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Correlation Between Astigmatism and Asthenopic Symptoms

Zahid Yasin[1], Mariam Sana Ullah[2], Muhammad Khalid[3], Nabila Zulfiqar[4], Rebecca Asa Youail[5]

Correspondence
Zahid Yasin
zahidyasin55@gmail.com
Affiliations
1 POB Eye Hospital, Lahore, Pakistan
2 Munawar Memorial Hospital, Chakwal, Pakistan
3 Lincoln University College, Malaysia
4 Fatima Memorial Hospital, Lahore, Pakistan
5 Amanat Eye Hospital, Islamabad, Pakistan

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ABSTRACT

Background: Astigmatism is a prevalent refractive error that significantly impacts visual comfort and daily activities. Uncorrected astigmatism can lead to asthenopic symptoms, such as blurred vision, headaches, and eye fatigue, affecting quality of life.

Objective: This study aimed to assess the prevalence of astigmatism types and their correlation with asthenopic symptoms among individuals aged 12 to 35 years.

Methods: A descriptive cross-sectional study was conducted on 96 patients (41.7% males, 58.3% females) at POB Eye Hospital, Lahore. Participants underwent cycloplegic refraction, visual acuity testing, and symptom evaluation for activities like reading, mobile phone use, and computer work. Symptoms including blurring, headaches, eye ache, and watering were recorded. Data were analyzed using SPSS version 25, with Chi-square tests for categorical variables.

Results: Of the 96 participants, 45.8% had with-the-rule astigmatism, 27.1% had against-the-rule, and 10.4% had oblique astigmatism. 60.4% reported problems while reading, with blurring (55.17%) and headaches (27.58%) being the most common symptoms. 56.3% and 55.2% experienced issues while using mobile phones and computers, respectively. 93.75% were satisfied with their prescription.

Conclusion: This study demonstrates a high prevalence of asthenopic symptoms among individuals with astigmatism, highlighting the need for timely corrective measures to improve visual comfort.

INTRODUCTION

The visual demands of modern life, combined with the prevalence of refractive errors such as myopia, hyperopia, and astigmatism, have highlighted the critical need for comprehensive vision care globally. Refractive errors, being among the most frequently reported visual impairments, affect individuals of all ages and have significant social and economic repercussions (1, 2). Astigmatism, in particular, represents a complex and multifaceted refractive error caused by an irregular curvature of the cornea or lens, leading to distorted and blurred vision at all distances. Unlike myopia and hyperopia, which involve uniform curvature deviations, astigmatism creates multiple focal points, resulting in elongated images that disrupt visual clarity and comfort (6). This visual distortion can negatively impact patients' quality of life, causing functional limitations in daily activities such as reading, using computers, and driving, particularly under challenging lighting conditions (9, 14).

Astigmatism is widely recognized as the most prevalent refractive error, with an estimated global prevalence of approximately 40% among adults, as highlighted by Hashemi et al. in a systematic review and meta-analysis (1). Its etiology is attributed to a combination of genetic, anatomical, and environmental factors, including age, ethnicity, extraocular muscle tension, and eyelid pressure, which contribute to the irregular corneal or lenticular shape (7). The condition is categorized into with-the-rule, against-the-rule, and oblique types based on the orientation of the steepest meridian, with younger individuals more commonly presenting with the with-the-rule variant (8). Despite advances in corrective measures, such as spectacles, contact lenses, and surgical options like toric intraocular lenses and corneal refractive surgery, uncorrected or poorly corrected astigmatism remains a significant contributor to visual discomfort and reduced quality of life (10, 13).

Asthenopic symptoms, characterized by eye fatigue, headaches, blurred vision, and visual discomfort, are commonly reported among individuals with uncorrected astigmatism. These symptoms, often exacerbated by prolonged near work or digital screen exposure, highlight the functional impact of astigmatism on visual tasks (21). Previous research has shown that even mild levels of uncorrected astigmatism can impair near vision, reducing reading speed, accuracy, and task efficiency (16, 17). Experimental studies further support the association between astigmatism and visual discomfort, with increased reports of asthenopic symptoms during computer use and reading (19, 20). Although the link between astigmatism and headaches remains debated, there is substantial evidence suggesting that the visual strain associated with

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uncorrected astigmatism contributes to these symptoms (22).

The global burden of uncorrected refractive errors, including astigmatism, remains substantial, with the World Health Organization reporting that over 123.7 million people worldwide suffer from moderate to severe vision impairment or blindness due to these conditions (5). This underscores the importance of timely detection and correction to mitigate the adverse effects of astigmatism on individuals' functional and psychological well-being. Astigmatism's impact on visual performance, particularly in today's digital age, necessitates a deeper understanding of its correlation with asthenopic symptoms to inform effective management strategies. This study aims to explore the prevalence and types of astigmatism and their relationship with asthenopic symptoms, providing valuable insights into the functional burden of astigmatism and emphasizing the critical role of corrective interventions in alleviating visual discomfort.

