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Original Research Article

Facial Width and Inter-Pupillary Distance - A Useful Tool for Superimposition Technique

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Abstract

Craniofacial superimposition technique was used for identification, when a skull of a missing person is recovered, by comparing with ante-mortem photographs or video. Parameters like inter-pupillary distance and bizyomatic width/ facial width of the human face are used in the superimposition technique in order to identify a missing person. The study was conducted to find out the mean facial width and mean inter-pupillary distance separately in both males & females and correlation between these parameters. This study was conducted in 100 healthy subjects (50 males & 50 females) in the age group of 19 to 22 years at the Himalayan Institute of Medical Sciences, Uttarakhand. Interpupillary distance (IPD) and facial width (FW) were measured by means of vernier callipers. The data was compiled and analyzed by computer software SPSS version 20. Among the females, descriptive analysis of quantitative data showed that the mean IPD was 4.8272 ± .37395, mean FW was 12.4240 ± .69151 and Pearson Correlation coefficient was 0.168. Among the males, mean IPD was found out to be 5.9365 ± 0.37072, mean FW was 16.8290 ± 1.11108 and Pearson Correlation coefficient was 0.216. The mean value of both, IPD and FW were higher in males as compared to females.

A weak correlation was found in both sexes and no statistically significant correlation was found in face width and Interpupillary distance in both males and females as the p value for male was 0.133 and for female it was 0.245.

Keywords*: Anthropometry, Interpupillary distance, Facial width, Vernier calliper, Superimposition technique*

Introduction

Forensic Anthropology is the application of physical anthropology in a legal setting, usually for identification of recovered skeletonized human remains.[1,2,3] It was first mentioned by Professor Brash in 1935 that missing persons can be traced by matching antemortem photograph and skull of the deceased as an identification technique.[1] This technique of craniofacial superimposition which compares photographs or video shots of missing person with the recovered skull remains can be found to be more beneficial if measurement of interpupillary distance and bizygomatic width/ Facial width of human face are included. Thereby, anthropometry could be used to help the law enforcement agencies in establishing personal identity, in cases of unknown human remains.

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Interpupillary distance is the distance between the centre of pupils of both eyes which varies mainly by 3 major factors i.e. race, gender and age and it remains nearly constant after the age of 14 years.[4-6] Mean interpupillary distance has been quoted in the stereoscopic literature as being anything from 58mm to 70mm.[7] Face width as such does not have significant medico legal importance but it is used as a factor in facial framework and certain plastic surgeries.[8] It too depends on factors such as genetics, age, gender, race as well as on environmental factors.[9]

Materials and Method

The study was descriptive, observational and cross-sectional in nature, carried out in the Himalayan Institute of Medical Sciences, Dehradun during July-October 2015. A total of 100 subjects (50 males and 50 females) were selected; demographic information like age and sex was recorded. The age ranged between 19 and 22 years. The individuals with conditions like history of craniofacial trauma, squint and congenital abnormalities of face or surgery of the eye were excluded from the study. Informed consent was duly taken from all the subjects for using their data in research.

For measuring the interpupillary distance, participants were seated comfortably in an upright position and asked to look straight. The measurements were made from the mid pupil of one eye to the mid pupil of other eye using a manual vernier calliper with 0.02 mm accuracy. Facial width was measured according to the bizygomatic width (the distance between the most prominent points on bilateral zygomatic arches). The subject was made to sit in a chair with the backrest, head positioned normally. The two cardboard plates were placed vertically touching the most prominent points on bilateral zygomatic arches either side, horizontal distance between the two plates were measured using a metric scale.

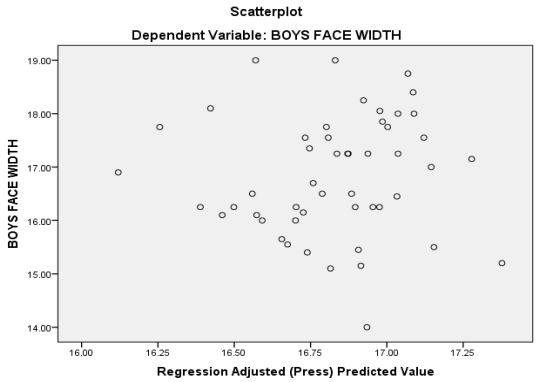
Each parameter was measured two times and the average value was computed and recorded.

