Influence of Age and Gender on Interpupilary Distance and Comparison of PD Ruler and Auto Refractometer Values of Interpupillary Distance

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Abstract: *Information about the normal values of interpupillary distance (IPD) for particular age group, gender, and ethnic background has important clinical implications. Normative values of IPD could be useful in the diagnosis of certain syndromes and also in surgery after facial trauma. Our main aim to carrying out this study was to find out the effect of gender and age on interpupillary distance in a total study sample of 30 subjects within the age limit of 15 to 60 years and IPD measurements were compared taken with two different instruments i.e. PD ruler and auto refractometer. Data was collected using descriptive cross-sectional study at Ophthalmology Department at Medina Teaching Hospital, Faisalabad. Proper room for examination with all instruments that were used in the study was chosen after history taking. With Torchlight, we examined that the pupil is round, regular and reactive. Then IPD values were measured using a millimeter PD ruler and auto refractometer. Our study results show that gender has an effect on IPD measurements and also that males have 3mm wider papillary distance than females. Our study subjects were divided into 3 age groups and IPD in younger age (15-30 years) group keep on increasing, afterward, it remains constant. And another object of our study was to compare IPD values with different instruments i.e. PD ruler and auto refractometer used and results are significant. It is suggested that IPD should be an integral part of an eye examination to avoid any future intolerance of spectacles and asthenopic symptoms.*

Keywords: Interpupillary Distance, PD Ruler, Auto Refractrometer, Pupil Round, Regular and Reactive, Age, Gender.

INTRODUCTION

Optometrists, through their clinical education, training, experience, and broad geographic distribution, provide primary eye and vision care for a significant portion of the public. Optometrists are often the first health care practitioners to diagnose patients with accommodative or vergence dysfunction (Cooper J.S et al. 2010).The eye is an organ that detects light and sends signals along the optic nerve to the brain. In humans, the eye is a valuable sense organ that gives us the ability to see. It allows for light perception and vision, including the ability to differentiate between colors and depth. Although small in size, the eye is very complex organ. The eye is almost 1 inches wide, 1 inch deep and 0.9 inches tall. The human eye has a 200-degree viewing angle and can see 10 million colors and shades (Bedinghaus T, 2016). The clinical importance of IPD is to facilitate the correct positioning of ophthalmic lenses before the eyes to eliminate unwanted strain on the eyes due to induced prismatic effects from the lenses. For the principal view distances of far and near, there exist specific points on the lenses which have to coincide with the center of the pupil (visual axis) of each eye. As such, for the fitting of ophthalmic lenses, both the IPD for far and near are necessary. This is especially true when multifocal lenses are to be dispensed. Interpupillary distance has been defined by various authors as the distance between the centers of the pupils in millimeters. The main reason for measurings the interpupillary distance is to align the optical centers of ophthalmic lenses, on the visual axis of each eye. Failure to do so results in an unwanted induced prismatic effect which may lead to eyestrain and asthenopia. The optical center of each lens should accurately position to the pupil of the wearer's eye. It gives the best vision for distance or also plays a role when you use lenses for reading. When you read, you turn your eyes in and down or converge on your book so special reading glasses with an appropriate optical center with each lens required. When wearer does not look from the OC it may cause eyestrain, diplopia, asthenopia headache or the patient complain of non-tolerance towards the spectacle. For the accurate centration of the spectacle lens, two important guidelines should be taken into account are IPD of the patient and the frame dimensions. Apart from that prismatic effect will be induced. To avoid this, IPD is taken (Moodley et al. 2011). The interpupillary distance is also influenced by several components; which also influence

stereopsis indirectly. Before we can discuss these factors, first we should know what IPD is. Interpupillary distance (IPD) is the distance between the centers of the pupils. It obviously determines the stereo separation of the two images which are combined in the brain to produce stereo perception. The factors Influencing IPD are gender, race, and age. Mean IPD is important in the design of stereoscopic display devices and the production of stereoscopic content (Shafiee.D et al. 2014). A study was carried out at Ophthalmology Department Madina Teaching Hospital Faisalabad. It was a descriptive cross-sectional hospital-based study. The study sample of 30 subjects between the ages of 12 years of age to 60 years of age. The convenient sampling technique was used to collect the data for the duration of January 2017 to March 2017. The purpose of our study was to measure interpapillary distance (IPD) according to gender and age. The objective of our project was to find the relation of inters papillary distance and age & interpapillary distance and gender

RESULTS

The study was planned to find out the effect of gender and age on interpupillary distance in a total study sample of 30 subjects. And IPD measurements were compared taken with two different instruments i.e. PD ruler and auto refractometer. Analysis table from SPSS shows that the range, mean and standard deviation of all groups of data set. The age limit was from 16 to 60 with 37.7 mean and 14.6 standard deviation. IPD values were with auto refractometer range from 57-72 with 62.56 mean and 3.97 standard deviations. IPD values with PD ruler range from 56-71 with a mean value of 62.6 and 3.96 standard deviations.

