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Research Article

Unseen Risks: The Association Between Screen Time and Refractive Errors in Ophthalmology Patients at Al-Nafees Medical College Hospital

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Abstract

Objective: The objective of this study is to assess the relationship between screen time, reading posture, and the prevalence of refractive errors among ophthalmology patients at Al-Nafees Medical College Hospital.

Study Design: A descriptive cross sectional study.

Study Setting and Duration: Ophthalmology OPD patients of Al- Nafees Hospital over the period of 8 weeks from 1st May 2020 to 30th June 2020.

Methodology: A convenient sampling technique was used for 140 (N) participants. A designed questionnaire with close ended questions for the study was used. The patients that were coming to ophthalmology OPD that gave written consent were included in our study. The parameters like age and gender was filled and the data regarding refractive errors was collected while they were examined by the doctor in ophthalmology OPD along with the related questions filled on self-recall basis. All the data was collected and was then analyzed for frequency in terms of percentages by using SPSS version 25.

Results: A total of 140 participants responded to the study, yielding a response rate of 93.3%. Among the participants, myopia was the most prevalent refractive error (43%), followed by emmetropia (22%), astigmatism (11%), and presbyopia (12%). Shorter reading times (<5 hours/week) were associated with higher rates of myopia, while longer reading times (11-24 hours/week) showed higher prevalence of hyperopia and presbyopia. Posture while reading or using device did not show statistical significance ($p > 0.05$) associated with refractive errors except astigmatism and presbyopia ($P < 0.05$). Extended screen time showed a statistically significantly associated with anisometropia, astigmatism and Presbyopia ($p = 0.018$, 0.002 and 0.004 respectively). Visual conditions were not significantly affected, and ocular exercise participation was low across all refractive errors.

Conclusion: Screen time is significantly associated with refractive errors, whereas posture while using the device or reading showed statistical significant association especially with astigmatism and presbyopia. Extended reading hours are associated particularly with myopia and hyperopia. These results underline the importance of promoting balanced screen use with proper posture and regular eye examinations.

Keywords: Ophthalmology; Refractive Errors; Screen Time; Reading Posture; Ocular Exercises

Introduction

Many people lose their vision or go blind due to refractive problems such as myopia, hyperopia, astigmatism, or presbyopia. According to the World Health Organization (WHO), over 8 million individuals are rendered blind as a result of untreated refractive defects, which affect an estimated 153 million people globally [1]. Despite the fact that these errors are often harmless and may be corrected with corrective lenses or surgery, they occur frequently and significantly affect global public health, particularly in underdeveloped regions where access to eye care can be challenging.

The prevalence of refractive errors is on the rise globally, according to recent studies. There are regions of China where myopia affects almost 80% of the youth population, and experts predict that this figure will only rise [2]. The prevalence of myopia and its significant impact on long-term eye health has been shown by research conducted in East Asian countries such as Singapore, Taiwan, and others [3]. Lifestyle factors, such as increasing screen time, are contributing to the escalation of myopia [4], which is causing refractive errors to become more common, especially among children and young people, in industrialized countries like North America and Europe.

A person's gender and age significantly impact the prevalence of refractive errors. Presbyopia, the progressive worsening of near vision, often worsens with age, in contrast to myopia, which is more common in younger people [5]. According to an American research, hyperopia is more common in women, whereas myopia is more common in males [6]. However, it is important to note that there is conflicting evidence on the gender gap in refractive errors. Further study is needed to get a definitive understanding of this association [7,8].

Myopia and other refractive errors are becoming more common, and with them come health hazards including glaucoma, cataracts, and retinal abnormalities [9]. As a result, it is crucial to fix these issues quickly to avoid long-term consequences. With a focus on a cohort of patients from Al-Nafees Medical College Hospital in Islamabad, Pakistan, this research intends to examine the prevalence of refractive errors across various age groups and genders. This project will analyze the patterns of refractive errors within this population and provide significant insights into the epidemiology of visual impairment. It will also affect public health efforts for eye care.

