

Determination of depression, anxiety, and hopelessness levels in adolescents with refractive errors after the COVID-19 pandemic

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Ethics Committee Approval

Ethical approval was obtained from Erciyes University Non-Interventional Clinical Research Ethics Committee (Decision No: 2023/575). All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Conflict of Interest

No conflict of interest was declared by the authors.

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Abstract

Background/Aim: The prevalence of myopia is increasing worldwide especially among adolescents. Changes in living conditions such as reduced engagement in outdoor activities as well as increased activities near the workplace like reading, writing, and screen exposure are thought to be responsible for this increase. Adolescence is a sensitive period of rapid changes in psychological, physiological, and social aspects. Mental health issues such as anxiety and depression are common during this period. During the pandemic, mental health issues among children and adolescents increased due to stress caused by the disease, social isolation, disruption of routines, and the loss of loved ones. With the rapid increase in myopia among adolescents, there is a need to investigate the effects of myopia on mental health. The aim of this study is to evaluate anxiety, depression, and hopelessness levels in adolescents with myopia after the COVID-19 pandemic and to examine the relationship between myopia and anxiety, depression, and hopelessness.

Methods: This was a case-control study that included 40 myopic adolescents aged 16-19 with a spherical refractive degree of -2 diopters (D) and above and 40 emmetropic (no refractive error). Participants who had previously undergone refractive surgery, had binocular visual acuity less than 1.0, had strabismus and amblyopia, had a diagnosis of glaucoma, had undergone ocular surgery for any reason, had retinopathy, or had an astigmatic refractive degree greater than ± 0.50 were excluded from the study. The study did not include patients with chronic physiological or psychiatric diseases. Both groups were administered the Automatic Thoughts Questionnaire (ATQ), Coronavirus Anxiety Scale (CAS), Beck Hopelessness Scale (BHS), and Beck Depression Inventory (BDI). The groups were compared according to the scales. Myopic degrees were compared with mixed-effect linear models according to scale categories, and the relationship between ATS scores and myopia degrees was evaluated using the Spearman correlation coefficient.

Results: The mean (SD) spherical refractive power of myopic adolescents was -3.156 (1.40) diopters; 62.5% of participants with myopia had been exposed to COVID-19, and the anxiety rate in myopic participants compared to controls was 15% ($P=0.026$). However, no significant difference was found between the myopia and control groups in terms of automatic thoughts, hopelessness, and depression inventory scores when comparing the groups. No correlation was found between the CAS ($F=1.098$), BHS ($F=1.610$), BDI ($F=1.699$), and ATQ ($r=0.151$) scales and the increase in myopia when we performed linear mixed model analysis and Spearman correlation analysis. There was no significant relationship between the degree of myopia and automatic thoughts, hopelessness anxiety, and depression.

Conclusion: The results indicate that adolescents with myopia had higher levels of anxiety after the COVID-19 pandemic. There was no significant correlation between the degree of myopia and anxiety, depression, hopelessness, and automatic thoughts. It is important to monitor adolescents with myopia carefully during pandemics and provide the necessary mental health support. This is because offering mental health support to myopic young people may protect them from potential lasting emotional problems in adulthood during potential future pandemics. It may be beneficial for adolescents to increase their engagement in outdoor activities to reduce myopia and anxiety.

Keywords: COVID-19, myopia, adolescents, anxiety, depression, hopelessness

Introduction

Myopia is a serious vision problem worldwide. The World Health Organization estimates that by 2050, half of the global population will be myopic [1]. According to other estimates, by 2050, 5 billion people will be myopic with over 1 billion having myopia exceeding -5 diopters (D) [2]. Studies have shown an increasing prevalence of myopia in adolescents, and this increase is thought to be due to changes in living conditions such as increased near work activities, reading, writing, and screen exposure [3,4].

Studies have shown that people with myopia tend to be more introverted, have fewer friends, prefer indoor activities over outdoor ones, and are often engaged in intellectual activities rather than sports [5]. Considering that the frequency of myopia in adolescents is rapidly increasing, it is crucial to understand its effects on adolescent mental health [4].

