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# Comparative Study of Refractive Errors Pre and Post COVID-19 Pandemic in Individuals with Increased Screen Time in the Age Group of 18-25 Years: A Literature Review

**Nilofer M. Shaikh[1], Sameer S. Nadgauda[2], Ragini M. Raut[3]**

[1]Associate Professor, Department of Community Medicine, Bharati Vidyapeeth Deemed to be University, Homoeopathic Medical College, Katraj, Pune, India

[2] Associate Professor, Department of Practice of Medicine, Bharati Vidyapeeth Deemed to be University, Homoeopathic Medical College, Katraj, Pune, India

[3]Associate Professor, Department of Forensic Medicine and Toxicology, Bharati Vidyapeeth Deemed to be University, Homoeopathic Medical College, Katraj, Pune, India

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**ABSTRACT**

This literature review examines existing research on the comparative changes in refractive errors (such as myopia, hyperopia, and astigmatism) in young adults aged 18-25, related to increased screen time before and after the COVID-19 pandemic. With remote work, online education, and social isolation leading to prolonged exposure to digital devices, there is a growing concern regarding the impact of this lifestyle change on visual health. The review synthesizes findings from cross-sectional studies, discusses the potential mechanisms linking increased screen time to worsening refractive errors, and highlights gaps in the literature for future research directions.

***Keywords:*** *Screening, COVID-19 Pandemic, Refractive Errors, Review*

## 1. INTRODUCTION

The COVID-19 pandemic led to significant lifestyle changes, particularly in the form of increased screen time due to remote work, online education, and restrictions on outdoor activities. Young adults, especially those aged 18-25, experienced a substantial rise in daily screen exposure. Studies suggest that prolonged near-work activities, including screen use, are linked to visual impairments, specifically refractive errors. This literature review explores the comparative prevalence and progression of refractive errors among young adults pre- and post-COVID-19, aiming to understand how pandemic-induced screen time may have affected eye health in this demographic.

## 2. REFRACTIVE ERRORS: BACKGROUND AND PREVALENCE

### 2.1 Types of Refractive Errors

Refractive errors occur when light is not focused correctly on the retina, leading to blurred vision. The primary types are:

Myopia (nearsightedness): A condition where close objects appear clear, but distant objects are blurred.

Hyperopia (farsightedness): Distant objects are seen more clearly than close ones.

Astigmatism: Caused by an irregularly shaped cornea, resulting in distorted vision.

### 2.2 Prevalence and Determinants of Refractive Errors

Globally, the prevalence of myopia and other refractive errors has been increasing, particularly among young adults in urban environments where near-work activities are more common and outdoor exposure is limited. Factors such as genetics, environmental influences, and behavioral aspects (like screen time) play crucial roles in the development and progression of refractive errors.

## 3. IMPACT OF SCREEN TIME ON REFRACTIVE ERRORS

### *3.1 Mechanisms of Digital Eye Strain and Visual Fatigue*

Digital eye strain, also known as computer vision syndrome, is characterized by symptoms such as eye strain, headaches, and blurred vision due to prolonged screen use.

**The mechanisms include:**

Accommodation Spasm: Prolonged near work can lead to a spasm of the ciliary muscles, resulting in difficulty refocusing at different distances.

Reduced Blink Rate: Screen usage often reduces the blink rate, leading to dry eyes and visual discomfort.

Blue Light Exposure: Blue light from digital devices may cause oxidative stress in retinal cells, further contributing to eye strain.

### *3.2 Association between Screen Time and Myopia*

Multiple studies before the pandemic showed a positive correlation between high screen time and the progression of myopia in young adults. Increased close-up work forces the eye to adapt to a closer focal distance, potentially contributing to an elongation of the eyeball, which is a structural characteristic of myopia.

Prolonged electronic screen use can cause digital eye strain.[1]

## 4. COVID-19 PANDEMIC AND INCREASED SCREEN TIME

### *4.1 Screen Time during the Pandemic*

The COVID-19 pandemic led to a marked increase in daily screen time across all age groups, with young adults being one of the most affected demographics due to the shift to online education and remote work. Studies conducted during the pandemic reported an average increase of 2-5 hours of screen exposure per day compared to pre-pandemic levels.

### *4.2 Pandemic-Induced Lifestyle Changes and Visual Health*

Lockdowns and restrictions on outdoor activities limited exposure to natural light, which is protective against myopia. Consequently, the pandemic lifestyle has been associated with a higher prevalence of myopia and other refractive errors, raising concerns about the long-term effects of this shift on visual health.

## 5. COMPARATIVE ANALYSIS OF REFRACTIVE ERRORS: PRE AND POST-COVID-19

### *5.1 Studies before the COVID-19 Pandemic*

Research conducted before the pandemic indicated that myopia was on the rise, particularly in East Asian and urbanized regions where screen time and near-work demands were high. However, the annual progression rate of myopia was lower than what has been observed post-pandemic.

### *5.2 Studies Conducted During and After the Pandemic*

Recent cross-sectional and longitudinal studies show a significant increase in refractive error rates post-pandemic. In particular, myopia incidence and progression rates appear to have accelerated among individuals aged 18-25. A notable cross-sectional study in China, for example, found a 10-15% increase in myopia incidence among college students in 2021 compared to pre-2020 levels. Similar findings were reported in other regions, suggesting a global trend. The low hyperopia, emmetropia and mild myopia groups were more sensitive to environmental changes during COVID-19 than before.[2]

### *5.3 Contributing Factors and Confounding Variables*

Increased screen time, reduced outdoor activity, and heightened near-work activities were all exacerbated by the pandemic and are likely contributors to the observed trends. However, some studies highlight potential confounding factors, such as lifestyle stressors and changes in socioeconomic conditions, which may also have influenced visual health.

## 6. METHODOLOGY OF CROSS-SECTIONAL STUDIES IN REFRACTIVE ERROR RESEARCH

### *6.1 Strengths of Cross-Sectional Analysis*

Cross-sectional studies provide a snapshot of refractive errors at specific time points and are effective in comparing data collected pre- and post-pandemic. They allow researchers to identify correlations between screen time and refractive error changes.

### *6.2 Limitations and Future Directions*

Limitations include the reliance on self-reported screen time, which may be subject to recall bias, and the lack of longitudinal follow-up to monitor refractive error progression over time. Future studies should incorporate objective measures of screen time, use larger and more diverse sample sizes, and explore interventions to mitigate the effects of increased screen exposure.

## 7. CONCLUSION

The COVID-19 pandemic has significantly altered daily habits, particularly increasing screen time among young adults aged 18-25. Preliminary evidence from cross-sectional studies indicates a rise in refractive errors, especially myopia, likely due to prolonged screen use and reduced outdoor activity. Further research is needed to establish causality, explore potential interventions, and guide public health strategies to prevent the long-term impact of pandemic-induced screen habits on eye health.

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