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Original Research Article

Assessment of Vision Related Quality of Life in Myopic Children and Adolescents

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Abstract:

Purpose: The aim of the study was to assess the impact of myopia on vision related quality of life by evaluating their stereopsis and contrast sensitivity.

Methods: This is a hospital-based, cross sectional analytical study conducted on 150 young patients with myopia. After a detailed evaluation of anterior and posterior segment using slit lamp bio microscopy to rule out any other concurrent ocular comorbidity, UCVA, BCVA was assessed using Snellen's chart. Stereopsis and contrast sensitivity were assessed using Titmus Dots and Circles chart and Pelli Robson chart respectively. Posterior segment was evaluated using indirect ophthalmoscopy with 20D to rule out any other pathology. Descriptive statistics, namely, mean, standard deviation to express quantitative variables wherever applicable. Correlation between myopia and stereopsis and correlation between myopia and contrast sensitivity was analyzed by using Chi-square test and Pearson's correlation coefficient. P value <0.05 was considered as statistically significant.

Results: Among total 150, 64 (42.7 %) were myopes, 61 (40.7 %) had simple myopic astigmatism, 25 (16.7 %) had compound myopic astigmatism. Contrast sensitivity was found decreased in 78.1% myopes, 65.6% simple myopic astigmatism, 48% compound myopic astigmatism. Further, contrast sensitivity was abnormal in 67.3% with mild myopia (<3D); in 72.7% with moderate myopia (3-6D) and 100% with high myopi (>6D) respectively. There was a strong negative correlation showing that, as the severity of myopia increased, the contrast sensitivity loss increased too. A statistically significant reduction in stereopsis was also noted with increase in degree of refractive error.

Conclusion: Myopic refractive error is associated with reduced stereopsis and contrast sensitivity, causing a negative impact on vision related quality of life. Early detection and correction of same needs added emphasis particularly in the growing years to ensure both good quality of vision and visual acuity.

Keywords: Best-corrected visual acuity, Contrast sensitivity, myopic refractive error, quality of vision, stereopsis.
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Introduction

Refractive error is one of the most common causes of visual impairment around the world and the second leading cause of treatable blindness[1] with uncorrected myopia being a leading cause of distance vision impairment [1,2] especially in paediatric and adolescent age group.

Binocular single vision is a state when a normal individual fixes his visual attention on an object of regard and the image is formed on the fovea of both eyes separately; but the individual is able to perceive it as a single image.

Stereopsis forms an important part of binocular single vision, providing functional benefits in everyday tasks. [3] it is the smallest horizontal retinal image disparity (measured in arc seconds) giving rise to the perception of relative depth. Hence, deficits in stereopsis can affect precision movements, precision grasping and sense of distance/depth affecting image quality and perception.

Contrast sensitivity is the ability to detect subtle differences in shading and patterns- thus helpful in detecting objects without clear outlines and discriminating objects or details as separate from their background, [4] thereby influencing the quality of our vision. A decrease in the contrast sensitivity function can lead to a loss of spatial awareness and mobility and may thus affect the ability to recognize

faces, walk down steps in the dark, drive at night and in the rain and more of such daily routine activities.

Poor vision in childhood affects performance in school. Children and adolescents are considered a high-risk group because uncorrected refractive errors can seriously affect their learning abilities and their mental and physical development. [5] They may tend not to undertake any work that needs visual concentration, thus affecting their performance. [6]

Relevance of the Study: Visual acuity is the most emphasized component of visual function that is used in clinical practice. However, this study aims to look into the relevance of neglected components of visual function – contrast sensitivity and stereopsis in assessing the impact on quality of vision in patients with myopia-one of the leading causes for defective vision worldwide.[1,2] Contrast sensitivity is sometimes more important than visual acuity. Contrast sensitivity helps to distinguish between an object and its background and can be useful in day to day activities while stereopsis forms the highest grade of binocular single vision aiding in depth perception- both of which are important in quality of vision in an individual. Considering the prevalence of myopia and importance of stereopsis and contrast sensitivity functions in day to day life, but fewer reports that address the correlation between the severity of myopia and the two, a study was chosen in this regard.

Aims and Objectives

To assess the impact of myopic refractive error in vision related quality of life of children and adolescents by evaluating

1. Correlation between myopic refractive error and stereopsis
2. Correlation between myopic refractive error and contrast sensitivity

Materials and Methods

This is a hospital based cross sectional analytical study conducted in a tertiary eye care hospital in South India from July 2021 to June 2022 on 300 eyes of 150 patients (children and adolescents in the age group 5-19 yrs) with myopic refractive error. Following approval and clearance from institutional ethics committee, participants were enrolled in the study after obtaining written informed consent. Participants were excluded when valid consent was not obtained or any cognitive dysfunction was noted or evidence of any other cause for visual impairment other than myopia was present, or any history of previous ocular surgery/procedures was present.

