

Research on the Anxiety and Depression of Patients with Mechanical Ocular Injuries: A Cross-Sectional Study

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Purpose: The present study aimed to investigate the prevalence of anxiety and depression in patients with mechanical ocular injuries, and the effects of worry and resilience on anxiety and depression.

Patients and Methods: Patients with one eye of mechanical ocular injuries and healthy residents were recruited from June 8, 2022, to March 1, 2023. All subjects participated in psychologically relevant questionnaires including the Self-rating Anxiety Scale(SAS), the Self-rating Depression Scale(SDS), the Connor- Davidson Resilience Scale (CD-RISC), and the Penn State Worry Questionnaire(PSWQ). Data were collected and subjected to statistical analysis.

Results: There were no significant differences in SAS and SDS total scores based on demographics ($p > 0.05$) except for the subjective appraisal of the family economy ($p < 0.05$). The SAS and SDS total scores and the positive rates of anxiety and depression in the ocular trauma group were significantly higher than those in the healthy control group ($p < 0.01$). The positive rates of anxiety and SAS total scores of individuals with mild visual impairment were significantly higher than those with low vision ($p < 0.01$) and blindness ($p < 0.05$). There was no difference between the remaining groups. The positive rates of anxiety and SAS total score (36.5%, 45.92) of individuals with mild visual impairment were significantly higher than those with low vision (4.3%, 38.15) ($p < 0.01$) and blindness (19.4%, 40.19) ($p < 0.05$). There was no difference between the other groups. All effects of mechanical ocular injuries on anxiety and depression were significant ($p < 0.01$). The indirect mediating effects on anxiety by worry alone, resilience alone, resilience, and worry were significant ($p < 0.01$). The mediating indirect impact on depression by worry alone ($p < 0.01$), worry and resilience ($p < 0.05$) were significant while resilience ($p > 0.05$) did not show a significant mediation effect.

Conclusion: Patients with mechanical ocular injuries are prone to developing anxiety and depression with resilience and worry playing a mediating role.

Keywords: anxiety, depression, resilience, worry

Introduction

Mechanical ocular injuries, the most common type of ocular trauma, can result in structural damage to the eye and a decrease in visual function, often leading to physiological and psychological issues.¹ It is common for patients with eye diseases to experience anxiety and depression. According to the study, 31.2% of patients with eye diseases reported anxiety symptoms, while 25% reported depression symptoms.^{2,3} Many ophthalmic conditions, including blindness, also have psychological manifestations, which need to be addressed.⁴ These negative mental health conditions may arise due to various eye-related symptoms such as discomfort, pain, visual impairment, and more. Additionally, social factors, doctor visits, and medical expenses may also contribute to the development of anxiety and depression.^{2,5} Vision impairment and facial deformities resulting from mechanical ocular injuries can lower a patient's quality of life, affecting

their social, daily life, and work abilities. This increased functional disability can lead to mental health problems such as clinical depression and anxiety, placing patients at greater risk.^{6,7} Anxiety can worsen the decline in quality of life caused by vision impairment, and it can also directly affect visual function by disrupting autonomic nervous or hormonal balance, which can affect ocular blood flow.⁸ Depression can also aggravate the symptoms of eye pain and discomfort.⁵ There is a significant link between eye disease and mental illness.⁹ People with an ocular prosthesis experience emotional distress post-injury.¹⁰ Unfortunately, there is currently a lack of research on the prevalence of anxiety and depression in patients with mechanical ocular injuries.

The development of anxiety and depression can be influenced by psychological factors such as worry and resilience.^{11,12} Research has shown that individuals with higher scores in traits related to worry are more likely to experience anxiety and depression.^{5,7} Worry is a form of negative thinking oriented to the future, which can appear after the occurrence of an event, promote the generation of anxiety and depression through the mediating effect, and prolong the duration of anxiety and depression.¹² Resilience is a psychological trait that promotes an individual's positive adaptation in the face of stress and adverse events and as a protector can reduce perceived stress and alleviate anxiety and depression.^{13,14} However, trauma can weaken psychological resilience, leading to poor adaptation to the disease and promoting the occurrence of anxiety and depression.^{8,11,12} Nevertheless, the role of worry and psychological resilience in the process of mechanical ocular injuries leading to anxiety and depression is currently unknown. The purpose of this study is to explore post-traumatic anxiety and depression symptoms in patients with mechanical ocular injuries while examining the impact of psychological resilience and worry.

