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Effect of Visual Reaction Time on Refractive Errors- A Comparative Study.

Viji Devanand*, Balasubramanian K, and Chithrapavai SU.

Department of Physiology, Stanley Medical College, Chennai, Tamil Nadu, India.

ABSTRACT

Visual reaction time (VRT) is the time taken by the individual to respond to the visual stimulus. Hypermetropia (HM, the light is focused behind the retina (eye too small). Both distance and near objects are blurred. Myopia, the light focused in front of the retina (eye too large). Distant objects are blurred and nearby objects are seen clearly. We aimed to assess visual reaction time in hypermetropics, myopics and emmetropics and compare visual reaction time between different refractive errors to that of emmetropics. With sample size of 20 subjects of age 8 to 25 years from each group, this study was done in Department of Physiology in subjects attending Ophthalmology Out Patient Department, Department of Ophthalmology, Stanley Medical College, Chennai. Visual reaction time was recorded using PC1000 Hz reaction timer. This recorded data is stored in separate files and analysed using audacity software version 1.3 Beta. Statistical analysis was done using independent Student t- test and chi square test using SPSS version 17.0. In hypermetropia, myopia and emmetropia, the values were 0.994 $\pm$ 0.20, 0.417 $\pm$ 0.07, and 0.642 $\pm$ 0.19 respectively. Mean difference between each groups were also recorded, with P value highly significant. Hence from this study we observed that, visual reaction time is shortened in myopics when compared to hypermetropics and emmetropics, which is supported by earlier studies.

Keywords: Visual reaction time, hypermetropics, myopics, emmetropics, PC1000 Hz reaction timer.

Corresponding author

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INTRODUCTION

Reaction time is the time taken by an individual to react to the external stimulus. Visual reaction time (VRT) is the time taken by the individual to respond to the visual stimulus. A decrease or increase in VRT shows there is an alteration in sensory motor performance. It is considered as an ideal tool for measuring sensory motor association [1, 3]. The stimulus can be of any source of sensory input like visual, auditory, pain, touch or temperature. The response to such stimulus can be a button press, an eye movement, a vocal response, or some other observable behavior [4]. It is a measure of sensory motor association and performance of an individual. It is a simple and non invasive test for peripheral as well as central structures [2]. Hypermetropia (HM) is the light is focused behind the retina (eye too small). Both distance and near objects are blurred. The young eye can compensate with accommodation. Reading glasses are required at a younger age than normal. Axial hypermetropia is the most common type and aphakia is an extreme example of acquired refractive HM. Hypermetropia can be divided into manifest HM, latent hypermetropia, facultative hypermetropia and absolute hypermetropia. Hypermetropia is corrected with a convex (+) lens. Myopia is light focused in front of the retina (eye too large). Distant objects are blurred and nearby objects are seen clearly. Occurs most commonly due to abnormally long eye, increased dioptric power (refractive or index myopia) like Keratoconus and nucleosclerosis. Myopia is graded as low, moderate, high and extremely high. In high and extremely high myopics it is associated with myopic macular degeneration and peripheral retinal degeneration. Myopia is corrected with concave (-) lenses. Axial myopia gets manifested in the early age group and is stabilized around the age of 24[5].

Objectives

To assess visual reaction time in hypermetropics, myopics and emmetropics and compare visual reaction time between different refractive errors to that of emmetropics.

MATERIALS AND METHODOLOGY

Sample size: 20

Inclusion criteria

Subjects with hypermetropia, myopia and emmetropia of age group 8 to 25 years.

Exclusion criteria

Subjects with ophthalmic disorders like squint, astigmatism, presbyopia, glaucoma, congenital visual disorders, previous ophthalmic surgical corrections and other systemic illness.

Parameters studied

Visual Reaction Time (VRT) using PC1000 Hz reaction timer.