Methodology

Descriptive cross-sectional study conducted at the Ophthalmology outpatient department of Al-Nafees Hospital during an 8-week period from May 1, 2020, to June 30, 2020. Sample size was calculated using the formula for single proportion (Z^2 p q/d^2) at 95% confidence and 5% margin of error, yielding a minimum of 138; the final sample was 140 patients (N) was obtained using a convenience sampling technique was selected due to limited OPD attendance during the COVID-19 period. Patients who presented to the ophthalmology outpatient department and provided written permission were included, whereas those who either did not attend the ophthalmology outpatient department of ANMCH or failed to provide written consent were omitted.

A questionnaire was developed that included a consent form for participant enrollment (patients attending the ophthalmology outpatient department at Al-Nafees Hospital), a personal profile section, and a section for documenting refractive errors (i.e., myopia, high myopia, hyperopia, presbyopia, astigmatism, anisometropia). Screen time and posture while reading and using device were self-reported via structured questionnaire (validated through pilot testing on 10 participants). Average weekly hours of device use were recorded in six ordinal categories (<5, 5–10, 11–18, 19–24 hours, etc.). The structured questionnaire, including closed-ended questions, was completed by medical students among the chosen participants who provided written permission and met the inclusion criteria.

Medical students completed the portion on refractive errors during the examination of participants conducted by an ophthalmologist at Al-Nafees Hospital, based on the doctor's findings. The identity of every participant was maintained as anonymous throughout the research. Following data collection, the parameters—gender, age, and refractive errors—were inputted into the Statistical Package for the Social Sciences (SPSS) version 25 for analysis. Descriptive statistics summarized categorical variables. Association between screen time, posture, and refractive errors was evaluated using chi-square tests; $p < 0.05$ was considered significant.

Results

A total of 140 participants out of 150 responded to the study, yielding a response rate of 93.3%. The study aimed to explore the relationship between reading time, reading posture, and the prevalence of various visual conditions, including Emmetropia, Myopia, High Myopia, Hyperopia, Anisometropia, Astigmatism, and Presbyopia. The data collected provided valuable insights into how different reading habits and postural behaviors correlate with the occurrence of these refractive errors.

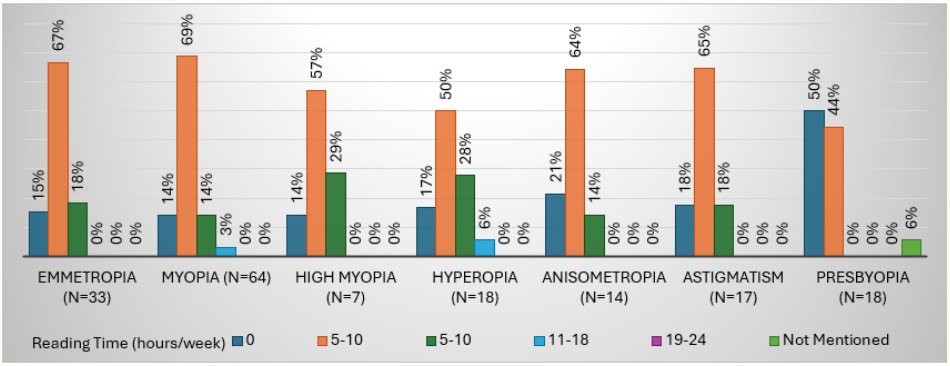

Figure 1: Distribution of Visual Conditions Based on Reading Time (N = 140).

The figure 1 illustrates the distribution of visual conditions based on reading time. Emmetropia was most common (67%) among participants reading for less than 5 hours/week, with significantly lower prevalence in the 5-10 and 11-18 hours/week groups (15% and 16%, respectively). Myopia showed a similar trend, peaking at 63% in the under 5 hours/week category and decreasing with longer reading times. High Myopia was most prevalent (57%) in the 5-10 hours/week group, while Hyperopia was highest (43%) in the 11-18 hours/week category. Anisometropia was most common (50%) in the 5-10 hours/week group, and Astigmatism occurred more frequently (53%) in the 5-10 hours/week group as well. Presbyopia was most prevalent (59%) in those reading for 5-10 hours/week. In general, shorter reading times were associated with higher occurrences of Myopia and Emmetropia, whereas longer reading times were linked to higher incidences of Hyperopia, Anisometropia, and Presbyopia.