Materials and Methods

Study Participants

From June 8, 2022, to March 1, 2023, a total of 135 patients with one eye of mechanical ocular injuries and 135 healthy residents participated in a questionnaire survey, divided into an ocular trauma group and a healthy control group. The included respondents of ocular trauma group must meet the following criteria: (1) patients with ocular trauma within the past 7 days; (2) no severe physical illnesses or other eye diseases except ocular trauma; (3) aged 18 or above; (4) no history of neurodevelopmental or neurocognitive disorders; (5) no history of anxiety, depression, or other psychological disorders.

The inclusion criteria for the healthy control group included: (1) healthy residents without systemic illnesses; (2) matched in terms of gender and age with the ocular trauma group; (3) no history of ocular trauma or other eye diseases; (4) no history of neurodevelopmental or neurocognitive disorders; (5) no history of anxiety, depression, or other psychological disorders.

Conduct of the Assessment

This study employed a combination of electronic and paper questionnaires. Trained ophthalmologists organized the administration of questionnaires either in person or online, and patients provided informed consent before completing the questionnaires. The collected responses were assessed by professional psychiatrists. All participants must complete the written informed consent by handwritten or electronic signature before the interview. The study was conducted under the guidance of the Ethics Committee of Tianjin Medical University General Hospital.

Demographic Characteristics Questionnaire

A self-developed demographic characteristics questionnaire was used to collect general population statistics, including gender, race, marital status, living conditions, educational level, employment status, age, and economic status. Information on systemic illnesses and mental conditions was obtained to determine whether participants should be excluded from the study.

Self-Rating Depression Scale

The Self-rating Depression Scale (SDS)¹⁵ was used to assess the severity of depressive symptoms. The scale has been widely used in Chinese populations and has demonstrated good validity and reliability.¹⁶ It consists of 20 items, scored

on a 4-category rating scale. “1–4” represent “none or a little of the time”, “a little of the time”, “a good part of the time”, and “most or all of the time”, respectively. The main statistical index for the SDS is the total score. After self-assessment, the scores for each of the 20 items were summed to obtain the raw score, which was then multiplied by 1.25 and rounded to the nearest integer to obtain the standard score. A standard score above 53 indicates the presence of depressive symptoms, with higher scores indicating more severe symptoms.

Self-Rating Anxiety Scale

The Self-rating Anxiety Scale (SAS)¹⁷ was used to assess the severity of anxiety symptoms in patients over the past 7 days. The scale has been widely used in Chinese populations and has demonstrated good validity and reliability.¹⁸ It consists of 20 items, scored on a 4-category rating scale. “1–4” represent “none or a little of the time”, “a little of the time”, “a good part of the time”, and “most or all of the time”, respectively. After self-assessment, the scores for each of the 20 items were summed to obtain the raw score, which was then multiplied by 1.25 and rounded to the nearest integer to obtain the standard score. A standard score above 50 indicates the presence of anxiety symptoms, with higher scores indicating more severe symptoms.

Connor-Davidson Resilience Scale

The Connor-Davidson Resilience Scale (CD-RISC)¹⁹ was used to assess an individual’s psychological resilience and had good reliability and validity in its prior Chinese version.²⁰ It consists of 25 items, scored on a 4-category rating scale. “0–4” represent “never”, “rarely”, “sometimes”, “often”, and “almost always”, respectively. After self-assessment, the scores for all 25 items were summed, with higher scores indicating better psychological resilience.

