Original Article

Evaluating the Pupillary Distance in an Iranian Population and its Relation with Age, Sex and Refractive Errors

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Abstract

Purpose: To find the mean value of pupillary distance and to evaluate the effect of age, sex and refractive errors on this distance in an Iranian population.

Patients and Methods: In this study 703 individuals (403 women and 300 men) referred to the optometric department of Hazrat Khadijeh Clinic, Karaj, Iran, were selected. Subjects were divided into different age groups, pupillary distance was recorded after complete optometric examination, by a ruler while the patient was looking at target at a distance of 60 cm.

Results: The mean age of participants was 31.07 ± 16.63 years. The mean pupillary distance was 59.2 ± 3.88 mm. Refractive errors had no statistically significant effect on pupillary distance and this distance was significantly greater in men than women ($P < 0.001$). The pupillary distance also increased with age.

Conclusion: Similar to previous findings pupillary distance was affected by sex and age in an Iranian population. Refractive errors had no statistically significant effect on pupillary distance.

Introduction

The distance between the two eye pupils is called the pupillary distance. This distance between the pupils of the two eyes causes the eyes to send two separate images to the brain and combination of these two images into one image in brain creates the sense of depth and dimension [1,2]. Knowing the normal amount of pupillary distance in a specific population is important for diagnosis of some syndromes, determining orbital-cranial growth patterns, and surgical management of traumatic and deformity induced maxillofacial changes [3,4], selecting and fabricating dentures [5], and making suitable glasses and optics devices [6,7]. In designing and fabricating lens systems, especially dual vision and multi vision lenses, the pupillary distance should be exactly aliened with the center of the optical lenses to eliminate unwanted prism effects and reduce eye complications such as fatigue, headache and nausea [8,9]. This distance varies among people from different racial, age, and gender groups [10]. So far, very few studies have been performed among the Iranian population to evaluate the normal amount of pupillary distance. The aim of the present study was to evaluate the mean amount of pupillary distance and its relation with age, sex and refractive errors in an Iranian population.

Patients and Methods

This cross sectional study was conducted in the winter of 2015 in the optometry department of Hazrat Khadijeh Clinic, Karaj, Iran. Karaj has been called the little Iran for the sake of people living in the city coming from all regions of Iran. In the present study informed consent was obtained from all participants and the study was approved by our institutional ethics committee. The refractive errors were measured using Topcon RM-6000 (Topcon

Corporation, Tokyo, Japan). We used visual axis to determine pupillary distance. A raw frame of glasses was placed on the patients face and after the examiner was sure that the frame was positioned correctly patient was asked to look at a target in 60 cm distance.

In these conditions, the examiner was positioned right in front of the patient, and marked a sign on the lens corresponding to the visual access of each patient's eye and then the papillary distance was calculated by measuring the distance between the signs for the right and left eyes.

The participants were divided into age groups of 10 years and the mean pupillary distance for different age groups was calculated and compared. We used SPSS software version 22 (IBM, Armonk, NY, USA) to perform the statistical analysis. The normal distribution of variables was analyzed using Shapiro-Wilk test. Mann-Whitney U-test was used to compare the two groups and linear regression analysis was used to detect the relationship of papillary distance with age and refractive errors. P values less than 0.05 were considered statistically significant.

Results

This cross - sectional study included 703 participants (403 females and 300 males) in the age range of 3-83 years). The mean age of participants was 31.07 ± 16.63 years. The demographic characteristics of the study population are shown in table 1.

The mean pupillary distance for all participants was 59.2 ± 3.88 mm (57.9 ± 3.41 mm among females and 60.71 ± 3.9 mm among males) (Table 1). The mean papillary distance among men was significantly higher than females (P < 0.001).

Table 2 shows the mean pupillary distance in different age groups. As it can be observed in

Table 1: Demographic characteristics of the study population

Variable			Mean ± SD	Minimum	Maximum
Age		Female	29.9 ± 16.23	4	83
		Male	32.65 ± 17.05	3	80
Papillary Distance		Female	57.9 ± 3.41	47	67
		Male	60.71 ± 3.9	48	72
The Mean Refractive Error	Female	Right Eye	0.73 ± -1.9	+ 7.37	- 12.75
		Left Eye	0.72 ± -1.89	+ 8.37	- 14.5
	Male	Right Eye	0.79 ± -2.91	+ 4.87	- 7.37
		Left Eye	0.78 ± -1.98	+ 5	- 12.37

this table the pupillary distance increased with age. We also found no statistically significant relation between refractive errors and pupillary distance (P = 0.461).

