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Research Article

Impact of Daily Living Activities on Blink Rate and Blink Patterns

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Received: June 13, 2020; **Published:** October 30, 2020

Abstract

Purpose: To measure blink rate (BR) and pattern of blink per minute and to compare variations in blink rate and blink pattern of both the genders during different daily living activities.

Methods: The descriptive cross sectional was conducted from November 2019 to May 2020 at The University of Faisalabad and Aspire college, Pakistan. 100 females and 100 males were included age ranging from 18 - 25 years. We measured the blink rate per minute and check the pattern of blink during different tasks i.e. computer use, reading, scotopic condition, gazing, conversation. Blink rate was measured using stopwatch. We engaged the individuals in different tasks using different instruments. Short stories, a healthy conversation, puzzle games, dim light, pencil as a target were used to engage them. The data was analyzed using latest version of SPSS.

Result: By applying Descriptive statistics we measured and compared variations in BR of both the genders. Significant Variations were seen among both the genders during different tasks. Our results showed that BR was excessively reduced from its normal range i.e. (12 - 15 blinks/min) during computer use and while reading and there are more incomplete blinks. BR was also reduced while looking in different gazes and increased while conversation. In scotopic condition, blink rate was reduced.

Conclusion: Study concluded that different daily living activities had an impact on BP and BP and blink rate is significantly reduced in both genders during computer use, while reading and seeing in different gazes due to increased cognitive demand and increased during conversation. Adequate illumination, taking regular breaks during computer use can facilitate in improving blink rate and blink pattern, especially among computer users.

Keywords: *Blink Rate; Blink Pattern; Computer Use; Conversation; Gazing; Scotopic*

Introduction

Blink plays an important role in protection of eye surface and acts as a line of defense as it helps to clean eye surface from debris and to distribute the tear film. Blink is an involuntary action by which the tear film is distributed over the eye surface, helps to keep the surface

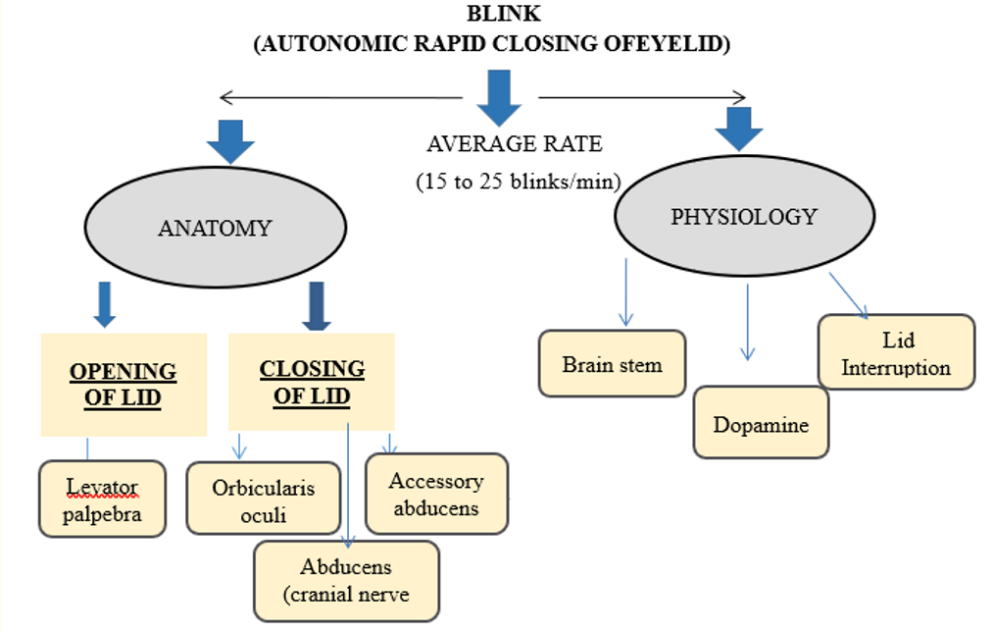
moist and lubricated. Blinking is necessary for healthy eyes because our eye surface requires moisturization to maintain the health of cells (Murphury, 2008).

Blinking helps to protect our eyes from the stimuli that are potentially damaging to eyes, such as foreign bodies and bright light (Mauk, 2012).

If eyes do not blink for longer period, they may be at increased risk of infection, dry and uncomfortable eyes, and have decreased vision clarity. A dry eye can be more prone to bacterial infection because the eye fluids have antibodies that helps to fight against harmful bacteria. During each blink, the upper lid encounters the lower lid. Corneal area will remain exposed if upper lid is not completely closed and will not be lubricated by the tears. As a result of this the exposed corneal area may become dry, itchy, and scratchy. The response of eyes to dryness is that the affected area becomes red, causing discomfort and is not appealing cosmetically (Gould, 2019).

Phenomenon behind blink is that whenever we blink, we close the eyelids completely. When eye blinks properly Meibomian glands are squashed or crushed in eyes to formulate or distribute the tear film. New tears can only be exchanged with the old tears when our eyes are fully closed during blink. Blinking helps to keep eyes wet, thus preventing from dry eye by distributing the tear film. Whenever we blink the debris are flushed outside the eye and keep our eyes clean. Clean and smooth eyes will result in clear and sharp vision. Blinking also prevents our eyes from hypoxial conditions (Nymark, 2016).

Blinking is rapid opening and closing of eyes. Levator palpebrae is responsible for opening of eyes and orbicularis oculi, abducens and accessory motor neurons are responsible for closing the eyes. Blinking is considered as an involuntary action but sometimes it may voluntary in action.