Penn State Worry Questionnaire

The Penn State Worry Questionnaire (PSWQ)²¹ was used to assess an individual’s level of worry and had good reliability and validity in its prior Chinese version.²¹ It consists of 16 items, scored on a 5-category rating scale. “1–5” represent “not at all typical”, “very typical”, “somewhat typical”, “usually typical”, and “always typical”, respectively. The scores for all 16 items were summed to obtain the total score, with higher scores indicating greater levels of worry.

Data Analysis

Statistical analysis was performed using SPSS version 26.0 (Chicago, IL, USA) software. The ANOVA and the chi-square test were used to analyze the demographic characteristics and the psychological traits scales to determine differences between the two groups. Spearman correlation coefficient was used to explore the relationship between total SDS, SAS, CD-RISC, and PSWQ scores. The mediation model was set up using Model 6 in PROCESS v3.4.1. The independent variable was mechanical ocular injuries; the dependent variable was depression or anxiety; and the mediating variables were resilience and worry. Covariates introduced in the models were subjective appraisals of the family economy with statistical significance. For the best test of the mediation effect, the bootstrapping procedure to measure the indirect effect was carried out, the number of bootstrap samples was 5000, and a 95% Confidence Interval (CI) was estimated. When the 95% CI for an indirect effect does not include 0, the indirect effect can be considered significant. $P < 0.05$ was considered to be statistically significant.²²

Results

Comparative Analysis

Comparison of demographic characteristics between the ocular trauma group and the healthy control group.

A total of 135 patients with mechanical ocular injuries and 135 healthy residents participated in this study. The mean age in the ocular trauma group was 46.38 ± 12.89 years, while in the healthy control group, it was 45.25 ± 11.34 years. There were no differences between the ocular trauma group and the healthy control group in terms of gender, marital status, employment status, age, or ethnicity ($p > 0.05$). However, there was a significant difference in subjective appraisal of the family economy between the two groups ($p < 0.01$) (Table 1).

Table 1 Comparison of Demographic Characteristics Between the Ocular Trauma Group and Healthy Control Group

		Ocular trauma group	Healthy control group	χ^2/F	P
Gender	Female	14(10.4%)	14(10.4%)	0.00	1
	Male	121(89.6%)	121(89.6%)		
Marriage status	Single	15(11.1%)	13(9.6%)	2.15	0.54
	Married	115(85.2%)	115(85.2%)		
	Divorced	5(3.7%)	7(5.2%)		
Ethnicity	Han	125(92.6%)	131(97%)	5.00	0.08
	Others	10(7.4%)	4(3%)		
Employment status	Employed	119(88.1%)	117(86.7%)	4.00	0.26
	Unemployed	16(11.9%)	18(13.3%)		
Age	<25	5(3.7%)	5(3.7%)	9.44	0.09
	26–35	23(17%)	30(22.2%)		
	36–45	39(28.9%)	30(22.2%)		
	46–55	30(22.2%)	37(27.4%)		
	56–68	32(23.7%)	33(24.4%)		
	>68	6(4.5%)	0		
Subjective appraisal of the family economy	Rich	4(3%)	17(12.6%)	44.27	0.00*
	General	88(65.2%)	114(84.4%)		
	Poor	43(31.9%)	4(3%)		

Notes: * $p < 0.05$, χ^2/F is χ^2 or F.

Analysis of differences in anxiety and depression between the ocular trauma group and the healthy control group.

In the ocular trauma group, the total scores of SAS and SDS showed no differences based on demographic factors such as gender, age, ethnicity, marital status, living conditions, education level, and employment status ($p > 0.05$). However, there was a significant difference in subjective appraisal of the family economy ($p < 0.05$) (Table 2).

The ocular trauma group had significantly higher SAS total scores (43.41 ± 5.25) compared to the healthy control group (40.94 ± 10.35) ($p < 0.01$). The positive rate of anxiety in the ocular trauma (20%) was significantly higher than that in the healthy control group (5.9%) ($p < 0.01$).