Table 1: Prevalence of Visual Conditions by Reading Time (N = 140).

% (N)		Emmetropia	Myopia	High Myopia	Hyperopia	Anisometropia	Astigmatism	Presbyopia
		% (N)	% (N)	% (N)	% (N)	% (N)	% (N)	
Reading Time (hours Per week)	0	4% (5)	6% (9)	1% (1)	2% (3)	2% (3)	2% (3)	6% (9)
	<5	16% (22)	31% (44)	3% (4)	6% (9)	6% (9)	8% (11)	6% (8)
	5-10	4% (6)	6% (9)	1% (2)	4% (5)	1% (2)	2% (3)	0
	11-18	0	1% (2)	0	1% (1)	0	0	0
	19-24	0	0	0	0	0	0	0
	Not Mentioned	0	0	0	0	0	0	1% (1)
Reading Posture	Sitting	18% (25)	34% (48)	3% (4)	11% (15)	7% (10)	6% (9)	6% (8)
	Lying	4% (6)	11% (15)	1% (2)	2% (3)	1% (2)	7% (10)	1% (1)

The table 1 showed the prevalence of visual conditions based on reading time and posture. Myopia was the most common condition, especially in participants who read for less than 5 hours/week, where it affected 31% of individuals, with 16% having Emmetropia. In the 5-10 hours/week reading group, the prevalence of Myopia decreased to 6%, and Astigmatism was observed in 4%. Other conditions such as High Myopia, Hyperopia, and Anisometropia were rare across all reading time categories. Participants who read for 11-24 hours/week showed minimal visual impairments. In terms of posture, sitting participants had 34% Myopia, 18% Emmetropia, and 6% Astigmatism. Those reading while lying had 34% Myopia, with lower prevalence of other conditions. Overall, Myopia was the most prevalent condition, particularly among those with shorter reading durations, while other visual impairments occurred less frequently.

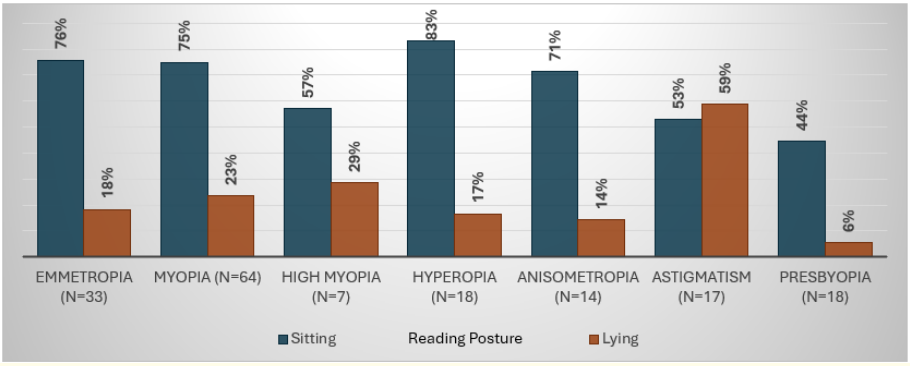

Figure 2: Distribution of Visual Conditions Based on Reading Posture (N = 140).

The distribution of visual conditions based on reading posture is shown in Figure 2. Participants with Emmetropia (76%) were predominantly observed while sitting, with a much lower percentage (18%) while lying. For Myopia, 75% of participants were sitting, and 25% were lying. High Myopia cases were also more common in the sitting posture (71%), while Hyperopia was predominantly seen in the sitting position (79%) compared to lying (21%). Anisometropia had a relatively even distribution, with 53% sitting and 47% lying. Astigmatism was more prevalent in the sitting posture (59%), while Presbyopia showed a slight increase in the sitting position (56%). Overall, the sitting posture was associated with a higher prevalence of most visual conditions, suggesting that reading posture may influence the occurrence of refractive errors.