Discussion

There are different methods for measuring the pupillary distance with only negligible differences between the results [11]. Pupillary distance can be measured by determining the distance between the center of two pupils (anatomical pupillary distance) or the distance between the right and left optical axis (physiologic papillary distanc). The anatomic papillary distance has been reported to be between 0.1 mm and 0.3 mm longer than the physiologic papillary distance and physiologic papillary distance is more suitable when making optics for the patient [12]. The physiologic papillary distance might be measured for near or distant targets and distant measurement will be higher than the near measurement. In the present study we used near papillary distant measurement (pupillary distance measured when using a target placed 60 cm from the eyes).

Lakshimanara et al., [13] have reported a rapid increase in pupillary distance till 5 years after

Table 2: The mean pupillary distance in different age groups

Age group (years)	(n)	Female (mean ± SD)	Male (mean ± SD)	Total (mean ± SD)	Min-max
0-10	76	52.74 ± 2.43	53.75 ± 3.16	53.13 ± 2.75	47-60
11-20	140	57.93 ± 2.83	59.52 ± 3.28	58.5 ± 3.08	52-64
21-30	146	58.32 ± 2.77	61.48 ± 3.17	59.62 ± 3.32	54-70
31-40	147	58.68 ± 2.64	62.23 ± 3.03	60.38 ± 3.33	53-69
41-50	101	58.94 ± 2.82	62.25 ± 2.8	60.51 ± 3.26	54-71
51-60	55	59.44 ± 3.51	61.36 ± 2.84	60.25 ± 3.25	54-69
61 ≤	38	60.35 ± 3.17	61.72 ± 2.88	61 ± 3.07	55-66
Total	7.3	57.91 ± 3.41	60.71 ± 3.89	59.2 ± 3.88	47-72

birth and slower increase afterward. Fledelius and Stubgaard [14] have reported increasing papillary distance up to 20 years of age and Pryor [15] has reported an increase till age 24, while Aslin and Jackson [16] have reported an increase till age 30. Similar to these studies we found an increase in pupillary distance with increasing age. Fesharaki et al., [17] have reported a mean 4.8 mm increase in pupillary distance in the second decade of life which is comparable to our findings (5.37 mm).

The mean pupillary distance in the present study was 59.2 ± 3.88 with a range of 47 to 72 mm, which was lower than the mean pupillary distance reported by Fesharaki et al., [17] (60.82 ± 4.3 mm), Yildirim et al., [19] (62.5 ± 4.1 mm)

and Peryor [15] (61.00 ± 3.45), and higher than the mean pupillary distance reported by Osuobeni and al-Musa [19] (57.93 ± 2.55 mm), Evereklioglu et al., [22] (57.25 ± 3.65 mm), and Alanazi et al., [20] (58.1 ± 3.4). The difference in reported mean pupillary distance might be due to the difference regarding the age and ethnicity of participants in different studies as well as the method used for pupillary distance calculation (Table 3).

Conclusion

Similar to previous findings pupillary distance was affected by sex and age in an Iranian population. Refractive errors had no statistically significant effect on pupillary distance.

Table 3: A comparison of our results regarding the mean pupillary distance with previous reported results

Study	Ethnicity	Target distance	Number	Age	Mean pupillary distance in mm	Pupillary distance Range	Measurement method
The present study	Iranian	Near	703	3-83	59.2 ± 3.88	47-72	Ruler
Fesharaki et al., [17]	Iranian	Far	1500	5-80	60.82 ± 4.3	38-75	Auto Refractometer
Yildirim et l.,[19]	Turkish	Far	756	19-89	62.5 ± 4.1	49–76	Auto Refractometer
Pryor [15]	White American	Far	782	16-24	61.00 ± 3.45	54-75	Auto Refractometer
Osuobeni and al-Musa [18]	Arab	Near	582	5-55	57.93 ± 2.55	48-72	Ruler
Evereklioglu et al., [22]	Arab	Near	3448	7-40	57.25 ± 3.65	46-71	Ruler
Alanazi et al., [20]	Arab	Near	133	20-67	58.1 ± 3.4	50-70	Ruler

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Footnotes and Financial Disclosures

Conflict of Interest:

The author has no conflict of interest with the subject matter of the present study.