The ocular trauma group had significantly higher SDS total scores (49.69 ± 11.91) compared to the healthy control group (40.94 ± 9.78) ($p < 0.01$). The positive rate of depression in the ocular trauma group (44.4%) was significantly higher than that in the healthy control group (14.8%) ($p < 0.01$) (Table 3).

Due to various reasons for binocular vision impairment or reduced field of vision, it is difficult to do the work, study, or other activities that ordinary people can do. Based on the National Standard for Disability Classification and Grading for Persons with Disabilities (GB/T26341-2010), The Injured eyes of patients with mechanical ocular injuries were categorized into groups based on their visual impairment: mild visual impairment (visual acuity > 0.3) included 19

Table 2 Demographic Differences in SAS and SDS Total Scores

	SAS total score (F)	P	SDS total score (F)	P
Gender	0.14	0.92	0.99	0.36
Employment status	1.49	0.54	1.28	0.47
Living conditions	0	0.39	5.76	0.40
Education level	1.07	0.37	1.14	0.34
Marital status	0.29	0.82	0.73	0.53
Ethnicity	0.69	0.09	0	0.08
Age	1.23	0.29	1.74	0.29
Subjective appraisal of the family economy	3.84	0.024*	5.36	0.006**

Note: * $p < 0.05$, ** $p < 0.01$.

Table 3 Differences in SAS and SDS Total Scores and the Positive Rates of Anxiety and Depression Between the Ocular Trauma Group and Health Control Group

Group	SAS total scores	Anxiety positive rates	Total score of SDS	Depression positive rates
Ocular trauma group	43.41±5.25	27(20%)	49.6±11.91	60(44.4%)
Healthy control group	40.94±10.35	8(5.90%)	40.94±9.78	20(14.8%)
χ^2/F	52.31	17.71	7.99	28.42
p	<0.01**	<0.01**	<0.01**	<0.01**

Note: ** $p < 0.01$. χ^2/F is χ^2 or F.

Table 4 The Positive Rates of Anxiety, Depression, and SAS, SDS Total Scores, Among Mechanical Ocular Injury Patients Stratified by Visual Impairment Level

Visual impairment level	Anxiety positive rates	SAS total score	Depression positive rates	SDS total score
Mild visual impairment	36.5%	45.92	36.8%	48.62
Low vision	4.3%*	38.15**	39.1%	49.46
Blindness	19.4%*	40.39*	47.3%	51.16

Note: * $p < 0.05$, ** $p < 0.01$.

individuals, low vision (visual acuity 0.05–<0.3) included 23 individuals, and blindness (no light perception–<0.05) included 93 individuals. Among these, there were 65 cases of corneal perforating injuries, 46 cases of globe rupture injuries, 10 cases of globe contusion injuries, and 14 cases of intraocular foreign body injuries. The positive rates of anxiety and SAS total score (36.5%, 45.92) of individuals with mild visual impairment were significantly higher than those with low vision (4.3%, 38.15) ($p < 0.01$) and blindness (19.4%, 40.19) ($p < 0.05$), while it was no difference between those with blindness (19.4%, 40.19) and those with low vision (4.3%, 38.15) ($p > 0.05$). There was no difference in the positive rates of depression and SDS total score between individuals with low vision (39.1%, 49.46), mild visual impairment (36.8%, 48.62), and those with blindness (47.3%, 51.16) ($p > 0.05$) (Table 4).

Scale Reliability

Scale reliability, represented by the α coefficient, reflects the scale results' stability, consistency, and reliability. The SAS ($\alpha = 0.87$), SDS ($\alpha = 0.87$), PSWQ ($\alpha = 0.89$), and CD-RISC ($\alpha = 0.95$) all demonstrate good scale reliability.²³

Correlation Analysis

There was a significant correlation among all scales ($P < 0.01$), SAS score was negatively correlated with the CD-RISC score ($r = -0.493$ ** $P < 0.01$), and positively correlated with the PSWQ score ($r = 0.686$ ** $P < 0.01$). PSWQ score was negatively correlated with CD-RISC score ($r = -0.479$ ** $P < 0.01$). SDS score was negatively correlated with CD-RISC score ($r = -0.612$ ** $P < 0.01$), and positively correlated with PSWQ score ($r = 0.555$ ** $P < 0.01$).