Figure

The full forced closure of the lid is caused by activation of orbital part of orbicularis oculi which may be activated by our facial muscle contraction and therefore facial muscles are considered to be the blinking accessory muscles named as Corrugator Supercilli Muscle which is located just beneath the eyebrows towards nose bridge. On contraction this muscle brings the eyebrows towards nose bridge. Orbicularis oculi which helps in closing of eye lid innervated by 7th cranial nerve or the facial nerve and its motor fibers (Davson, 2018).

Blinks are controlled by the brain stem or may have a direct relationship with dopamine level or may be controlled by the cognitive processes. Brain processes are directly related with blink rate (Mark, 2011).

There are three types of blink involuntary blinks, voluntary blinks, and reflex blinks. Involuntary blinking is not under conscious control. Voluntary blinking is under one's conscious control and reflex blinking is produced by any stimulus that can be a bright light, foreign body. Other types are excessive and reduced blinking.

Various daily living tasks affects BR and can impact the completeness of blink. Focusing on a task produced less or incomplete blinks. BR is decreased and incomplete blinks are increased when individuals are engaged in concentrating work like reading, looking at computer screens for long hours. The reason is may be more concentration is required during reading or close work, to prevent distraction by lids and reduced blink rate may also be due to increased cognitive demand during tasks [1].

During prolonged reading, computer use BR may be significantly decreased or reduced, the layer of lipid disappears and then reappear with conscious blinking. IB at this period can cause reduction in the integrity of the lipid layer. However, incomplete blink rates may vary widely among individuals. Blink is normally controlled by visual task, emotional state, mental effort, illumination level, atmospheric conditions etc. Thus, visually and intellectually demanding tasks may be associated with higher than normal rates of incomplete blinking (Levi, 2010).

If specific changes occur in blinking patterns it can lead towards exposure of anterior eye surface and can also cause inflammation and irritation (Mark,2011).

Normal blink rate is 12 and 15 blinks/min and it changes during different tasks. A resting blink rate is estimated to be between 8 to 21 blinks per minute, BR is increased when persons are engaged in conversation, averaging 10.5 to 32.5 blinks per minute. While focusing on a task, blink rate is likely to decrease. Blinking rate during reading decrease to an average of 4.5 blinks per minute (Mark, 2011).

Methods

Informed consent of individuals was taken. This study included 100 females and 100 males who do not have any ocular infections, allergy, dry eye, contact lens user and age arising from 18 - 25 years from The University of Faisalabad and Aspire college. Blink rate was measured using stopwatch. Different instruments were used short stories or near vision chart, puzzle games, pencil, dim light. We measured the blink rate and blink patterns by engaging the individuals. The persons were given interesting short stories to read. On computer they were asked to solve interesting puzzle games. In different gazes they were given a target and smooth eye movements were observed, they were asked to smoothly shift eyes from one target to another so that blink rate easily be measured. In scotopic condition dim light was used and the persons were engaged in a healthy conversation. Total time in measuring blink rate in all these activities was 5 minutes, one minute for each activity. We took 3 readings and average to minimize the subjective error. Study design was descriptive cross-sectional study. Purposive sampling technique was used, and duration of this study was from November 2019 to May 2020. This study highlight variations in blink rate and blink patterns with different daily living activities and different tasks have an impact on blink rate and blink patterns. Blink rate was reduced during computer use and while reading or focusing on a task and increased during conversation.

Result

This study included 400 eyes of 200 individuals and age arising between 18 - 25 years. 100 subjects were males (N = 100) and 100 subjects were females (N = 100). We divided the ages in two groups Group 1 (18 - 20 years) and Group 2 (21 - 23 years). We performed five different activities to check blink rate and blink patterns and compared variations during these activities on both the genders in one minute. Significant Variations were seen among both the genders during different tasks. Our results showed that BR was excessively reduced from its normal range i.e. (12 - 15 blinks/min) during computer use and while reading and there are more incomplete blinks. BR was also reduced while looking in different gazes and increased while conversation.

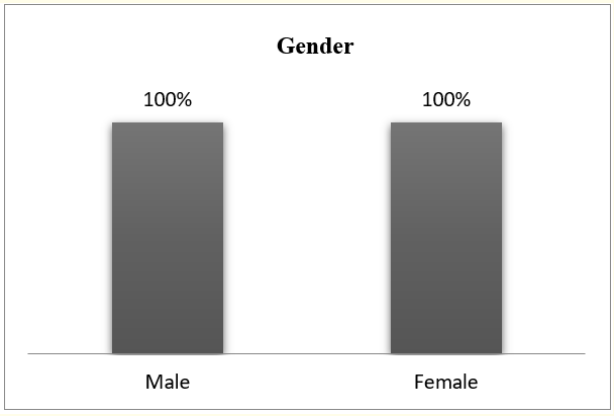


Figure 1: *Gender distribution.*

The bar chart represents frequency distribution of both genders. 100% were males and 100% were females.

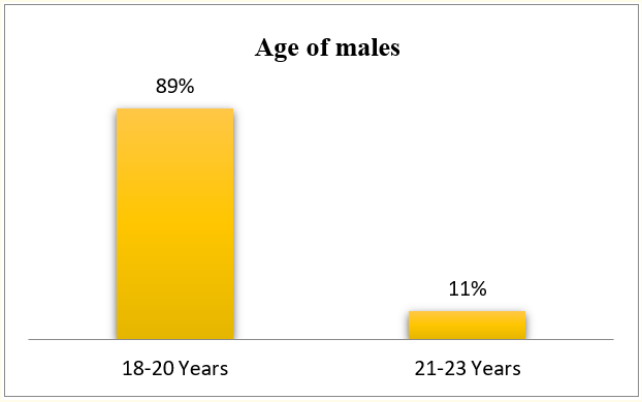


Figure 2: *Age distribution in males.*

The bar graph shows age group of males. In males 89% were those who fall in group 1 (18 - 20 years) and 11% fall in group 2 (21 - 23 years).