The demographic data- name, age, gender was recorded using a pre-fixed questionnaire. A complete ocular examination including visual acuity testing, assessment and grading of refractive error, contrast sensitivity and stereopsis assessment was done, Fundus examination carried out.

UCVA and BCVA assessed using Snellens chart, anterior segment examined using slitlamp biomicroscopy and Fundus examined by indirect ophthalmoscopy with 20 D lens.

Grading of refractive error was done using spherical equivalent as mild (<3d), moderate (3-6d), high (>6d).

Stereopsis was assessed using Titmus test (dots/circles) (Stereo Fly Test Optical CO inc) at a distance of 40 cm (16 inches) and graded as

Normal – upto 120 seconds of arc

Equivocal- 120-240 arc seconds

Abnormal >240 arc seconds

Contrast sensitivity of either eye assessed using Pelli Robson chart and was classified into normal (>/=2) and poor (<2 log units)

The type of refractive error was also charted into simple myopia, simple myopic astigmatism, compound myopic astigmatism.

Sample Size Estimation: The sample size is calculated based on the previous study by Chanchal G, Anamika A , Darshana R, Anuja Gharat, Amruta K, Aditi et al (2014-2015) –"A Study of Stereopsis in Children and Adolescents with Myopic Refractive Error"[7] from which mean and standard deviation was obtained.

Sample size was calculated using the formula

$$n = \frac{Z^2 (1-\alpha/2\ p(1-p}{(\varepsilon P)2}$$

Where P = anticipated population proportion, ε = relative precision

Table 1: Sample size calculation

	Normal and Equivocal Combined	Abnormal
Expected Proportion	0.61	0.39
Relative Precision (%)	20	20
Desired confidence level (1- alpha) %	95	95
Required sample size	61	150

For the study, larger sample size of 150 is used.

Consecutive sampling was done.

Statistical Analysis: The data collected was entered into MS Office Excel sheet and was analyzed using SPSS software version 20.0. Categorical and quantitative variables were expressed as frequency (percentage) and mean ± SD respectively. Independent t test was used to compare quantitative parameters between categories. Chi-square test was used to find association between categorical variables. Karl Pearson Correlation Coefficient was used to find out relationship of quantitative parameters. For all statistical interpretations, $p<0.05$ was considered the threshold for statistical significance.

Results

During the study period from, 150 myopic children and adolescents in the age group 5-19 yrs were evaluated and the relation of myopic refractive error with stereopsis and contrast sensitivity were assessed respectively.

Of the total 150, 46.7% were males and 53.3% were females. The mean age of the study subjects was 12±3.3 years.

64 were myopes, 61 had simple myopic astigmatism, 25 had compound myopic astigmatism. The spherical equivalent of refractive error of these subjects ranged from -0.25D to -6.25D (Mean±SD= 1.5 ± 1.2D)

Table 2 shows the correlation between stereopsis and myopic refractive error and the statistically test used is Pearson's correlation coefficient.

Among those with mild degree of myopia (≤3D) 89.5% cases had normal stereopsis while 13.4 % had equivocal results. Abnormal stereopsis was observed in only 0.8%; among those with moderate degree of myopia (3-6D) 59.1% cases had normalstereopsis, 39.1% showed equivocal results and 4.1 % showed abnormal stereopsis. Thus, a statistically significant reduction in stereopsis was observed with increase in degree of refractive error (p=0.002).

Table 2: Comparison of degree of refractive error based on stereopsis

Degree of Refractive Error	Normal		Equivocal		□2	p
	Count	Percent	Count	Percent		
Mild	109	86.5	17	13.5	9.72	0.002
Moderate	13	59.1	9	40.9		

Table 3 shows the correlation between contrast sensitivity and myopic refractive error. Contrast sensitivity was found to be abnormal in 67.3% patients with mild degree of myopic refractive error; in 72.7% patients with moderate degree and 100% among those with severe degree of refractive error. Karl Pierson correlation coefficient was calculated w.r.t average degree of refractive error in the study population and contrast sensitivity function. A strong negative correlation was noted between contrast sensitivity and myopic refractive error. It was found to be statistically significant. Relationship between contrast sensitivity and myopic refractive error r = -0.244, p<0.01