MEAN AND STANDARD DEVIATION

	N	Minimum	Maximum	Mean	Std. Deviation
InterPupillary Distance with AutoRefractometer	30	57.00	72.00	62.5667	3.97131
InterPupillary Distance with PD Ruler	30	56.00	71.00	62.6000	3.96189
Age	30	15	60	37.70	14.598
Valid N (listwise)	30				

Statistical analysis shows that values of t-test are significance which means that gender and age has an influence on IPD measurements with 95% confidence interval for IPD with an auto refractometer. After finding out the relationship between these two instruments, a t-test was applied. Significant results between IPD with an auto refractometer and PD ruler means that values taken from different instruments vary with each other.

AGE CATEGORIZE * INTERPUPILLARY DISTANCE WITH

AUTO REFRACTROMETER CROSS TABULATION

Age Category	Interpupillary Distance with Auto refractometer										Total
	57	59	60	61	62	63	66	67	68	72	
15-30yrs	2	1	2	2	2	3	0	0	1	0	**13**
31-45yrs	1	0	3	2	0	1	0	1	1	1	**10**
64-60yrs	0	0	1	1	1	1	1	0	1	1	**7**
Total	3	1	6	5	3	5	1	1	3	2	**30**

Above given table 10 shows the effect of age on IPD values, that it increases in younger age and remains constant afterward.

DISCUSSION

The study was planned to find out the effect of gender and age on interpupillary distance in 30 sample size collected from Medina Teaching hospital. And IPD measurements were compared taken with two different instruments i.e. PD ruler and auto refractometer. The results show that gender has an impact on IPD measurements. With the mean value of IPD 63.4± 4.0 and the males have wider IPD than females on the average 3mm. This correlates to the results of Yildirin (2015) showing that the mean value of IPD was observed of 756 subjects aged 19 o 89 years to be significantly higher in males compared to females(P<0.001). IPD increased by 4.19m in males and 3.11mm in females from the young adults to older adults These results are similar to other studies conducted in subjects aged 1 months to 19 years in the USA, that IPD value of male was found to be 1.58mm higher than that in females. (MacLachlan, C &Howland, H.C 2002). A study conducted in Arab population by Osubeni (1993) also similar results. In this study provided the average value and range of values of normal IPD for Arab boys, young adults, and older adults. Arab males have IPD on the average 2mm wider than female. In our study, we divided our study subjects (30) into four groups i.e. 15-30 years (13 subjects), 31-40 years (10subjects) and 46-60 years (7 subjects) and effect of IPD values was observed. In group 15-30 years IPD values are from 57-68mm and in other two groups IPD varies up to 72mm and more that shows IPD increases with advancing age. Variation in IPD is 4mm on the average. Another study results by Kumah et al. (2016) including 500 subjects

aged 10-20 years showed that mean IPD increase with age. The mean IPD increase by 60% from 40mm in newborn to about 60mm in adults. It has been reported that most of this change occurs in the first years of life continuing to the age of 17 years and probability to age 30 years. In our study, we used PD ruler and auto refractometer to compare IPD values of 30 subjects categorized into 3 groups on the basis of age. Our results analyzed by using correlation showed strong positive effect with value 1-.94 that means different experimental techniques effect IPD values. To find out significant results we applied t-test that gives give of.00 means that IPD measured with different instruments gives different values. This study correlates to Kumah et al. (2016) including 500 subjects aged 10-20 years. He used manual IPD measure with PD ruler and digital IPD measure with PD ruler and concluded that the use of pupillometer allows an advantage of measuring monocular PD's more accurately compared to the PD ruler. A study conducted in Arab population by Osubeni (1993) also similar results. In his, he studies provided the results that different experimental techniques and ages of subjects make conclusive statements about the ethnic variation of IPD difficult. There were some limitations of our study that age group was considered only 15-60years that were smaller than other studies regarding interpupillary distance. Because of this, we could not prove an already proven relationship between Interpupillary distance and age. Ocular pathology patients were not included that effects interpupillary distance measurements. Anisocoric, Strabismic, and abnormal pupil shape subjects were not considered in our study. Another limitation was time bounded.

CONCLUSION AND RECOMMENDATION

The present study was to determine the effect of interpupillary distance on age and gender and comparison of two instruments used for interpupillary distance measurement. Our study results showed that gender and age had a significant effect on interpupillary distance. Gender has an influence on interpupillary distance measurements, that males have more pupillary distance than females. This study shows a significant increase in interpupillary distance in children and adults below 20 while it remains almost constant in adults over 20. It is evident that absolute value of IPD increases with age at least until the 3rd decade of life. The study shows that different experimental techniques hinder the generalization of interpupillary distance values. The present study suggested that the patient should be checked by skill full optometrist for proper evaluation of interpupillary distance and make it an integral part of an eye examination to avoid any future intolerance of spectacles and asthenopic symptoms. It is recommended that future study should include age below 15 years that is developmental age and interpupillary distance should be evaluated as it increases with advancing age. Interpupillary distance knowledge may be useful in studying orbits-cranial growth pattern. Syndrome diagnosis, surgical management of craniofacial deformities and trauma, manufacture of optical frames and lenses.

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