Mediation Analyses

A subjective appraisal of the family economy with significant differences identified in the univariate analysis was included in the mediation models as control variables. As shown in Figures 1 and 2, all the path coefficients were significant ($p < 0.01$). These results of the mediation analysis show that when the indirect effect value (β) with a 95% confidence interval (CI) does not include 0, it is considered a significant indirect effect.

The total effect on anxiety was significant (effect = 6.17, $p < 0.01$, 95% CI = 3.93 to 8.42), the direct effect of the mechanical ocular injuries was significant (effect = 8.97, $p < 0.01$, 95% CI = 6.79 to 11.15), and the indirect effect was also significant (effect = -2.80, $p < 0.01$, 95% CI = -4.73 to -1.36). The mediation effect of worry was significant (effect = -1.14, $p < 0.01$, 95% CI = -2.04 to -0.25); the mediation effect of resilience was significant (effect = -1.50, $p < 0.01$, 95% CI = -2.65 to -0.54); the mediation effects of worry through resilience were also significant (effect = -0.15, $p < 0.01$, 95% CI = -0.36 to -0.02) (Table 5).

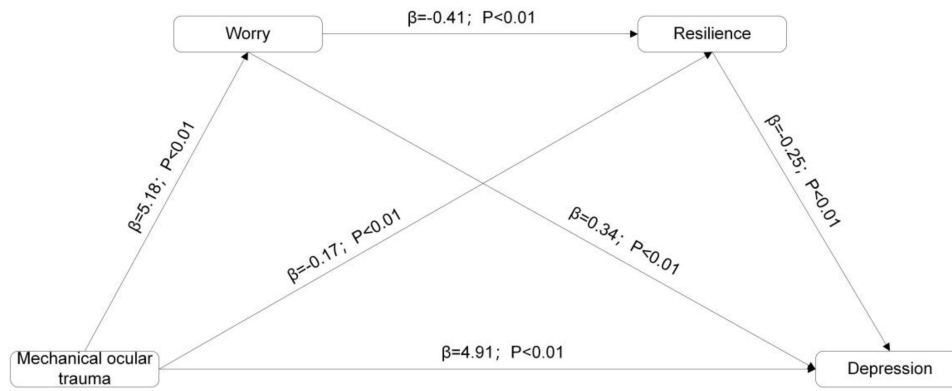


Figure 1 Path models of the mediation effects of worry and resilience between mechanical ocular injuries and anxiety.

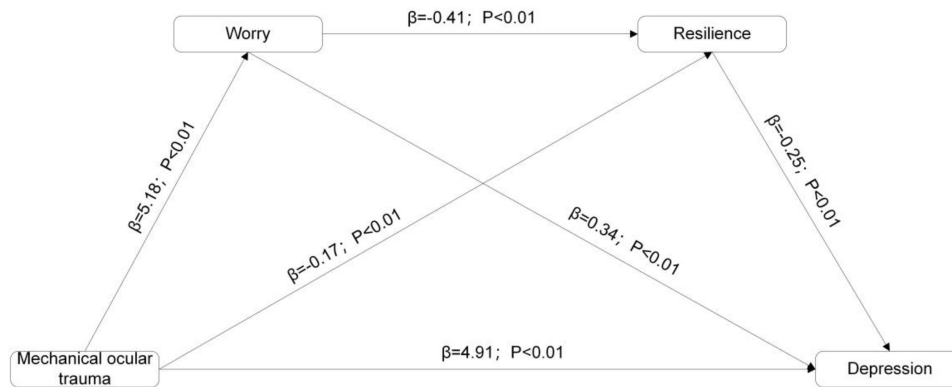


Figure 2 Path models of the mediation effects of worry and resilience between mechanical ocular injuries and depression.