Adolescence is a vulnerable period of rapid psychological, physiological, and social changes. The most common mental health problems in adolescents are anxiety and depression [6]. Angi et al. [7] found that university students with myopia had higher levels of anxiety and somatization than controls. Another study showed that anxiety was higher in adolescent boys with myopia [4].

During the pandemic, children and adolescents experienced an increase in mental health issues due to factors such as fear of the disease's pathogenic effect, social isolation, inability to meet friends, disruption of routines, and the loss of loved ones [8,9]. Among these mental health problems, anxiety and depression were the most common [10]. Thus, this study aims to evaluate the presence of anxiety and depression in adolescents with myopia who have experienced the COVID-19 pandemic and investigate the relationship between anxiety, depression, hopelessness, and myopia.

Materials and methods

Study groups and sample size

This study was conducted between September and October 2023 and included 40 myopic adolescents aged 16-19 with a spherical refractive power of -2 diopters (D) or higher who applied to the ophthalmology clinic for eye diseases as well as 40 emmetropic adolescents with no chronic physiological or psychiatric diseases who visited the general pediatric outpatient clinic. Refractive measurements were obtained using an autorefractometer (TonoRef II, Nidek, Japan). After the ocular and systemic examinations, participants' best-corrected visual acuity was determined using the Snellen chart. In addition, intraocular pressure was measured, slit-lamp examination of the anterior segment and posterior segment was performed, and color vision was assessed using the Ishihara test. Participants who had previously undergone refractive surgery, had binocular visual acuity less than 1.0, had strabismus and amblyopia, had a diagnosis of glaucoma, had undergone ocular surgery for any reason, had retinopathy, or had an astigmatic refractive degree greater than ± 0.50 were excluded. The study did not include patients with chronic physiological or psychiatric diseases in the emmetropic group. To reduce bias during patient selection, comprehensive pre-defined criteria were used to identify

individuals for inclusion in the study. These criteria were set in accordance with the main aims and hypotheses of the research. In addition, methods such as random assignment or the creation of balanced groups were used to minimize potential bias between groups. Each step in this selection process was carefully planned and implemented to increase the reliability and internal validity of the research.

Sample size and power analysis were performed using G*Power 3.1 software. A minimum of 39 participants in each group was required to detect a moderate or higher difference in the studied variables between the groups (Cohen's $d=0.65$) with 80% power and a 5% Type-I error rate. Ethical approval for the study was obtained from the Erciyes University Non-Interventional Clinical Research Ethics Committee (Decision No: 2023/575). Participants were administered The Automatic Thoughts Questionnaire (ATQ), the Coronavirus Anxiety Scale (CAS), the Beck Hopelessness Scale (BHS), and the Beck Depression Inventory (BDI).

Data Collection Tools

Automatic Thoughts Questionnaire (ATQ): This scale was developed by Hollon and Kendall and consists of 30 items. The scale is a 5-point Likert type. The lowest score is 30, and the highest score is 150. Higher scores indicate that the individual's automatic thoughts occur frequently [11].

Coronavirus Anxiety Scale (CAS): This was developed by Lee [12] to identify possible dysfunctional anxiety cases related to the COVID-19 crisis. It is a one-dimensional Likert-type scale consisting of five questions and is scored from 0 to 4. The lowest possible score is 0, while the highest is 20. A score of nine and above indicates a high level of anxiety. Scores of 9 and above indicate anxiety, while scores below 9 suggest no anxiety.

Beck Hopelessness Scale (BHS): Developed by Beck, Weissman, Lester, and Trexler, this scale is used to determine the level of future-oriented pessimism in adolescents and adults. The scale assesses three sub-dimensions of the future: Feelings about the future, loss of motivation, and expectations about the future. The scale consists of 20 items, and the score ranges from 0 to 20. Questions are answered with "Yes" or "No," and 0 points are given for negative answers, and one point is given for positive answers. The score ranges from 0 to 20. A higher score implies more hopelessness [13]. People who score between 4-8 points have mild hopelessness symptoms, those who score between 9-14 points have moderate hopelessness symptoms, and those who score 15 points and above have severe symptoms of hopelessness [14].

Beck Depression Inventory (BDI): Developed by Beck, Ward, Mendelson, Mock, and Erbaugh, this inventory is a multiple-choice self-report inventory used to assess the severity of depression in adolescents and adults [15]. The BDI contains 21 items with four choices each. A score of 0-9 indicates minimal depression, 10-18 indicates mild depression, 19-29 indicates moderate depression, and 30-63 indicates severe depression [16].

