

COMPARATIVE ANALYSIS OF BLUE PERCEPTION INDUCED BY CYLINDRICAL ORIENTATION IN EMMETROPIC AND MYOPIC EYES

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Abstract

Introduction

Astigmatism is a common refractive condition that occurs when the eye has unequal refractive power in different meridians, resulting in blurred or distorted vision. Even small amounts of uncorrected astigmatism can affect visual acuity, contrast, clarity of vision, and overall visual comfort. The visual impact of astigmatism may vary depending not only on the magnitude of cylindrical power but also on the orientation of the cylindrical axis.

Blur perception is a subjective visual response that may differ among individuals with different refractive statuses. Emmetropic eyes may be more sensitive to induced optical blur because they are accustomed to clear retinal images, whereas myopic eyes may demonstrate a different tolerance to blur due to long-term exposure to defocused visual input. This suggests that refractive status may influence how individuals perceive and respond to astigmatic blur.

The orientation of induced cylindrical lenses may also play an important role in visual performance. Astigmatism induced at different axes, such as 90° and 180°, can produce varying levels of visual degradation due to differences in retinal image distortion and meridional blur. Understanding these differences is important in clinical refraction, as even minor changes in cylindrical axis correction can influence visual clarity and patient satisfaction.

Objectives

This study aimed to evaluate the influence of different levels of myopia on visual acuity and subjective blur perception under induced astigmatism, with a focus on how cylindrical axis orientation (90° vs. 180°) affects visual performance in young adults.

Methodology

A cross-sectional observational study was conducted at Vision Care Head Office, Colombo, Sri Lanka, from March to August 2025. Two hundred participants aged 15 to 30 were recruited and categorized into four refractive groups: emmetropia, low myopia (−0.50D to −2.00D), moderate myopia (−2.25D to −5.00D), and high myopia (> −5.00D). Visual acuity and subjective blur perception were assessed under induced astigmatism at two cylindrical axis orientations (90° and 180°). All myopic participants were tested with full refractive correction.

Results

Induced astigmatism caused a significant reduction in visual acuity and an increase in subjective blur across all groups. Emmetropic participants experienced the greatest decline in acuity and highest blur perception, especially with

astigmatism induced at 90°. Myopic participants showed progressively less blur perception with increasing myopia, with high myopes demonstrating the least sensitivity. The 90° axis induced more visual degradation and blur perception than the 180° axis in all groups.

Conclusion

Visual performance under induced astigmatism is significantly affected by refractive status and cylindrical axis orientation. Emmetropic eyes are more sensitive to astigmatic blur, while higher myopia is associated with reduced blur perception, indicating possible perceptual adaptation. These findings have important implications for astigmatic correction and visual performances

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