MATERIAL AND METHODS

This study was conducted as a descriptive cross-sectional investigation over a period of six months, targeting individuals aged 12 to 35 years diagnosed with astigmatism. Participants were recruited from the POB Eye Hospital, Lahore, through a non-probability convenience sampling method. The inclusion criteria focused on patients within the specified age range who presented with astigmatism of ≥ ±0.50 diopters, while excluding individuals younger than 12 years or older than 35 years, those with systemic illnesses, unconscious patients, or individuals with mental or physical disabilities. A total of 96 participants were enrolled in the study after providing informed consent. Both verbal and written consent were obtained to ensure the voluntary participation of all individuals, and their data were handled with strict confidentiality in accordance with ethical standards. The study adhered to the principles outlined in the Declaration of Helsinki for medical research involving human subjects (23). After obtaining demographic data, each participant underwent a comprehensive evaluation of their visual status and refractive error, with a particular focus on astigmatism. Cycloplegic refraction using retinoscopy was performed to ensure refractive stability, followed by visual acuity testing using Snellen's chart. The accuracy of astigmatic refraction was further verified with a Jackson cross-cylinder. The participants were assessed for visual symptoms experienced during common activities, such as reading, using mobile phones, computer use, night driving, and watching television. Symptoms such as blurring of vision, eye ache, headache, and watering were recorded, with participants identifying the most predominant symptoms affecting their daily lives.

Data collection was systematically organized using a self-designed pro forma to capture clinical findings, symptom prevalence, and prescription details. During follow-up visits, participants' satisfaction with their corrective prescriptions was evaluated. For those reporting dissatisfaction with their current glasses, subjective refraction was repeated, and updated prescriptions were provided as needed. Final prescriptions included measurements of sphere (SPH), cylinder (CYL), axis, near vision (Add), and visual acuity (VA) for both eyes.

The ethical approval for this study was obtained from the institutional review board of the POB Eye Hospital, ensuring all protocols complied with established ethical guidelines. Data were analyzed using the Statistical Package for Social Sciences (SPSS) Version 25. Quantitative variables such as age were summarized using means and standard deviations, while categorical variables such as gender and symptom distribution were presented as frequencies and percentages. The Chi-square test was applied to examine associations between categorical variables. All statistical analyses were conducted with a significance level set at $p < 0.05$.

This rigorous methodology ensured the reliability and validity of the data collected, providing a robust framework for understanding the correlation between astigmatism and asthenopic symptoms. The study's adherence to ethical and methodological standards further ensured its contribution to the growing body of research on refractive errors and their impact on visual and functional health.

RESULTS

The study included 96 participants diagnosed with astigmatism, comprising 41.7% males (n=40) and 58.3% females (n=56). The age range of participants was 12 to 35 years, with a mean age of 29 ± 3 years. Data on the cylindrical power of the right and left eyes, types of astigmatism, and the prevalence of symptoms related to visual discomfort are presented in tabulated format below, followed by a descriptive analysis of the findings.

Table 1: Cylindrical Power Distribution

Cylindrical Power (D)	Right Eye (n, %)	Left Eye (n, %)
0.0	8 (8.42%)	10 (10.42%)
-0.25	1 (1.05%)	2 (2.08%)
-0.50	38 (40.00%)	41 (42.71%)
-0.75	27 (28.42%)	21 (21.88%)
-1.00	8 (8.42%)	7 (7.29%)
-1.25	5 (5.26%)	3 (3.13%)
-1.50	2 (2.11%)	2 (2.08%)
-1.75	—	2 (2.08%)
-2.00	5 (5.26%)	—
-2.25	—	1 (1.04%)
-2.50	—	3 (3.13%)

Table 2: Types of Astigmatism

Type of Astigmatism	Frequency (n)	Percentage (%)
With-the-Rule	44	45.8%
Against-the-Rule	26	27.1%
Oblique	10	10.4%
Irregular	11	11.5%
0.25 DC (Minimal Power)	5	5.2%

The study also explored the prevalence of asthenopic symptoms, focusing on specific visual complaints during activities like reading, mobile phone use, and computer work. These findings are summarized in the following tables:

Table 3: Visual Symptoms and Problem Solving

Visual Symptoms While Reading:	Frequency (n)	Percentage (%)
Symptom		
Blurring Vision	32	55.17%
Headache	16	27.58%
Watering	5	8.6%
Eye Ache	5	8.6%
No Complaints	38	39.6%
Problems During Device Use:		
Activity	**Complaints (n, %)**	**No Complaints (n, %)**
Mobile Phone Use	54 (56.3%)	42 (43.8%)
Computer Use	53 (55.2%)	43 (44.8%)

A total of 96 participants attended follow-up consultations. Among these, 93.75% (n=90) reported satisfaction with their corrective prescriptions, while 6.25% (n=6) expressed dissatisfaction. For the latter group, subjective refraction was repeated, and updated prescriptions were provided.