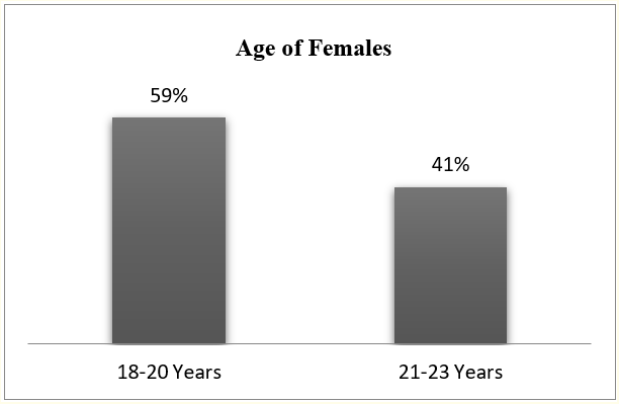


Figure 3: *Age distribution in females.*

The bar graph shows age group of females. In females 59% were those who fall in group 1 (18 - 20 years) and 11% fall in group 2 (21 - 23 years).

Frequency of blink rate and blink pattern in computer use

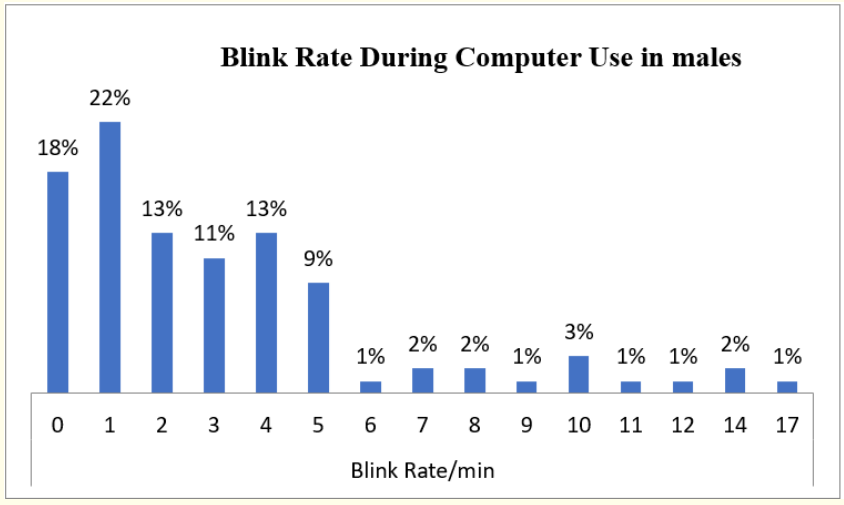


Figure 4: *Blink rate in males.*

The bar graph shows frequency distribution of Blink Rate during Computer use. Normal blink rate is 12-15 blink/min. 3% out of 100 individuals blink normally. 1% showed excessive blinking, 96% were below the normal range.

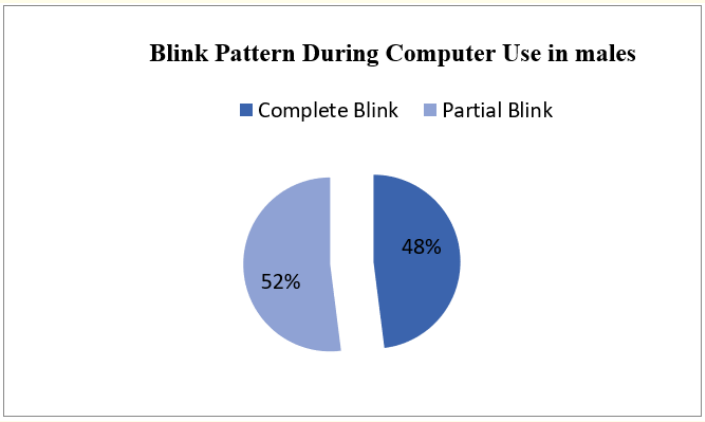


Figure 4.1

The pie chart shows frequency Distribution of Blink pattern during computer use. Out of 100 individuals 48% showed complete blink and 52% were those who blink partially

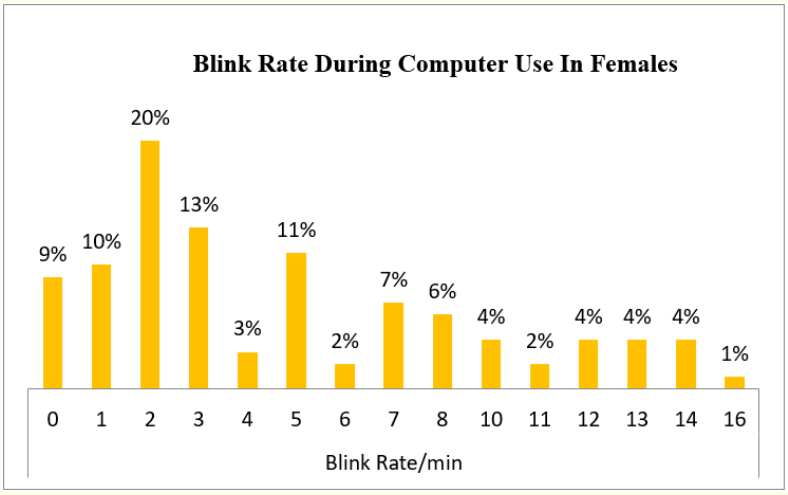


Figure 4.2

The bar graph shows frequency distribution of Blink Rate during Computer use. Normal blink rate is 12 - 15 blink/min. 12% out of 100 individuals blink normally. 1% showed excessive blinking, 87% were below the normal range.