The total effect on depression was significant (effect =7.20, $p<0.01$, 95% CI = 4.37 to 10.03), the direct effect of the mechanical ocular injuries was significant (effect = 4.91, $p<0.01$, 95% CI = 2.53 to 7.29), and the indirect effect was also significant (effect =2.28, $p<0.01$, 95% CI = 0.63 to 4.05). The mediation effect of worry was significant (effect =1.77, $p<0.01$, 95% CI =0.88 to 2.83); the mediation effect of resilience was not significant (effect = -0.04, $p>0.05$, 95% CI = -1.2 to 1.2); the mediation effects of worry through resilience were also significant (effect = 0.55, $p<0.01$, 95% CI = 0.23 to 0.93) (Table 6).

Table 5 The Mediation Effects of Resilience and Worry Between Mechanical Ocular Injuries and Anxiety

	Effect(β)	95% CI	
		Lower bound	Upper bound
Total effect	6.17**	3.93	8.42
Direct effect	8.97**	6.79	11.15
Indirect effect	-2.80**	-4.37	-1.36
Mechanical ocular injuries-Worry-Anxiety	-1.14**	-2.04	-0.25
Mechanical ocular injuries-Resilience- Anxiety	-1.50**	-2.65	-0.54
Mechanical ocular injuries-Worry-Resilience-Anxiety	-0.15**	-0.36	-0.02

Notes: ** $p<0.01$. β is the mediation effect value. Subjective appraisal of the family economy was included as covariates in the models.

Table 6 The Mediation Effects of Resilience and Worry Between Mechanical Ocular Injuries and Depression

	Effect(β)	95% CI	
		Lower bound	Upper bound
Total effect	7.20**	4.37	10.03
Direct effect	4.91**	2.53	7.29
Indirect effect	2.28**	0.63	4.05
Mechanical ocular injuries - Worry - Depression	1.77**	0.88	2.83
Mechanical ocular injuries - Resilience - Depression	-0.04	-1.2	1.2
Mechanical ocular injuries-Worry-Resilience- Depression	0.55**	0.23	0.93

Notes: ** $p < 0.01$. β is the mediation effect value. Subjective appraisal of the family economy was included as covariates in the models.

Discussion

Severe mechanical ocular injuries can cause significant damage to the eye structures, leading to visual impairment and sometimes, the removal of the eye.¹ Suffering from traumatic experiences can significantly affect a patient's mental health, causing various psychological changes.²⁴ According to this study, patients with mechanical ocular injuries had significantly higher rates of anxiety and depression as well as elevated levels of anxiety and depression compared to a healthy control group. In the acute phase of mechanical ocular injuries, patients may experience physical discomfort, pain, and reduced mobility due to visual impairment. In an unfamiliar hospital environment, reduced social activities and decreased social engagement of patients will lead to the ability to experience happiness also decreasing, finally contributing to the development of depression.²⁵ It's worth noting that a considerable number of individuals who experience mechanical ocular injuries are migrant workers with limited financial means. The high cost of treatment can put a significant strain on their finances, leading to psychological distress such as anxiety and depression. Emergency surgery under general anesthesia is often necessary for those with mechanical ocular injuries. The possibility of complications arising from the surgery and anesthesia can cause further anxiety and depression.

This study further classified patients based on the severity of visual impairment according to national standards. SAS total score and the positive rates of anxiety of individuals with mild visual impairment were significantly higher than those with low vision and blindness. Patients with mild visual impairment often with corneal perforating injuries, usually experience significant pain and discomfort despite minimal visual impairment. Pain can activate the hypothalamic-pituitary-adrenal (HPA) axis and sympathetic nervous system, contributing to anxiety.²⁶ In the low vision group, there are more patients with ocular blunt trauma. Although blunt trauma can cause serious visual impairment like hyphema and lens dislocation, the patients experience fewer corneal irritation symptoms, pain, and discomfort and usually do not require emergency surgery during the acute stage. Hyphema can be absorbed quickly, and the loss of visual function due to lens dislocation can be corrected, with severe cases being treated under local anesthesia. Patients in the acute stage avoid the fear of general anesthesia and have a good visual prognosis, resulting in lower positive rates and anxiety levels. Most of the patients in the blindness group had eyeball rupture, severe vision impairment, and little chance of vision improvement the patients with blindness may accept this status, so they have little anxiety. However, the patients with blindness were prone to depression may be due to the severe injury of eyeball rupture and living difficulties caused by severe vision impairment.