The pie chart (Figure 3) illustrates the percentage of participants according to frequency of usage of devices such as computer and mobile across various visual conditions.

Among the participants, a higher percentage of those with Hyperopia (83%), Astigmatism (82%), Myopia (80%) and Emmetropia (79%) were found to engage in more use of devices. Participants with High Myopia (71%), and Anisometropia (57%) were lower, while the candidates with Presbyopia (39%) showed least engagement of device usage.

This data suggests that individuals with more common refractive errors like Astigmatism, Hyperopia, Myopia and Emmetropia are more likely to engage in device usage, while those with more complex conditions such as Anisometropia, High Myopia and Presbyopia report significantly lower participation.

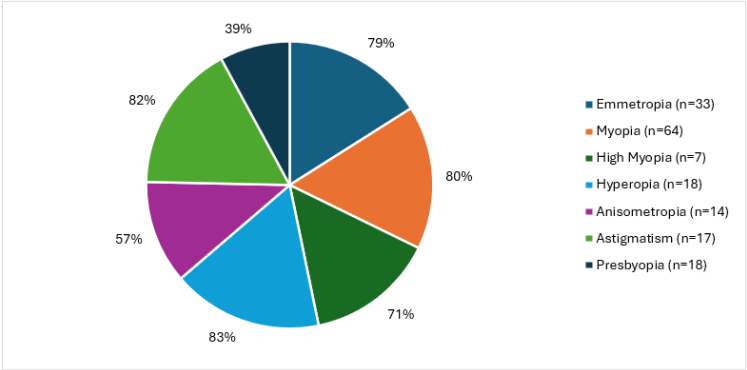

Figure 3: Percentage of Participants by use of computer/mobile by Visual Conditions (N = 140).

Table 2: Device Usage Patterns and Postural Data Across Different Visual Conditions (N = 140).

		Emmetropia	Myopia	High Myopia	Hyperopia	Anisometropia	Astigmatism	Presbyopia
		% (N)	% (N)	% (N)	% (N)	% (N)	% (N)	% (N)
Computer / Mobile Use		19% (26)	36% (51)	4% (5)	11% (15)	8% (11)	10% (14)	5% (7)
Time of Device Usage (hours Per week)	0	5% (7)	10% (14)	1% (2)	2% (3)	4% (6)	2% (3)	8% (11)
	<5	14% (20)	20% (28)	1% (2)	5% (7)	1% (1)	2% (3)	4% (6)
	5-10	4% (6)	11% (16)	2% (3)	5% (7)	4% (6)	5% (7)	1% (1)
	11-18	0	2% (3)	0	1% (1)	0	1% (2)	0
	19-24	0	2% (3)	0	0	1% (1)	1% (2)	0
	Not Mentioned	0	0	0	0	0	0	0
Posture while Using Device	Sitting	11% (16)	25% (35)	1% (2)	7% (10)	4% (5)	6% (8)	4% (6)
	Lying	9% (13)	18% (25)	4% (5)	5% (7)	4% (5)	8% (11)	1% (1)

The device usage and postural patterns across different visual conditions (Table 4) reveal notable trends. Emmetropia showed 19% of participants using mobile devices, with 14% using them for less than 5 hours/week. Myopia had 36% of participants using mobile devices, with the majority (25%) using them for less than 5 hours/week. High Myopia users reported 25% using mobile devices, with 18% using them for less than 5 hours/week. Hyperopia and Anisometropia had lower device usage, with the majority using devices for less than 5 hours/week, and Astigmatism showed a preference for lying posture (8%). Presbyopia showed the lowest device usage, with only 5% using mobile devices. Overall, shorter device usage times correlated with fewer visual conditions, while Myopia and High Myopia had more frequent and longer device usage, especially in sitting posture.