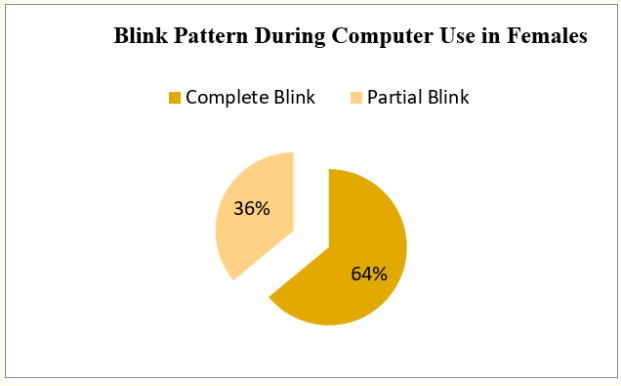


Figure 4.3

The pie chart shows frequency Distribution of Blink pattern during computer use. Out of 100 individuals 64% showed complete blink and 36% were those who blink partially.

Frequency of blink rate and blink pattern during conversation

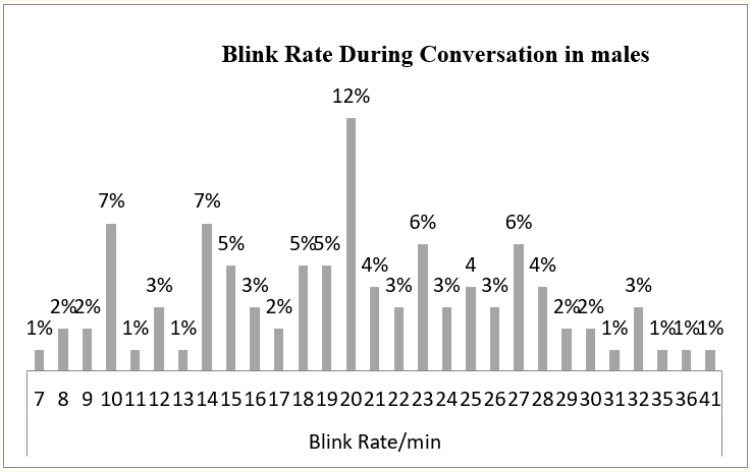


Figure 5

The bar graph represents frequency distribution of blink rate during Conversation. Normal blink rate is 12 - 15 blink/min. Out of 100 individuals 16% blink normally. 13% were those who showed reduced blinking, rest of all were above the normal range.

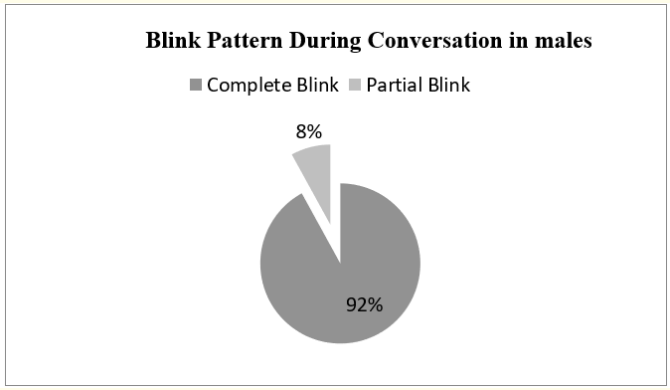


Figure 5.1

The pie chart shows frequency distribution of Blink pattern during conversation. Out of 100 individuals 92% showed complete blink and 8% blink partially.

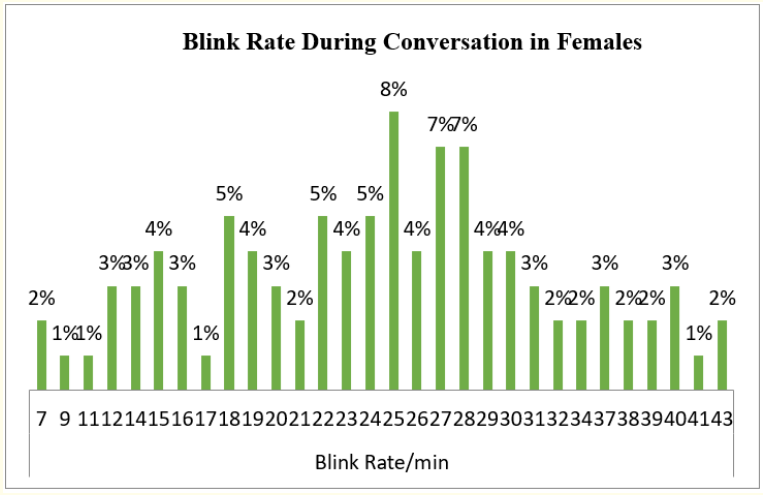


Figure 5.2

The bar graph represents frequency distribution of blink rate during Conversation. Out of 100 individuals 10% blink normally. 4% were those who showed reduced blinking, rest of all were above the normal range.

The pie chart shows frequency distribution of Blink pattern during conversation. Out of 100 individuals 83% showed complete blink and 17% blink partially 0 individuals 92% showed complete blink and 8% blink partially.

