

# Relationship Between Degree of Myopia and Stereoscopic Vision in Junior High School Students

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## Introduction

Stereoscopic is the depth perception of an object seen by good binocular vision of both eyes, where 2-dimensional shadows falling on the retina are transformed into 3-dimensional shadows. One factor that causes interference with one's vision is myopia. Myopia is a refractive disorder that has a high prevalence in school-aged children and is likely to affect stereoscopic visual impairment in children.

## Method

This research was observational analytic with cross sectional study method. The research subjects were Al-Azhar Medan Junior High School students with myopia refraction abnormalities and then a stereoscopic vision test was performed using Titmus Fly Test.

## Results

Of the total 75 children, there were 46 mild myopia, 24 moderate myopia, and 5 severe myopia. The statistical test found a relationship between myopia and stereoscopic vision ( $p = 0.001$ ) and there were significant differences in stereoscopic vision between each degree of myopia ( $p = 0.001$ ).

## Conclusion :

There are significant differences in stereoscopic vision between patients with mild, moderate and severe myopia. Stereoscopic vision in children with moderate myopia and severe myopia is worse than children who suffer from mild myopia

**Keywords:** Stereoscopic vision, myopia, Titmus Fly Test, Children.

## 1. INTRODUCTION

Stereoscopic is the depth perception of an object seen using good binocular vision of both eyes, where 2-dimensional shadows falling on the retina are transformed into 3-dimensional shadows. Good stereoscopic vision is very useful in assessing and understanding the object being seen. Good binocular vision will have good stereoscopic vision.<sup>1</sup>

Impaired stereoscopic vision can interfere a person's activities in daily life, where a person will find it difficult to assess objects that require good three-dimensional or stereoscopic assessment. Good stereoscopic vision is influenced by the good sensory fusion and motor fusion. Clinically, stereoscopic vision examination is often used as an initial screening of eye examination.<sup>1</sup>

One of the causes of stereoscopic vision reduction in a person is the presence of refractive abnormalities such as myopia, hypermetropia or astigmatism. This is because the conditions for yielding a good stereoscopic vision are not fulfilled. From some refractive disorders, myopia is a refractive disorder that has the high prevalence.<sup>2,3</sup>

## II. METHOD

This research is a research with a cross sectional study design and approved by the ethics committee of the Faculty of Medicine, University of North Sumatra. The research subjects were third grade students of Al - Azhar Junior High School in Medan who suffered from myopia from June to July 2018. The total sample was 75 students who suffered from myopia included in the inclusion criteria consisting of mild myopia 46 children, moderate myopia 24 children, myopia weight of 5 children. The subjects then performed a stereoscopic vision test using Titmus Fly Test. All data is entered with SPSS (IBM SPSS Statistic for Windows, Version 19.0). One way Anova test (difference in mean stereoscopic vision score between myopia groups) was used for analysis.  $p < 0.05$  was considered significant.

## III. RESULT

This research was conducted from June 2018 to July 2018 to Al Azhar Junior High School children who met the research criteria. The number of samples in this study were 75 children. This study was divided into three groups: mild myopia, moderate myopia, and severe myopia. In children who met the inclusion criteria, a visual examination and correction of refractive abnormalities are carried out and a stereoscopic test is performed using Titmus Fly Test. In this study several factors that influence stereoscopic vision such as history of eye surgery, infection, eye muscle abnormalities have been excluded so as not to influence the results of the study

Table 4.1. Characteristics of the research subject

Characteristics	n	Percentage (100%)
Characteristics		
• Male	27	36 %
• Female	48	64 %
Age		
• 13 years old	31	41,33%
• 14 years old	40	53,33%
• 15 years old	4	5,33%
Severity of the Miopia		
• Mild	46	61,33%
• Moderate	24	32,00%
• Severe	5	6,66%

In table 4.1 above shows that more girls have refractive disorders that are 48 (64%) compared to boys, 27 children (36%). From the age characteristics it was found that at the age of 14 years the highest number of respondents experienced refractive abnormalities which amounted to 40 children (53.33%), while respondents aged 13 years amounted to 31 children (41.33%) and respondents aged 15 years amounted to 4 children (5.33%) of all respondents. In the degree of myopia, it was found that the mildest degree of myopia was 46 children (61.33%), moderate myopia totaling 24 children (32%), and severe myopia totaling 5 children (6.66%).