The distribution of device usage and posture across various visual conditions is presented in Figure 4. The majority of individuals with Emmetropia (23.9%) reported using devices for less than

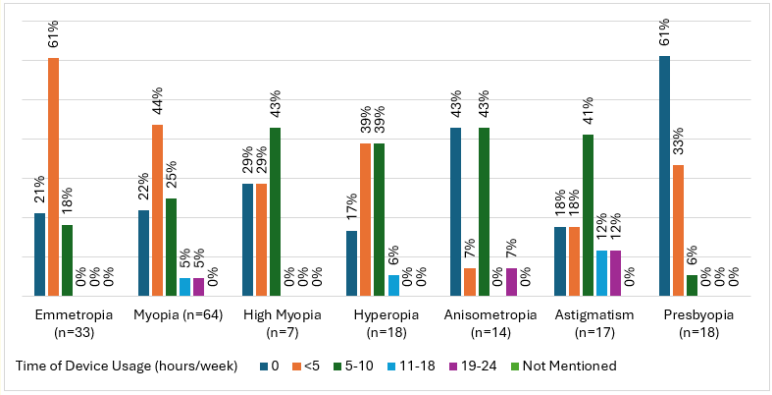

Figure 4: Distribution of Device Usage and Posture by Visual Condition (N = 140).

5 hours/week, with a significant proportion (19.4%) also using devices for 5-10 hours/week. In contrast, individuals with Myopia displayed a more even distribution across the 5-10 hours/week and 11-18 hours/week categories, each accounting for 22.2% and 22.2%, respectively. High Myopia was most common among those using devices for 11-18 hours/week (39%), followed by 5-10 hours/week (29%). The prevalence of Hyperopia was highest among individuals using devices for 5-10 hours/week (28%), with the lowest percentage (0%) seen in the >19-24 hours/week category. Anisometropia showed a notable proportion (39%) using devices for less than 5 hours/week, while Astigmatism and Presbyopia demonstrated a high usage in the 5-10 hours/week category, with Presbyopia having the highest proportion in the >19-24 hours/week category (33.8%).

The findings indicate varied patterns of device usage across visual conditions, with significant differences noted in the time spent using devices and the associated postural impacts.

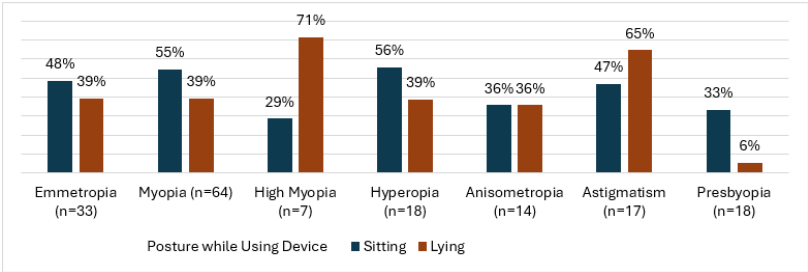

Figure 5: Distribution of Device Usage and Posture with Respect to Refractive Errors (N = 140).

Figure 5 illustrates the distribution of device usage and posture with respect to refractive errors. The data shows that most participants preferred sitting while using devices, particularly those with High Myopia (71%) and Astigmatism (65%). Participants with Emmetropia and Myopia also showed a preference for sitting (48% and 55%, respectively). In contrast, individuals with Presbyopia exhibited a notably lower sitting preference, with only 6% lying. These findings indicate a trend of sitting posture across various refractive errors, with notable variations in posture preference among different groups.

The majority of participants across different visual conditions did not perform ocular exercises. Specifically, 91% (n = 30) of Emmetropia, 97% (n = 62) of Myopia, 100% (n = 7) of High Myopia, and 100% (n = 18) of Hyperopia participants reported no ocular exercise participation. Similarly, 93% (n = 13) of Anisometropia, 94% (n = 16) of Astigmatism, and 100% (n = 18) of Presbyopia participants did not engage in ocular exercises.

The analysis of ocular exercise participation by refractive error revealed varying non-participation rates. Participants with Presbyopia (n = 18), Hyperopia (n = 18), and High Myopia (n = 7) exhibited 100% non-participation in ocular exercises. In contrast, 94% of Astigmatism (n = 17) and 93% of Anisometropia (n = 14) participants reported not engaging in exercises. The non-participation rate for Emmetropia (n = 23) was 91%, while the lowest rate was observed in Myopia (n = 54), with 57% of participants not performing ocular exercises.