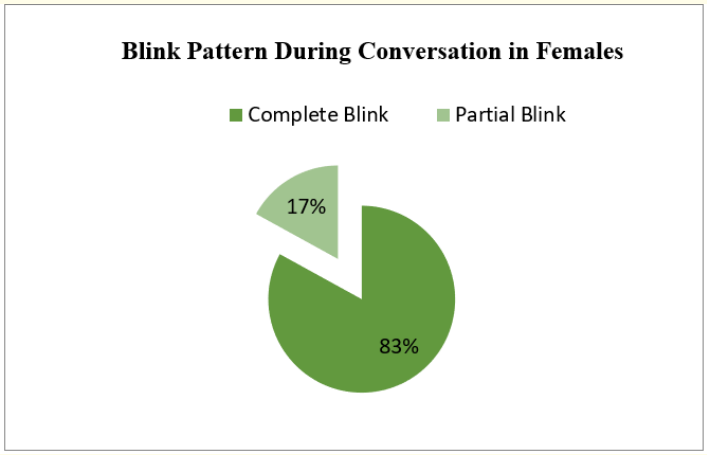


Figure 5.3

Frequency of blink rate and blink pattern during reading

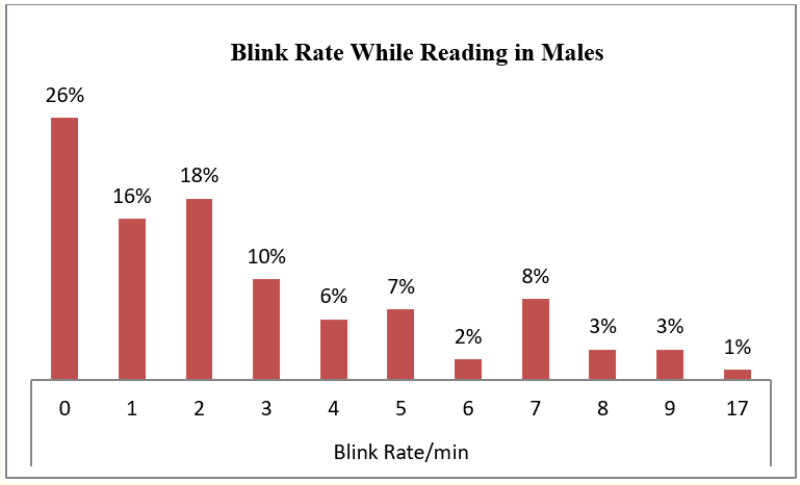


Figure 6

The bar graph represents frequency distribution of blink rate while reading. Normal blink rate is 12-15 blink/min. 99% Out of 100 individuals were those who had reduced blink rate, while only 1% showed excessive blinking.

The pie chart shows frequency Distribution of Blink pattern while reading. Out of 100 individuals 56% were those who blink their eyes completely and 44% blink their eyes partially.

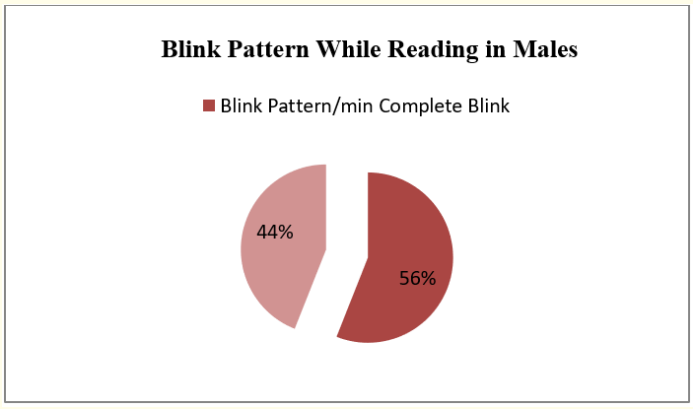


Figure 6.1

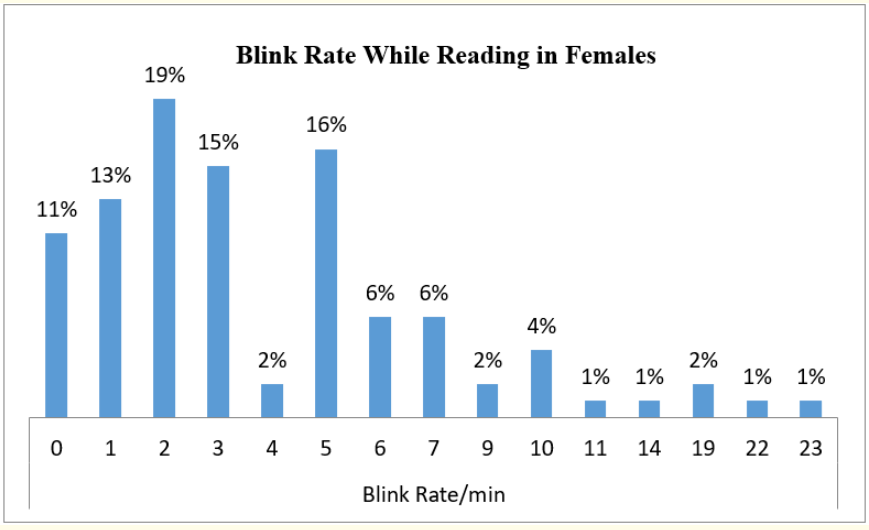


Figure 6.2

The bar graph represents frequency distribution of blink rate while reading. Normal blink rate is 12-15 blink/min. 95% Out of 100 individuals were those who had reduced blink rate, only 1%were those who blink within normal range. while 4% showed excessive blinking.