Observation and Results

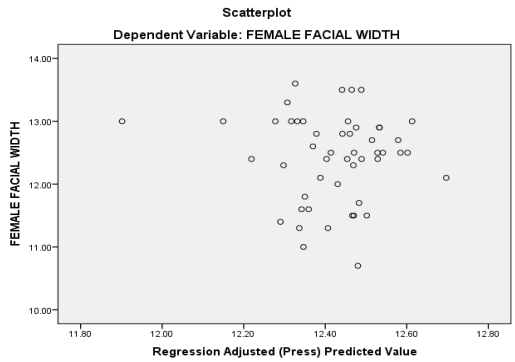
Table 1: Descriptive analysis of various parameters in both sexes.

SEX	PARAMETER	MEAN	STANDARD DEVIATION	PEARSON CORRELATION	P VALUE
MALES	Interpupillary Distance	5.9365	.37072	.216	.133
	Face width	16.8290	1.11108		
FEMALES	Interpupillary Distance	4.8272	.37395	.168	.245
	Face width	12.4240	.69151		

As depicted in table no.1 above, mean Interpupillary Distance in males (5.9365 ± 0.37072) is more than females (4.8272 ± 0.37395). Also, mean Facial Width in males (16.8290 ± 1.11108) is more than that in females (12.4240 ± 0.69151). The Pearson Correlation of males (0.216) and females (0.168) showed a weak positive correlation and p value in both males (0.133) and females (0.245) were found to be more than the level of significance (0.05). Hence, null hypothesis was accepted and it was found that there is no statistical significant correlation. The same findings were corroborated in scatter diagram of both males and females which showed weak positive correlation as showed in graph no.1 and 2.



Graph 1: Scatter diagram of facial width in males



Graph 2: Scatter diagram of facial width in females

By regression analysis of the quantitative data, regression equations were derived as depicted in table 2, where the Interpupillary distance is being considered as an independent variable and Facial Width as a dependant variable. If the value of Interpupillary distance is entered, by this regression equation value of face width can be predicted or vice a versa.

Table 2: Regression equation for male and female

Regression equation for Male	Y(Male Facial Width) = 12.995 + .646 * X where *X is Male Interpupillary Distance (a = 12.995, b = .646)
Regression equation for Female	Y(Female Facial Width) = 10.927 + .310 * X where *X is Female Interpupillary Distance (a = 10.927, b = .310)

Discussion

The mean IPD for males is found to be more than that for females. This is consistent with the study of various authors.[7,9-14]However, study of H NS et al[15] is not consistent with the present study; variation in the result as compared to present study could be attributed to factors in current study such as smaller sample group, single race & restricted age group.

In present study, both male (0.216) and females (0.168) showed a weak positive correlation between interpupillary distance and facial width and the p value in both males (0.133) and females (0.245) were found to be more than the level of significance. Some studies have been conducted which failed to establish correlation between interpupillary distance and anterior teeth[16] or anterior teeth to bizygomatic width.[18] However, a study similar to present study was conducted by Latta GH et al but, no correlation was found between these widths for the population as a whole, nor when the population was further divided into race, sex, or group.[17]On the other hand, it is also known that the value of IPD, Inner Outer Inter Canthal Distance (IOICD) and other orbital measurements are strongly and positively correlated.[15,19,20] Though, statistically both the variables in present study are not found significant, regression equation thus obtained by these values can be used for deriving inter-pupillary distance or face width when either of the two is known.

One of the most reliable tools for identification in cases of skull remains where DNA or fingerprinting is not possible is the superimposition technique. This involves enlarging the comparison photographs to the size of unknown skull and then positioning the skull in the same orientation as the facial photographs followed by testing for the agreement between distances of certain anatomical points in the photograph as well as skull.[22]The calculation of values of facial/ bizygomatic width and IPD thus play an important role in this technique which can be similarly used as one of the important parameters for cross matching. However, elaborate studies are still required to test their use in skeletal remains.

Conclusion

In India, superimposition is mainly employed in situations where investigation has suggested that a set of remains relates to a particular missing person whose photograph is made available. Generally, this technique is best used for exclusion as the issue of reliability in these comparisons for making positive identification is commonly debated among researchers.[22]However, if the morphological features are unique, it becomes more valuable when it is coinciding with other data of identification.[23] In this era of advanced technology, the craniofacial superimposition technique can prove to be more beneficial if measurement of interpupillary distance and bizygomatic width/facial width of human face may be integrated with them, in order to establish the identity.

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