The statistical analysis showed that reading time and posture (both sitting and lying) did not significantly affect visual conditions, with p-values greater than 0.05 except presbyopia i.e. 0.009 in sitting posture along with reading time, while strongly associated with astigmatism (i.e. $P < 0.05$) in lying position, while reading. Similarly, Posture while using a device, whether sitting ($p > 0.05$) or lying ($p > 0.05$), also showed no significant effect except astigmatism and presbyopia i.e. 0.012 and 0.003 respectively.

Computer/mobile use with p-values greater than 0.05, did not show significant effects on refractive errors except presbyopia i.e. $P < 0.05$. However, the time spent using a device was significantly associated with visual conditions such as anisometropia, astigmatism and Presbyopia ($p = 0.018$, 0.002 and 0.004 respectively). Lastly, ocular exercises had no significant impact on visual conditions ($p = 0.119$).

Discussion

The prevalence and difficulty corrected vision caused by refractive defects continue to be a major concern for global public health. Pakistan is one of several nations where the high rates of refractive errors—such as myopia, hyperopia, astigmatism, and presbyopia—have emerged as a major issue in public health. In order to determine if there is a correlation between ophthalmology patients' refractive defects and everyday habits like screen use and reading posture, this study was carried out at Al-Nafees Medical College Hospital. This study's results show a strong correlation between the prevalence of refractive issues, especially myopia, and the amount of time spent staring at screens, as well as certain posture patterns.

Researchers have paid increasing attention in recent years to the correlation between increased screen usage and refractive defects. Half of the school-aged youngsters in the research had refractive anomalies if they used screens for more than four hours a day. Among those who used screens for less than two hours daily, only 22.6% had them [10]. This highlights the significance of initiatives that encourage less screen time and more participation in outdoor activities as a means to mitigate the occurrence of refractive abnormalities.

People in Pakistan are worried about the standard of treatment for refractive problems. There are clear gaps in the provision of eye care services, as shown by a high percentage of incorrectly supplied glasses in a Punjab research that evaluated the quality of therapy for refractive errors [11]. The need of increasing eye care professional training and creating national guidelines for the treatment of refractive disorders cannot be overstated.

Quality of refractive error care

People in Pakistan have been worried about the quality of care for refractive errors. Our research indicated that numerous patients diagnosed with refractive problems did not obtain prompt remedial interventions, including prescription eyewear or referral to experts. A study in Lahore found that many individuals who went to basic healthcare centres for care had undiagnosed or poorly controlled refractive problems. This may have been avoided with regular eye examinations and adequate referrals [12]. This shows that more people need to know about and be able to get eye care services across the country.

A study conducted by Siddiqui., *et al*. [13] underscored the necessity of training healthcare personnel to detect refractive problems promptly and to administer corrective lenses effectively. A major problem in Pakistan is that there aren't enough resources for eye care, especially in rural regions. This makes it hard to deal with the rising number of refractive defects. Public health initiatives that teach people how important it is to have regular eye exams and fix refractive defects early on could be very important in lowering the number of people in the country who have vision problems.

Impact of screen time and device usage

The rising prevalence of digital gadgets, such as smartphones, tablets, and computers, has been associated with a surge in refractive errors, especially myopia. Our research indicated that those who utilized digital devices for over 4 hours daily exhibited a higher propensity for myopia, aligning with contemporary global trends. Our findings are consistent with Pakistani data by Rizwan., *et al*. [10] and Siddiqui., *et al*. [13], both reporting higher myopia prevalence among individuals with prolonged screen exposure. A study by Mohamed., *et al*. [14] revealed that school children utilizing digital devices for extended durations exhibited a much higher incidence of myopia than their peers who engaged with screens for shorter periods. This is probably attributable to the extended near-vision tasks linked to screen usage, which has been demonstrated to elevate the risk of myopia. This process is sometimes termed "near work," wherein the extended close-up attention demanded by screens may induce significant strain on the eye's accommodative system, resulting in the progression of myopia [15].

