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ARTICLE

EFFECT OF REFRACTIVE ERRORS, LIGHT, TEMPERATURE, NOISE AND SILENCE ON BLINKING RATE

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ABSTRACT

PURPOSE: *To investigate the effect of refractive errors, light, temperature, noise and silence on the blinking rate.*

METHOD: *A cross-sectional study was conducted at department of Ophthalmology, Mayo hospital Lahore. A self-made proforma based study is conducted in which 59 participants (35 males and 24 females) aged 17– 49years are included. Out of which 12 myopes, 12 hypermetropes, and 35 emmetropes (12 participants with and without illumination, 12 participants with high and low temperature and 11 participants with noise and silence) by counting their blink rates for one minute. This study was conducted from September to November 2019.*

RESULTS: *This study showed that minimum blinking rate of myopes, was 19 blinks/min while the maximum blinking rate was 37 blinks/min, and their mean value was 28.33 blink/min. Its p-value = 0.002 which is <0.05 so blinking rate is a significant variable in myopic patients. There were 12 hypermetropes, and their minimum blinking rate was 20 blinks/min while the maximum blinking rate is 42 blinks/min, and their mean value is 31 blink/min. its p-value = 0.000 which is <0.05 so the blinking rate is a significant variable in hypermetropes patients. This study also showed 35 emmetropes and their mean blinking rates. With illumination, the mean blinking rate is 37 blinks/min, its p-value = 0.002* which is <0.05 so blinking rate is a significant variable and without is 19.5 blink/min, its p-value = 0.002* which is <0.05 so blinking rate is a significant variable. The silence mean blinking rate is 17.9 blinks/min and in noise 24.5 blinks/min and p-value < 0.05 which is 0.001* shows significant affect. Similarly, high temperature shows 26.9 blinks/min and at a low temperature of 9.6 blinks/min and p-value < 0.05 which is 0.000 shows significant affect. Significant values at <0.05 level of significance; [a]one-sample t-test, [b]Paired Sample t-test.*

CONCLUSION: *In conclusion there is a significant effect of myopia,hypermetropia, with illuminated target, without illuminated target, temperature, noise and silence on the blinking rate. Blinking rate is higher in hypermetropes, with illumination, high temperature and noise as compared to myopes, without illumination, low temperature and silence.*

KEYWORDS: *Amblyopia, contrast sensitivity, Color vision, Farnsworth D-15 Dichotomous color vision test, Pelli Robson contrast sensitivity*

INTRODUCTION

Blinking means the rapid movement of eyelids that open and close the palpebral fissure.[1] It is essential for the formation and protection of the tear film.[2] Normalblink rate is measured to be 10 to 16 blinks per minute. The normal blinking mechanism is significantly variable in blinks rate and is under cortical control. Normal blink rate is affected by external factors like physiological and psychological influences.[3] SEBR play a vital role by stimulating tears and spreading the three-layer tear film. When eyes start blink, the tear film becomes gradually thin and dry spots on the conjunctiva and cornea may develop.[4] SEBR generally occur 15-20 blink/min. Their main role is to clean and moistens the cornea of eye.[5] In adults, spontaneous, voluntary and reflexive blinking can be distinguished by their amplitude, context and duration. SB are usually shorter in duration than voluntary and reflexive blinks show the greatest amplitude.[6] Definable neural systems controlled the rates of spontaneous blinking (SEBR) in which inhibitory modulation by occipital cortex and cerebellum and facilitate modulation by superior colliculus. There may be thalamus involvement but its

influence in still unclear.[7] Estimation indicates that 670 million are suffered from visual impairment because they don't have access for proper visual treatment or counseling. Due to uncorrected refractive errors, life of millions of people disturb.[8] Various factors causing refractive errors: when someone could not afford corrective lenses, lack of counseling, awareness in a community and lack of services for testing.[9] In refractive errors, optical corrections, as well as refractive surgery, don't change size of eye, that's why patients suffer from refractive error and myopia stay at risk for too much elongation of axial length.[10] Various factors are affecting the blinking rate, as we discussed above, Indoor air temperature affects the rate of blinking. When the room temperature increases, then the rate of blinking increases while when room temperature decreases, the blink rate also decreases.[11] Movement of eyes can be modulated by illumination conditions such as high or low light intensity that affects the blink rate as well.[12]

MATERIALS AND METHOD

Fifty nine participants of both genders with refractive errors (myopia and hypermetropia) and emmetropeswere taken from eye ward of Mayo hospital for examination. Participants were asked to answer different questions included in the questionnaire. The participants were to see a distant target at 6m under normal conditions in case of refractive errors. In case of emmetropes, participants were to see the distant target under different conditions like high/low temperature, with/without illumination and noise/silence while counting their blink rate for one minute.