The most common cylindrical power observed was -0.50D in both eyes. With-the-rule astigmatism was the most prevalent type, accounting for 45.8% of participants, while irregular astigmatism was observed in 11.5%. Asthenopic symptoms, particularly blurring vision (55.17%) and headaches (27.58%), were highly prevalent among participants experiencing problems while reading. Similarly, over half of the participants reported difficulties using mobile phones (56.3%) and computers (55.2%), underscoring the significant functional impact of astigmatism on digital device usage. These findings emphasize the need for early detection and timely correction of astigmatism to alleviate visual discomfort and improve patients' quality of life.

DISCUSSION

The findings of this study provided significant insights into the prevalence, types, and functional impacts of astigmatism on visual comfort, aligning with and expanding upon previous research in the field. Among the 96 participants, mild to moderate astigmatic powers (-0.50D to -0.75D) were most prevalent, consistent with prior studies indicating that low degrees of astigmatism are more common than higher cylindrical powers in general populations (26, 27). The predominance of with-the-rule astigmatism (45.8%) mirrored findings by Wilson et al., who reported its greater prevalence among younger individuals, with a gradual shift toward against-the-rule astigmatism occurring with age due to changes in corneal structure (28). This study reinforced the importance of understanding the distribution of astigmatism types when designing targeted corrective strategies for patients in specific age groups.

Asthenopic symptoms, particularly blurring vision and headaches, were frequently reported during activities requiring prolonged focus, such as reading and digital device use. These symptoms are well-documented in the literature, with studies by Kleinstein et al. and Wiggins and Daum similarly noting a strong association between uncorrected astigmatism and visual discomfort during near work and screen-based tasks (19, 29). The prevalence of symptoms such as blurred vision (55.17%) and headaches (27.58%) highlighted the substantial functional burden imposed by astigmatism on daily activities. The findings were also consistent with studies by Wolffsohn et al., who observed that uncorrected astigmatism adversely affects reading speed, accuracy, and task completion efficiency, further emphasizing the need for timely and accurate corrective interventions (16).

The study's strengths included a comprehensive assessment of visual symptoms across a range of daily activities, providing a detailed understanding of the impact of astigmatism on functional tasks. The use of cycloplegic refraction ensured accurate measurement of refractive errors, reducing the risk of overestimation or underestimation in cylindrical power assessments. Additionally, the high follow-up satisfaction rate (93.75%) underscored the effectiveness of individualized corrective prescriptions in alleviating visual discomfort, aligning with the findings of Ferrer-Blasco et al., who reported similar patient satisfaction levels following astigmatic correction (30).

However, the study was not without limitations. The sample size of 96 participants, while adequate for the scope of this cross-sectional study, limited the generalizability of the findings to broader populations. The use of a single-center

design further constrained the diversity of participants, potentially introducing selection bias. The reliance on self-reported symptoms also introduced the possibility of subjective variability in symptom reporting, which could influence the accuracy of associations between astigmatism and asthenopic complaints. Furthermore, the study focused primarily on cylindrical powers of ≥ ±0.50D, potentially excluding individuals with lower but clinically significant astigmatic powers who might also experience visual discomfort.

Recommendations for future research include the inclusion of larger and more diverse populations to enhance generalizability, as well as longitudinal designs to assess the long-term impact of astigmatic correction on quality of life. Further studies could also explore the role of advanced corrective options, such as toric lenses and refractive surgery, in alleviating asthenopic symptoms. Additionally, investigating the influence of comorbid conditions, such as dry eye or accommodative dysfunction, on the relationship between astigmatism and visual discomfort would provide a more comprehensive understanding of contributing factors.

CONCLUSION

In conclusion, this study highlighted the significant functional and symptomatic impact of astigmatism on individuals' daily lives, emphasizing the importance of timely diagnosis and effective correction. The findings contributed to the growing body of evidence underscoring the need for public awareness campaigns and regular vision screenings to reduce the burden of uncorrected refractive errors. Despite its limitations, the study provided valuable insights that could guide clinical practice and future research, ultimately improving patient care and visual outcomes.

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