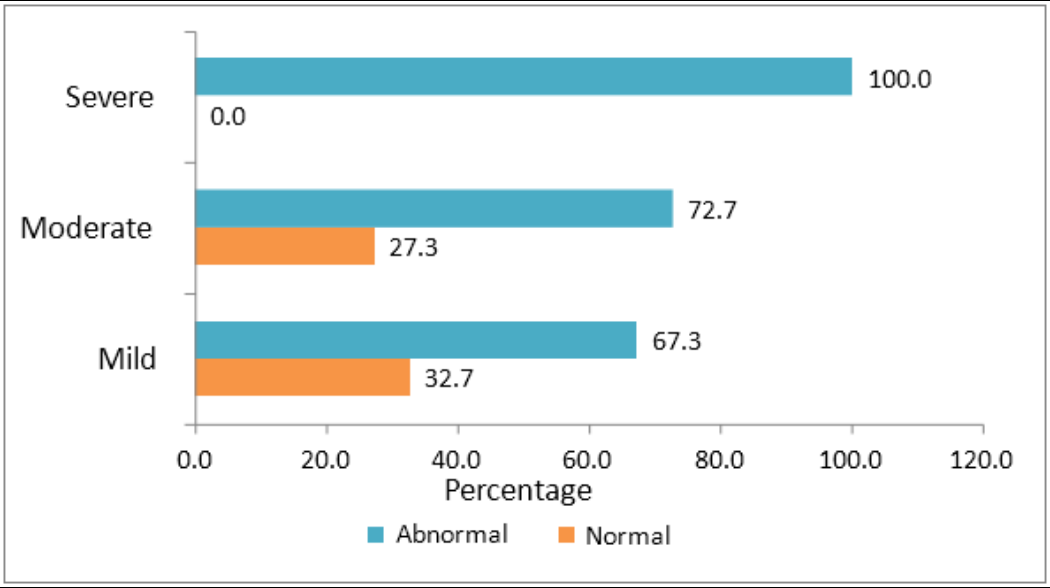

Figure 1: Association of contrast sensitivity and degree of myopic refractive error

Relationship between contrast sensitivity and myopic refractive error r = -0.244, p<0.01.

Table 3: Association of contrast sensitivity and type of refractive error

Type of refractive error	Normal		Abnormal		□2	P
	Count	Percent	Count	Percent		
Myopia	28	21.9	100	78.1	15.55	p<0.01
Simple myopic astigmatism	42	34.4	80	65.6		
Compound myopic astigmatism	26	52.0	24	48.0		

Discussion

From our study, it was observed that there is a statistically significant reduction in stereopsis noted with increase in degree of refractive error. Normal stereopsis was found in 86.5% patients with mild refractive error ≤3D while only 56.5% patients with moderate refractive error (>3D) had normal stereopsis. There was deterioration of stereoacuity as myopic refractive power increased. The relation was found to be statistically significant with p=0.002.

Similar results were reported by Chanchal G, Anamika A, Darshana R, Anuja Gharat, Amruta K, Aditi et al (2014-2015) in their study. [7] They found that simple myopia>3D was associated with reduced stereopsis. In "Stereoacuity and related factors: The Shandong Children Eye Study "Da-Dong Guo et al. PLoS One 2016 [8] lower stereoacuity was found to be significantly associated with lower BCVA (P<0.001), higher intereye difference in refractive error (p<0.001), higher cylindrical and spherical refractive error(p<0.001), higher intereye difference in BCVA (p=0.001).

Further, it was observed that there is a statistically reduction in contrast sensitivity with increase in degree of myopic refractive error. Karl Pearson correlation coefficient calculations w.r.t contrast function pointed to a strong negative correlation between contrast sensitivity and myopic refractive error. It was found to be statistically significant. Relationship between contrast sensitivity and myopic refractive error r = -0.244, p<0.01.

In our study, a strong statistically significant negative correlation was found between myopia and contrast sensitivity. The reduction in contrast sensitivity correlated with increase in the degree of refractive error, that is, with increasing severity of myopic refractive error, there was a decrease in contrast sensitivity score. Also, a statistically significant association was found between contrast sensitivity function and type of refractive error. Contrast sensitivity was found to be more affected in patients with pure myopia followed by simple myopic astigmatism and compound myopic astigmatism.

Thus, results of our study have demonstrated that both stereopsis and contrast sensitivity are reduced in those with myopia and myopic astigmatism, thus showing the negative impact of myopic refractive error on the quality of one's vision. This is significant particularly in the growing period of an individual's life indicating the importance of early detection and correction of refractive errors. Few other studies which investigated the impact of refractive errors on quality of vision also showed similar results. In the study by Stoimenova BD et al "The effect of myopia on contrast thresholds 2007." [9] Despite having corrected visual acuity, myopes exhibited reduced sensitivity to contrast in comparison to emmetropes. Also, the contrast sensitivity decreased with an increasing degree of myopia.

Limitations of the Study: The sample size was small and, the sample population did not have adequate representation of patients with severe/high degree of refractive error.

Conclusion

From the results of the study, it is observed that myopic refractive error is associated with reduced stereopsis and contrast sensitivity functions. A statistically significant reduction in stereopsis and contrast sensitivity is seen in those with myopic refractive error. Stereopsis decreases with increase in degree of myopia.

- Pure myopia has a strong association with poor contrast sensitivity followed by compound myopic astigmatism and simple myopic astigmatism
- This shows the negative impact of myopic refractive error on the quality of one's vision particularly in the growing period of an individual's life.
- Hence, early detection and correction of myopic refractive error is important for both visual acuity and good quality of vision. There is a definite role in screening of children for refractive error so that it gets detected and treated early.

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