The pie chart shows frequency Distribution of Blink pattern while reading. Out of 100 individuals 62% were those who blink their eyes completely and 38% blink their eyes partially.

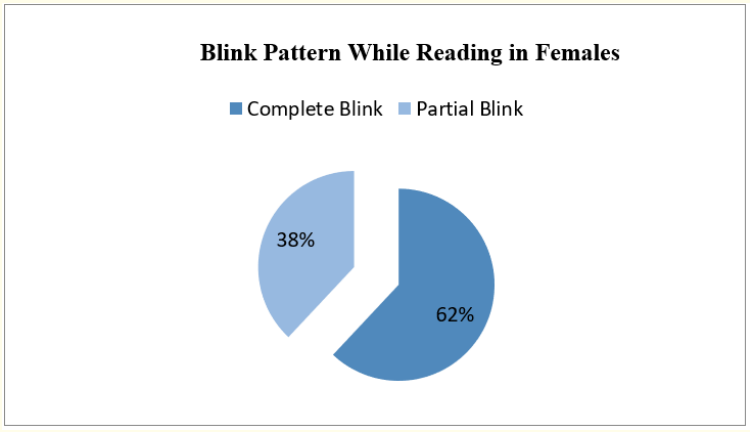


Figure 6.3

Blink rate and blink pattern during different gazes

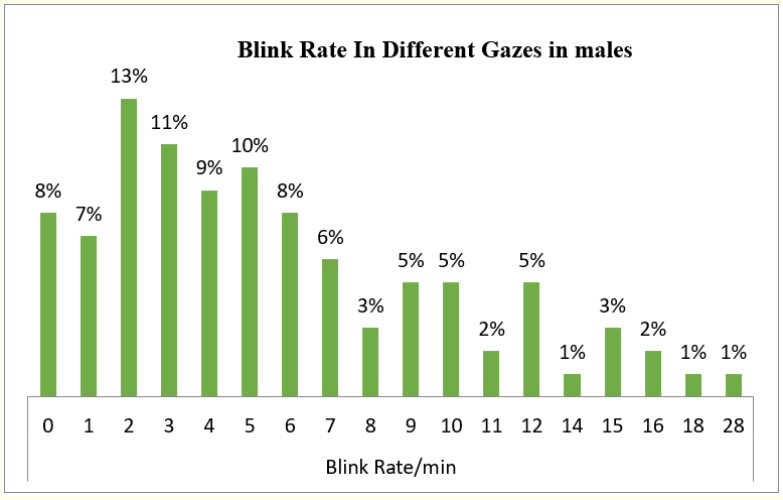


Figure 7

The bar graph represents frequency distribution of blink rate in different gazes. Normal blink rate is 12 - 15 blink/min. Out of 100 individuals 9% were those who blink normally. 87% were those who showed reduced blinking, 4% showed excessive blinking.

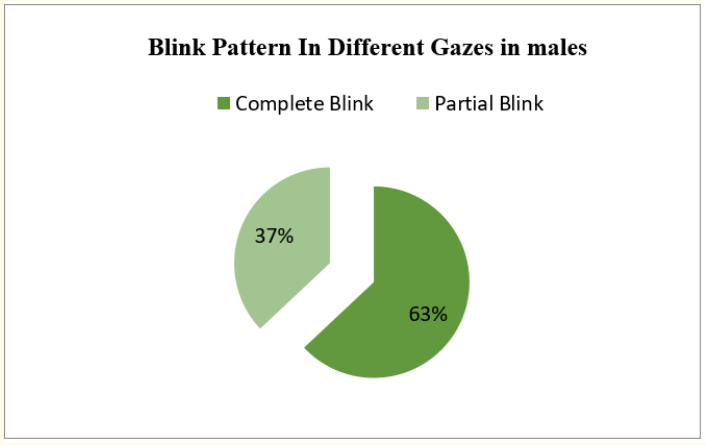


Figure 7.1

The pie chart shows frequency Distribution of Blink pattern during computer use. Out of 100 individuals 63% blink completely and 37% showed partial blinking.

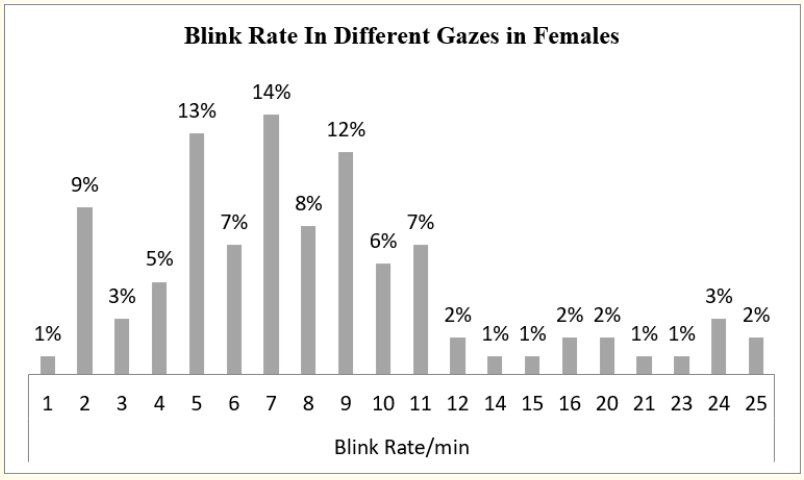


Figure 7.2

The bar graph represents frequency distribution of blink rate in different gazes. Normal blink rate is 12 - 15 blink/min. Out of 100 individuals 4% were those who blink normally. 85% were those who showed reduced blinking, 11% showed excessive blinking.