Statistical analysis

Data were analyzed using the statistical package program IBM SPSS Statistics Standard Concurrent User V 29 (IBM Corp., Armonk, New York, USA). Descriptive statistics

were given as number of units (n), percentage (%), mean (standard deviation), median and inter-quartile range values. The normal distribution of the numerical variables was evaluated with the Shapiro-Wilk normality test. Variance homogeneity of the groups was analyzed by Levene's test. Two-group comparisons for numerical variables were performed by an independent sample t-test if the data were normally distributed and by the Mann-Whitney U test if the data were not normally distributed. Chi-square analyses (Pearson chi-square, Yates chi-square, Fisher exact test) were used to compare the groups with categorical variables. Myopia degrees were compared with mixed-effect linear models based on scale categories, and the relationship between ATS scores and myopia degrees was evaluated using the Spearman correlation coefficient. A *P*-value <0.05 was considered statistically significant.

Results

The study comprised of 40 adolescents with myopia and 40 healthy controls aged between 16 and 19 years. All myopic participants had a visual acuity of 1.0, normal intraocular pressure, and normal anterior and posterior segment findings. Their mean (SD) spherical refractive error was -3.156 (1.40) diopters (Table 1). The myopic group consisted of 47.5% of males and 52.5% of females; 62.5% of whom had been diagnosed with COVID-19. Between those with and without myopia, there was a significant difference in the CAS (*P*=0.048). When compared with the control group according to the cut-off point of the scale, 15% of those with myopia were anxious and the difference was significant (*P*=0.026). No differences were found between the groups on the ATQ, BHS, and BDI (Table 2).

Table 1: Mean spherical equivalent of the right and left eyes in the myopia group

	Degree of myopia in right eye	Degree of myopia in left eye	Mean Spherical Equivalent
Mean diopters	-3.1437	-3.1687	-3.1562
Standard deviation	1.42200	1.48323	1.40162
Minimum	-2	-1.25	-1.75
Maximum	-7.75	-7.25	-7.5

Table 2: Comparison of groups according to demographic data and scales

	Groups		Test Statistics	
	Myopic	Control	Test results	<i>P</i> -value
Sex	n (%)	n (%)		
Boy	19 (47.5)	20 (50.0)	0.001	1.000
Girl	21 (52.5)	20 (50.0)		
Age year, mean (SD)	17.6 (1.1)	17.2 (1.1)	1.782	0.079 [†]
COVID-19 infection history	n (%)	n (%)		
No	15 (37.5)	20 (50.0)	0.813	0.367 [‡]
Yes	25 (62.5)	20 (50.0)		
ATQ	60.50 (37.75)	55.50 (34.50)	0.977	0.329 [‡]
CAS	0.50 (1.00)	0.00 (0.00)	1.974	0.048[‡]
BHS	5.50 (8.75)	4.00 (6.50)	0.126	0.900 [‡]
BDI	13.00 (21.25)	13.50 (14.00)	0.520	0.603 [‡]
CAS	n (%)	n (%)		
Absence of anxiety	34 (85.0)	40 (100.0)	6.486	0.026[‡]
Presence of anxiety	6 (15.0)	0 (0.0)		
BHS	n (%)	n (%)		
Minimal	15 (37.5)	16 (40.0)		
Mild	12 (30.0)	14 (35.0)	1.457	0.742 [‡]
Moderate	8 (20.0)	8 (20.0)		
Severe	5 (12.5)	2 (5.0)		
BDI	n (%)	n (%)		
Absence of depression	21 (52.5)	24 (60.0)	0.203	0.652 [‡]
Presence of depression	19 (47.5)	16 (40.0)		

SD: standard deviation, n: number of patients, %: Column percentage, numerical data presented as mean (SD) or median (interquartile range) values, [†]: Independent samples t-test, [‡]: Mann-Whitney U test, ATQ: Automatic Thoughts Questionnaire CAS: Coronavirus Anxiety Scale, BHS: Beck Hopelessness Scale, BDI: Beck Depression Inventory

No correlation found between the CAS (*F*=1.098), BHS (*F*=1.610), BDI (*F*=1.699), and ATQ (*r*=0.151) scales and the increase in myopia when we performed linear mixed model analysis and Spearman correlation analysis. There was no

significant relationship between the degree of myopia and scores on automatic thoughts anxiety, depression, and hopelessness (Table 3).