The posture adopted during the use of digital devices may potentially affect the development of refractive errors, in addition to the duration of screen time. Our investigation revealed that participants utilizing gadgets while seated exhibited a higher propensity for developing myopia, corroborating prior studies [15]. Conversely, people who read or utilized electronics in a supine position demonstrated a reduced incidence of myopia, however the disparity lacked statistical significance. This indicates that the manner in which individuals utilize digital devices—whether seated or recumbent—may influence the emergence of refractive errors, but further research is required to validate this concept.

Our research indicated that individuals who reported prolonged usage of digital devices were more susceptible to being diagnosed with myopia and extreme myopia. This trend corresponds with results from several worldwide studies, including those in China and Singapore, which indicated a direct correlation between screen exposure and the rising incidence of myopia [2]. Additionally, the findings indicated that individuals who spent excessive hours on digital devices were less inclined to participate in outdoor activities, a factor recognized for its role in mitigating the development of refractive defects [16,17].

Reading posture and its association with refractive errors

This research highlighted the potential role of reading posture in the development of refractive defects. Sitting was the most common position seen, particularly among those who had myopia. People who read while sitting had a far higher incidence of myopia, even though there was no statistically significant difference in visual conditions between sitting and sleeping positions. This finding might be explained by the way our eyes move when we read or use screens for long periods of time. Sitting for long periods of time causes us to blink less often and wears out our eyes, which increases the risk of developing refractive errors [11].

Although this study's anecdotal data supports the association between posture and refractive errors, more research is required to corroborate this hypothesis. Reading or using digital devices while supine may reduce accommodation pressure on the eye, which might decrease the probability of myopia, according to further studies [18,19]. However, in order to confirm these results, further thorough clinical trials are required.

Ocular exercises and preventive measures

Surprisingly, despite the known benefits of ocular exercises in reducing the symptoms of refractive errors, participants in this research did not participate in them very often. People with severe myopia and presbyopia were the most likely to not participate in ocular exercise. This finding highlights a major gap in the promotion of preventive strategies for eye care. Consistent ocular workouts may reduce eye strain and slow myopia progression, ac-

cording to research [13]. Therefore, encouraging ocular workouts, especially among young people, might be a good way to deal with or avoid refractive issues in clinical settings.

Implications for public health and eye care

The results of this research emphasize the urgent need for comprehensive eye care programs that address both the medical and lifestyle aspects of refractive errors, such as reduced screen use and improved reading posture. In order to prevent or delay the onset of myopia and other refractive disorders, it is crucial to implement public health programs that urge individuals, particularly children and teenagers, to have routine eye exams. Refractive errors may be less common in future generations if public health campaigns encourage moderate screen usage and regular physical activity [12].

Given the challenges faced by rural areas of Pakistan in accessing effective refractive error treatment, this research highlights the need of early diagnosis and fast correction. Research by Siddiqui., *et al*. [13] highlighted how many patients in rural regions do not get timely remedial therapies, which makes vision impairment even more difficult to manage. In order to address this issue, it is crucial for eye care practitioners to have the necessary expertise and tools to quickly identify refractive errors and provide appropriate corrective lenses.

The current literature on the epidemiology of refractive errors and its association with modern lifestyle variables, including as screen use and reading posture, is supplemented by this study. The findings highlight the need of enhanced public health programs to reduce the occurrence of refractive defects. To further our knowledge of the long-term effects of digital device use and postural habits on eye health, it is essential to do continuing research.

Conclusion

The significant association between reading time, reading posture, and the prevalence of visual conditions. Shorter reading durations and sitting postures were linked to a higher prevalence of Myopia, while conditions such as Hyperopia, Astigmatism and Presbyopia were more frequently observed in participants with specific reading times and postural habits. Extended screen use, particularly in a lying posture, was associated with higher rates of astigmatism and presbyopia, while ocular exercise participation was low across all refractive errors. The findings emphasize proper posture, reduced screen time, and regular eye checkups, especially in underserved areas. Although some associations showed statistical significance, particularly the impact of device usage and posture, further research with larger sample sizes and additional variables is necessary to explore the underlying mechanisms contributing to these patterns and their long-term effects on ocular health.

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