The pie chart shows frequency distribution of blink pattern during computer use. Out of 100 individuals 70% blink completely and 30% showed partial blinking.

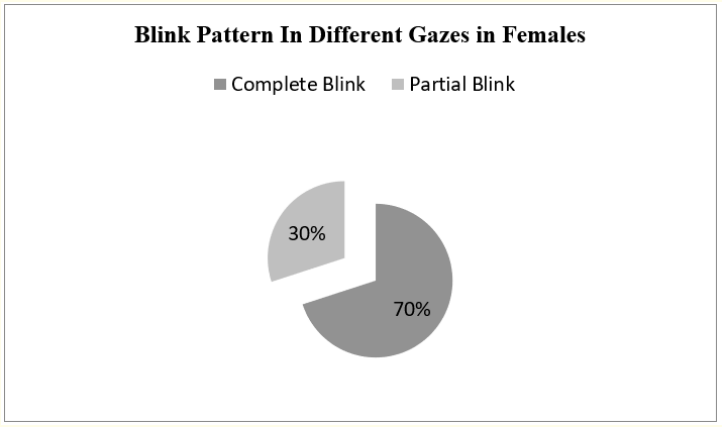


Figure 7.3

Frequency of blink rate and blink pattern during dim light

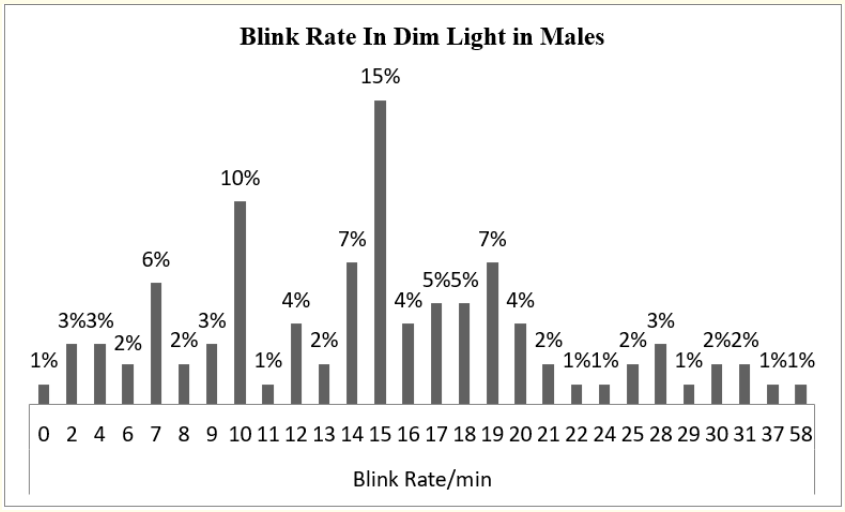


Figure 8

The bar graph represents frequency distribution of blink rate in dim light. 28% Out of 100 individuals were those who had shown reduced blinking, 31% had shown reduced blinking and 41% showed excessive blinking.

The pie chart shows frequency Distribution of Blink pattern in dim light. Out of 100 individuals 13% blink completely in low light and 87% blink partially in low light.

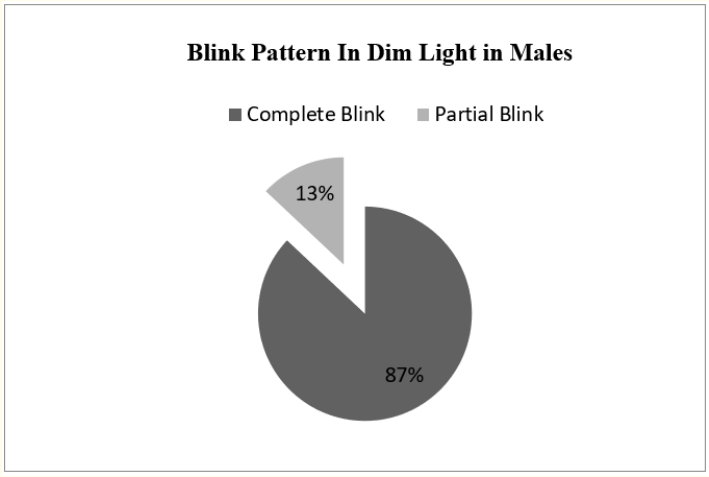


Figure 8.1

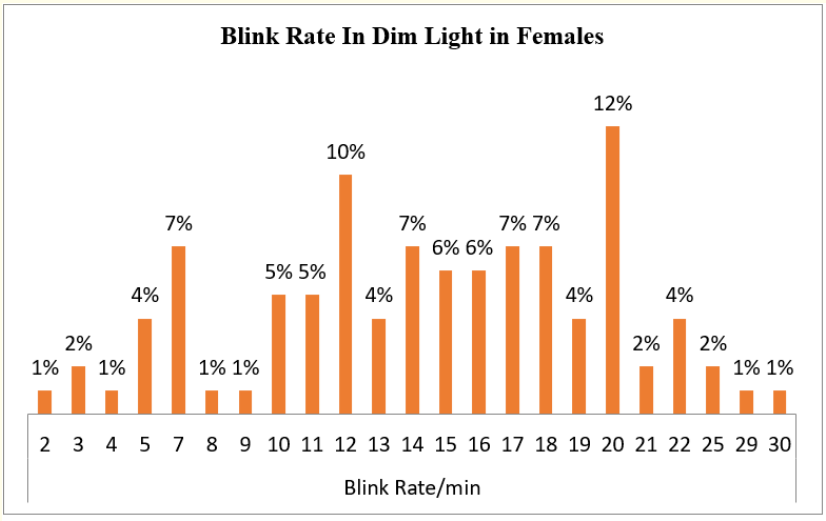


Figure 8.2

The bar graph represents frequency distribution of blink rate in dim light. 27% Out of 100 individuals were those who showed blink within normal range, 27% had shown reduced blinking and 46% showed excessive blinking.