Table 4.2. Stereoscopic measurement results

Miopia Groups	n	Stereoscopic vision (arc seconds)		p.
		$\bar{x} \pm SD$	[min-max]	
• Mild	46	26,80 ± 6,652	[20 – 40]	0.0001
• Moderate	24	44,21 ± 11,375	[20 – 63]	
• Severe	5	85,20 ± 20,266	[63 – 100]	

One way Anova test in Table 4.2 above shows a difference in the mean stereoscopic vision score between myopia groups (p = 0.0001). Furthermore, to see the average different stereoscopic vision scores can be seen in Table 4.3.

Table 4.3. Description between groups of myopia with stereoscopic vision

Myopic groups	P
Mild – Moderate	0.0001
Mild – Severe	0.0001
Moderate – Severe	0.0001

From table 4.3 it can be seen that there are significant differences in stereoscopic vision between mild myopia and moderate myopia groups (p = 0.0001). Significant stereoscopic vision differences were also found between mild myopia and severe myopia and between moderate myopia and severe myopia groups ( p = 0.0001).

#### IV. DISCUSSION

Stereoscopic vision is the highest level of binocular vision in humans. Stereoscopic itself is a binocular visual ability that is used for three-dimensional vision resulting from the neural process of stimulation in the retinal area that differs horizontally in the functional area of Panum's area. The development of stereoscopic vision will gain more development since the age of 5 years. According to Hriros et al., It was found that reduced stereoscopic vision was associated with decreased performance requiring hand and eye coordination and visual motor skills in school-age children.<sup>4</sup>

To produce good stereoscopic vision, there are a number of conditions that must be fulfilled, namely the normal driving muscles of the eye, there are no abnormalities in the peripheral and central visual nerves, no anatomical defects are found and no interference in the refraction field.<sup>1,5</sup>

In patients with myopia, shadows that occur form greater disparity of the retina which causes a decrease in the formation of shadow fusion which causes a decrease in the level of depth of binocular vision which will ultimately affect stereoscopic vision.<sup>3</sup>

Titmus stereotest, is one of the contour tests commonly used for stereoscopic tests in children, which can assess various differences from 3000 to 40 arcseconds. Good binocular function is very important for stereoscopic vision development.<sup>6</sup>

In table 4.1, it can be seen that the highest frequency of subjects suffering from myopia is women. By using the chi square test obtained p <0.05. This shows there is a relationship between sex with the occurrence of refractive abnormalities. The results of this study have similarities with the research of Rosman M. (2009) and Favhrian (2009). According to Rosman M (2009) research, refractive abnormalities are more common in women than men (61.1% versus 49.3%). While the results of

Fachrian's research (2009) showed that the number of female respondents (53.2%) was more than men (46.89%). Women have longer eyeball axial lengths, and have a vitreous chamber that is deeper than men. This allows women to have a higher refractive disorder than men.<sup>7,8</sup>

In table 4.2 shows the relationship between myopia and stereoscopic vision, where the higher the degree of myopia causes shadows falling on the retina are not identical and cannot be fused well, in some literature it is also explained that someone who has a high myopia disorder that is not well corrected and can cause esophoria and exophoria which can aggravate stereoscopic vision. This study is in line with previous studies by Pratjahja which stated that the occurrence of uncorrected refractive abnormalities such as myopia can cause a decrease in the quality of stereoscopic visual acuity.<sup>5</sup> Also in line with the research of Lai L et al in Taiwan and Kah Chung's research, it is said that myopia is closely related to phoria and tropic events which can interfere with one's stereoscopic vision.

Research similar to this study was conducted by Ju Wen Yang in Taiwan. However, Ju Wen's research emphasizes mild-moderate anisometropia in patients with myopia.<sup>10</sup>

In table 4.3 illustrates the relationship between the degrees of myopia with stereoscopic vision, where it was found that the more severe the degree of myopia, the greater the decrease in stereoscopic vision of a person. In some libraries, it is stated that the greater the horizontal retinal disparity that occurs in the Panum area caused by the more severe refractive abnormalities, the lower the depth of stereoscopic vision due to shadows formed in the peripheral area of the Panum area. This study is similar to a study by Chanchal G et al., Which states that myopia > 3D is closely related to a decrease in a person's stereoscopic vision.<sup>8</sup> Another similar study was conducted by Farid Setiawan et al., The study was conducted on adults whose eye development was perfect and TNO Stereotest was used as a stereotest test that is rarely used in children and found no significant results between mild myopia and severe myopia to stereoscopic vision.<sup>11</sup>

#### IV. CONCLUSION

Of the 75 children, it was found mild myopia in 46 children, moderate myopia 24 children, severe myopia 5 children. From the statistical test, there is a correlation between the increase in the degree of myopia and the decrease in stereoscopic vision with a value of  $p = 0.001$ .

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