RESULTS

Table -1: Effects On Blinking Rates

	Mean ± SD (Range)	P-value
Myopia[a]	28.3333±5.5486 (19-37)	0.002*
Hypermetropia[a]	31.2500±6.64368(20-42)	0.000*
With_illumination[b]	37.7500±5.04750(30-45)	0.000*
Without_illumination[b]	19.5833±2.02073(17-23)	
Silence[b]	17.9167±.90034(17-19)	0.001*
Noise[b]	24.50000±1.93061(22-28)	
High_temperature[b]	26.9091±3.17662(22-31)	0.000*
Low_temperature[b]	9.6364±2.06265(6-12)	

significant values at <0.05 level of significance; aone-sample t-test, bPaired Sample t-test.This study showedmyopes, and their minimum blinking rate is 19 blinks/min while the maximum blinking rate is 37 blinks/min, and their mean value is 28.33 blink/min. Its p-value = 0.002 which is <0.05 so blinking rate is a significant variable in myopic patients. 12 hypermetropes, and their minimum blinking rate is 20 blinks/min while the maximum blinking rate is 42 blinks/min, and their mean value is 31 blink/min. its p-value = 0.000 which is <0.05 so the blinking rate is a significant variable in hypermetropes patients. This study also showed 35 emmetropes and their mean blinking rates. With illumination, the mean blinking rate is 37 blinks/min, its p-value = 0.002* which is <0.05 so blinking rate is a significant variable and without is 19.5 blink/min, its p-value = 0.002* which is <0.05 so blinking rate is a significant variable. The silence mean blinking rate is 17.9 blinks/min and in noise 24.5 blinks/min and p-value < 0.05 which is 0.001* shows significant affect. Similarly, high temperature shows 26.9 blinks/min and at a low temperature of 9.6 blinks/min and p-value < 0.05 which is 0.000 shows significant affect. Significant values at <0.05 level of significance; aone-sample t-test, bPaired Sample t-test.

DISCUSSION

The normal blink rate is measured to be 10 to 16 blinks per minute. Normal blink rate is affected by external factors like physiological and psychological influences. It increases during sleep deprivation, anxiety, visual fatigue, flying, during the speech, conversation, anger, driving a car, and excitement. When the task is difficult, then a more blink rate can be seen. Psychiatric and neurological diseases also affect the normal blink rates of the eye. Challenging environments may also affect the tear film that will also increase blink rates like central heating, air conditioning, the smoke of cigarettes, wind, and low humidity in the surroundings.

Most of the computer users suffered from tired eyes, eyestrain, double vision, and blurred vision. These eye problems are due to inappropriate lighting. Spontaneous eye blinking is affected while using computers due to improper lighting. SEBR falls below the resting conditions while carrying out a task.

In a previous study only the blink rate was related to task difficulty; blink duration and blink amplitude were not. The relationship between blink rate and task difficulty

was similar to that in the study done by Tada on an auditory task using the discrete-trial task paradigm. This result indicated that not only in the discrete-trial task paradigm, but also in continuous-trial task paradigm, the more difficult the task becomes, the higher is the blink rate. This result suggests the following relationship between occurrence of blink and information processing. When the task becomes more difficult, more information processing is required. After information processing is done, the blink occurs. In other words, the more difficult the task becomes, the more information processing is required and the more blinks there are.

Stern, et al have described blink occurrence after information-processing takes place in the discrete-trial task paradigm. In the continuous-trial task paradigm, the same kind of information processing would start when blink occurs as in the discrete-trial task paradigm. Our result supports Tada's. However, the result may be dependent on the nature of task, so a different task was used to reexamine the relationship between task difficulties and blink activity.

Computer users work for a prolonged time that causing dryness of ocular surface, and visual discomfort results in a change of the blink rate. Noise negatively affects the operators. A noise level of 85 to 95 dBA is responsible for distress, feeling of irritation, and fatigue changes the spontaneous blink rate. Various factors are affecting the blinking rate, as we discussed above, Indoor air temperature affects the rate of blinking. When the room temperature increases, then the rate of blinking increases, while when the room temperature decreases, the blink rate also decreases. Movement of eyes can be modulated by illumination conditions such as high or low light intensity that affect the blink rate as well. This study shows that there is a significant increase in the blinking rate inmyopes,hypermetropes, with an illuminated target, without illuminated target, high temperature, low temperature, noise and silence.

CONCLUSION

In conclusion there is a significant effect of myopia, hypermetropia, with illuminated target, without illuminated target, temperature, noise and silence on the blinking rate. Blinking rate is higher in hypermetropes, with illumination, high temperature and noise as compared to myopes, without illumination, low temperature and silence.

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