The pie chart shows frequency Distribution of Blink pattern in dim light. Out of 100 individuals 93% blink completely in low light and 7% blink partially in low light.

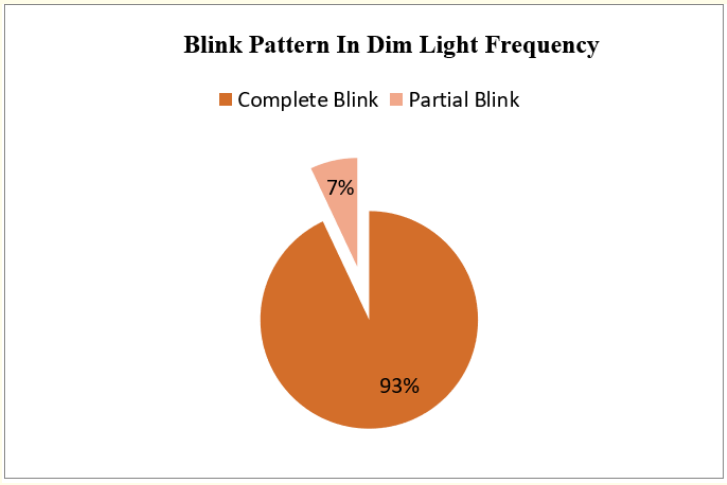


Figure 8.3

Discussion

In present research main objective was to measure blink rate and blink patterns and to compare variations in blink rate and blink patterns in both genders during different daily living tasks.

Results of study by Marc Arglles showed that the frequency of blinks is reduced during reading and in concentrating conditions and more incomplete blinks occurred due to high cognitive demand when looking at screen. He included 50 participant, 29 were females (Marc, 2015) Similarly, Our study also depicted same results that while reading and focusing conditions blink rate is reduced and incomplete blinks are increased. We included 200 individuals,100 females and 100 males.

According to Abusharha blink rate is decreased when reading either from computer, phone or from book and reduced blink rate may be due to increased cognitive demand during tasks. The purpose of this study was to measure changes in blink rate and ocular symptoms during different reading tasks [1]. Our study showed that blink rate is reduced while using screen or reading a book and our purpose was to measure blink rate during different daily living tasks.

In present study we included 200 individuals (100 males and 100 females) five different activities computer use, conversation, reading, gazing and scotopic condition were performed on both the gender and women blink more than men in all these activities. In contrast to our study, Bentivoglio's research included 150 participants (70 males and 80 females). Three different activities were performed resting quietly, reading a short passage, talking freely and computed mean blink rate during each task and he concluded that blink rate is increased while conversation and women blink more while reading only (Bentivoglio, 1997).

Unlike our study, Portello compared changes in blink patterns in two different tasks reading from screen and hard copy, and kept distance, luminance, angle and text same in both the tasks. And his results showed that there are more incomplete blink while using computer (Portello,2014) Our study compared blink patterns in five different activities. Our results showed that there are more partial blinks while reading, using computer, working in dim light and seeing in different gazes but more complete blinks during conversation.

In previous study Chu and Colleagues measured blink rates during two activities while reading from computer screen and hard copy on 25 participants. The purpose of this study was to determine whether it is computer screen viewing that produces the change in blink rate and to assess symptoms of dry eye. More incomplete blinks during computer as compared to hard copy. No significant difference found b/w both activities [2]. Contrary to present study we measured blink rates during five different activities on 200 individuals. Our purpose was to measure blink rate and blink patterns in all these activities and to compare variations during different activities.

According to white's results blinks frequency is increased in dry eye then normal individuals. Total 20 subjects were included, 10 with dry eye, 10 normal. Blink patterns were collected over a ten minute period while the subject performed a controlled visual task (television watching) and were compared between populations [3] but our study included normal 200 individuals and we performed five different tasks and compared variations in blink rate in all these tasks, We excluded those individuals having dry eye because blink rates are already increased in dry eye conditions [4-16].

Conclusion

This study revealed that blink rate and blink patterns varied with different daily living tasks and different tasks had an impact on blink rate and patterns of blink. And there was a significant variation in both genders during these activities. Normal blink rate is 12 to 15 blinks per minute. It concluded that in both the genders blink rate is significantly reduced during computer use, while reading and seeing in different gazes. During conversation both the genders showed excessive blinking. In scotopic or dim light condition most of them showed excessive blinking and some of them showed reduced blinking. In males Partial or incomplete blinks occurred during computer use and reading and complete blink pattern occurred during conversation, seeing in different gazes and in dim light condition. Females showed complete blinking in all these activities. Our results showed that females tend to blink more than males.

Recommendations

This research was conducted to open the way for further research to be conducted in this subject for the future. Blink rate and pattern should be included as a routine protocol of every eye examination because it also has a great impact on different occupations. Must be assessed in different occupations like night drivers, computer users, teachers, students and those who are more involved in conversation. So according to our research blink rate must be added as an essential element practice.

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Volume 11 Issue 11 November 2020