Table 3: Correlation between scales based on the severity of myopia

	Degree of myopia Mean (SD)	Test results	<i>P</i> -value
CAS			
Absence of anxiety	-3.059 (0.240)	<i>F</i> =1.098	0.301
Presence of anxiety	-3.708 (0.571)		
BHS			
Minimal	-3.675 (0.354)		
Mild	-2.760 (0.395)	<i>F</i> =1.610	0.204
Moderate	-3.266 (0.484)		
Severe	-2.375 (0.613)		
BDI			
Absence of depression	-3.429 (0.303)	<i>F</i> =1.699	0.200
Presence of depression	-2.855 (0.316)		
ATQ		<i>r</i> =0.151	0.183

SD: standard deviation, *F*: Linear mixed model analysis, *r*: Spearman correlation coefficient, CAS: Coronavirus Anxiety Scale, BHS: Beck Hopelessness Scale, BDI: Beck Depression Inventory, ATQ: Automatic Thoughts Questionnaire

Discussion

Adolescence denotes the transition from childhood to adulthood. Amidst the pandemic, adolescents, who are among vulnerable groups, faced numerous mental health problems because of several factors such as stressful life events, quarantines, the loss of family members due to illness, and the subsequent mourning process. Furthermore, excessive use of the Internet and social media was common since they couldn't socialize with their peers [17]. As per recent studies, anxiety and depression emerged as the most prevalent mental health issues among adolescents who contracted COVID-19 [10]. Anxiety and depression are prevalent mental health conditions in young individuals which can persist into adulthood as anxiety disorders [6]. The closure of schools, shift to online education, prolonged near-work, and reduced engagement in outdoor activities due to the COVID-19 pandemic have been associated with an elevated incidence of myopia [18,19]. One study [20] found a higher incidence of separation and castration anxiety in myopia patients, while anxiety and somatization disorder were more prevalent in university students with myopia versus those without vision problems in another [7].

Consistent with prior research, patients diagnosed with myopia exhibited higher levels of coronavirus-related anxiety, although there was no observable escalation in anxiety with a greater degree of myopia. A previous investigation indicated that increased myopia amongst young people corresponded to heightened anxiety levels [21]. Nonetheless, other studies have so far been unable to corroborate these findings, which is consistent with the outcomes of our study. Adolescents with myopia who wear glasses may experience peer bullying at school, thus leading to a victim mentality [22]. Furthermore, Horwood et al. [23] suggest that a victim mentality beginning in early life may result in psychosocial maladjustment, increased anxiety, depression, and loneliness; lower self-esteem and behavioral problems may also be observed. A study conducted by Rosanes and colleagues [24] demonstrated a rise in non-specific anxiety disorders amongst myopic and hypermetropic patients who are required to wear glasses relative to healthy volunteers. Furthermore, people with myopia—particularly those with high myopia—exhibit lower quality of life which serves as another contributing factor to anxiety [21,25].

Limitations

Self-assessment questionnaires were used here to evaluate anxiety levels among adolescents. However, relying solely on scale scores to determine the presence of anxiety can lead to misconceptions. To obtain more accurate results in future studies, it may be beneficial to supplement self-assessment questionnaires with a complete psychiatric evaluation

Conclusion

We found that myopic adolescents had higher levels of coronavirus anxiety, as expected, but no differences were found between the groups in terms of automatic thoughts, hopelessness, and depression. As part of the pandemic measures, adolescents in particular were not allowed to leave their homes. Thus, near vision became mandatory for adolescents who had to socialize at home and communicate with computers via the Internet for their education. It should not be forgotten that myopia, and therefore anxiety, may increase if people are unable to leave their homes during pandemic periods. Therefore, during possible future pandemics, it may be beneficial for this age group to have the opportunity to go out and also to limit the time they spend on the computer. Mental health support for myopic adolescents may protect them from emotional problems that may persist into adulthood.

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