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Methodology

This study was done in Department of Physiology in subjects attending Ophthalmology Out Patient Department, Department of Ophthalmology, Stanley Medical College, Chennai. After providing proper information and explanation to the study group written consent was obtained from the parent or the guardian of the subject who accompanied them to the OPD. A proper history including personal history, family history, past history of ophthalmic illness, refractory error corrections, spectacle usage was recorded. 20 subjects from each group of age ranging from 8 to 25 years were chosen and the study was conducted after recording their refractory error using Snellen's chart. The study individual were taken to a quiet room with good ambience and when the individual was comfortable with their parent or guardian nearby, visual reaction time was recorded using PC1000 Hz reaction timer [6]. This is a 1000 hertz square wave oscillator which has a soft key for start and stop function. It has two components (A and B). The A component has a START button and used by the examiner. The B component has a STOP button and given to the subject to record their response. This B component also has a RED LED light which glows every time when the stimulus is given. Red light has a long time representation in retina and hence red light was used. Component A and component B is in turn connected to a computer which is used for recording and has the audacity software installed in it. Audacity software records the reaction time in 0.001sec accuracy in wave format. After giving proper instructions to the individual, the examiner presses the start button in component A. This component is not seen by the subject when the stimulus is given. When the stimulus is given the LED light in component B glows and the subject is asked to press the stop button as and when they see the red light glows and the reaction time is recorded [2]. The recording is done five times consecutively and the least value among the five is taken. This recorded data is stored in separate files and analysed using audacity software version 1.3 Beta. With this data obtained, statistical analysis was done using independent Student t- test and chi square test using SPSS version 17.0.

RESULTS

Table 1: Showing mean and standard deviation of control and study groups

Groups	N	VRT (msec)Mean ± SD	P Value
Hypermetropia	20	0.994 ± 0.20	0.001**
Myopia	20	0.417 ± 0.07	
Emmetropia	20	0.642 ± 0.19	

** P value < 0.001 is highly significant

Table 2: Showing mean difference between control and study groups

Group (I)	Group (J)	VRT (msec) Mean difference (I - J)	P Value
Hypermetropia	Emmetropia	0.351*	0.001 **
	Myopia	0.577 *	
Myopia	Emmetropia	-0.225 *	
	Hypermetropia	-0.577*	
Emmetropia	Hypermetropia	-0.351 *	
	Myopia	0.225*	

* P value < 0.05 is significant.
** P value < 0.001 is highly significant.

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DISCUSSION

Objective of this study was to assess visual reaction time in hypermetropics, myopics and emmetropics and compare visual reaction time between different refractive errors to that of emmetropics. In this study, according to table 1, we observed that in myopics, the visual reaction time was reduced 0.417 $\pm$ 0.07 (msec) when compared to that of hypermetropics and emmetropics, whose visual reaction time were 0.994 $\pm$ 0.20 (msec) and 0.642 $\pm$ 0.19 (msec) respectively with highly significant P value. From table 2, it is observed that, the mean difference between groups I and J, were significant and their P value highly significant. Niruba et al [2], they have concluded that visual reaction time measurement is a good indicator of sensorimotor association and individual performance of an individual. In a study conducted by kurtev et al [8], they found that the visual reaction time is shorter in myopes compared to that of emmetropes. In kurtev study they tested and applied the hypothesis of Schiller et al [9] and Stoimenova et al [10] to limited number of subjects with low to moderate degrees of myopia using the paradigm of forced- choice reaction time. The results showed that the myopes have indeed a significantly shorter visual reaction time as compared to a matched group of emmetropes. Schiller found that in rhesus monkey, longer times are required for the discrimination of shape, colour, flicker, movement, and stereo images by selectively blocking the ON-system, whereas Stoimenova showed that myopes had a higher sensitivity to ON- than to OFF- stimulation, especially at mesopic luminance levels. These results support the earlier observation of Hiltz et al [7] for a supernormal temporal visual capacity in myopes.

CONCLUSION

Hence from this study we observed that, visual reaction time is shortened in myopics when compared to hypermetropics and emmetropics, which is supported by earlier observations from other studies.

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