group and sex.](image4)
The present study estimates the PFW in Indian adults to be 32.3 mm for men and 33.7 mm for women. Our results indicate that the PFW is higher in women than in men. This is in sharp contrast to other studies, where men have been shown to have a higher palpebral width. Our PFW decreased from Group A to Group B, but this decrease was not statistically significant. Only after the age of 45 years was a significant increase was seen in the PFW. However, on analysis by sex, the trend of increasing PFW was present in both men and women, but the increase was statistically significant in men only.

The vertical dimension of the palpebral fissure has been extensively studied in various racial groups. Moses reported peak values of approximately 8 to 10 mm, with no significant difference between Caucasians and Africans. Duke-Elder reported a mean value in the Western population of 9 to 13 mm. In Asia, Jung and Hong reported mean values of 8.2 mm in Korean men and 8.5 mm in women. Cho et al. studied Asians who were 18 years of age and reported that the vertical height of palpebral fissure in men and women was 8.2 mm and 8.5 mm, respectively. In another Korean study, Park et al. reported values of 8.0 mm in men and 8.2 mm in women, with no significant difference according to sex.

The mean vertical dimension in our study was 12.3 mm for men and 11.7 mm for women. There were no significant changes observed in the vertical height of the palpebral fissure with age and no significant variation with regard to sex. From these results, the vertical height of palpebral aperture in India apparently resembles the Western literature more than it does the Asian literature, so the values calculated in the Oriental population do not apply to Asia as a whole.

Barretto et al. studied racial variation in the ICD. They reported the mean ICD as 35.8 mm and 35.5 mm for African-American and Caucasian men, respectively. The corresponding values for women were 34.1 mm and 32.9 mm. Asian studies have also shown values of ICD in the same range as that reported by Barretto et al. Kim et al. reported a mean value of 37.4 mm in men and 35.9 mm in women. Park et al. reported a mean value of 36.3 mm in men and 33.4 mm in women. Hwang and Baik reported that the mean ICD was 34.0 mm in “beautiful” women and 36.7 mm in “plain” women. Cho et al. reported mean values of 35.3 mm for men and 35.5 mm for women. A study conducted in India by Gupta et al. found ICD values to range from 20 to 36 mm in men and women. In an Indian study by Goel et al., the mean ICD was reported to be 31.4 mm in adolescents aged 13 to 14 years. To the best of our knowledge, however, no study from India has reported all the aesthetic parameters analyzed in our study in an adult group.

Park et al. reported that the ICD increases rapidly between one and four years of ages and gradually until completion, between the age of 10 and 14 years. A study conducted by Park et al. showed that men and women reach a specific level of ICD by 14 to 16 years of age and that the level increases slightly after their sixties. The mean ICD value in our population was 32.8 mm for men and 32.7 mm for women. No significant change was observed in the ICD between Group A and Group B. However, the ICD increased significantly after the age of 45 years, which is in concordance with other studies.

Barretto et al. reported a mean IPD of 68.9 mm and 65.9 mm for African-American men and women, respectively. In the same study, the mean IPD was 65.15 mm and 61.47 mm for Caucasian men and women, respectively. The study conducted in India by Gupta et al. showed an IPD in the range of 46 to 70 mm for men and 46 to 75 mm for women. Goel et al. reported a mean IPD of 53.9 mm in their teenage population. Kim and Ham reported 59.9 mm in men and 63.5 mm in women. Hwang and Baik reported 63.5 mm for “beautiful” women and 63.6 mm for “plain” women. Park et al. reported 64.4 mm in men and 63.6 mm in women. Cho et al. reported 69.4 mm in men and 66.6 mm in women. Our study also confirmed that men had a slightly higher IPD value than women (64.2 mm vs. 63.1 mm). There was also a significant decrease in mean IPD as age increased.

Kim and Ham reported a mean value of 18 mm for the vertical dimension of the upper eyelid in Asian men and women aged 12 to 26 years. The Korean study conducted by Park et al. reported mean values of 12.3 mm in men and 12.5 mm in women for open eyelids, with no statistically significant difference according to sex. In our study, we found the vertical dimension of the upper lid to be 10.5 mm for men and 9.3 mm for women. There was a significant decrease in value as age increased across all study groups. The height of the upper eyelid was also significantly higher in men than in women.

Because we did not select the samples at random or consider population distribution in the process of sampling, it is doubtful that our measured results represent the entire Indian population. However, because the current literature lacks objective data for this ethnic group and relies heavily on calculations from Western patients, we believe that our data are important in establishing a baseline for normal eyelid values in this population and thus providing a useful foundation for future studies.

CONCLUSIONS

In this study, we calculated values for various aesthetic parameters of the palpebral aperture and upper eyelid in an Indian population. Of note, our values differed from the results of other ethnic groups in that the PFW in Indian men was lower than it was in Indian women. Overall, changes in the eye appear to be more pronounced after the age of 45 years, including an increase in the PFW, the ICD, and the height of the upper lid, along with a decrease in the IPD.

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