Resilience is a psychological feature that promotes individual positive coping in the face of stress and adverse events and is a protective factor for anxiety and depression.²⁷ This study showed that psychological resilience decreased after mechanical ocular injuries, which contributed to the occurrence of anxiety and depression. Resilience is influenced by factors such as occupation, family income, and social support from family and friends.^{28,29} Patients with ocular trauma experience high operation costs and often come from poor economic backgrounds with no stable income. Without adequate social support and financial resources, these patients can experience decreased psychological resilience and struggle to cope with adverse events, which may lead to depression.³⁰ Worry is associated with unhealthy psychology and

has a significant positive effect on anxiety.³¹ This study showed that worry promoted the generation of anxiety and depression in patients with mechanical ocular injuries. Patients are prone to anxiety and depression due to their concerns about the treatment effect, whether the injury will cause disability, and whether it will affect their facial appearance. Patients with severe mechanical ocular injuries are faced with the risk of general anesthesia surgery, uncertain visual prognosis, wound infection, eyeball atrophy, involvement of uninjured eyes, and other complications that make them more worried and prone to anxiety and depression.

The diagnosis and treatment of patients with mechanical ocular injuries should not only focus on the preservation of eye and visual function but also address their mental health. Multidisciplinary interventions should be implemented to improve patients' psychological resilience and alleviate worry, which can ultimately enhance their psychological well-being and reduce the occurrence of adverse psychological events. Initiatives such as improving medical insurance coverage, establishing welfare organizations related to ocular trauma, and providing economic support to financially disadvantaged patients can also play a crucial role in reducing the psychological burden on these patients.

It is worth noting that this study has some limitations. First of all, our sample size is small, which may lead to problems such as uneven inversion and grouping and poor patient representation. Therefore, we need to expand the sample size in the follow-up experiment.

Secondly, we selected patients with 7-day mechanical ocular trauma in the acute stage as the study object, lacking follow-up at a later stage. Visual impairment in patients with acute pain is a major cause of anxiety and depression. In the acute phase, our results showed that SAS total score and the positive rates of anxiety of individuals with mild visual impairment were significantly higher than those with low vision and blindness. When the patient's condition tends to be stable, he will face the inconvenience of life and work brought by vision loss, and even unemployment and other problems, which may be more direct factors in the change of mental state of patients in the later stage. This result has some limitations, lack of comparison with the long-term follow-up results. Based on this, we hope that follow-up trials will collect more patients in the long-term post-injury assessment.

Conclusion

To sum up, individuals who experience mechanical ocular injuries often have a higher likelihood of developing anxiety and depression. In such cases, psychological resilience and worry can have a significant impact on their mental health. Therefore, it is important to promptly evaluate the psychological status of patients with mechanical ocular injuries, provide appropriate psychological intervention, and alleviate negative emotions. This can improve the visual quality and prognosis of patients while also reducing the risk of adverse events related to cardiac abnormalities. The comprehensive evaluation of the psychological status of patients with mechanical eye injury, it has guiding significance for clinical diagnosis and treatment. In terms of clinical treatment and treatment: (1) Appropriate relief of patients' pain discomfort in the acute phase and reduction of discomfort caused by pain. (2) Medical staff should strengthen the education work related to eye trauma, so that patients can better understand the relevant conditions and possible prognosis, reduce the fear caused by the unknown, and gain the trust and cooperation of patients. (3) In the acute stage, patients can be psychologically assessed, interdisciplinary diagnosis and treatment can be conducted according to the psychological status of patients, and corresponding intervention measures can be given to achieve mental health guidance for patients and avoid the occurrence of adverse events.

Data Sharing Statement

Data will be made available on reasonable request from the corresponding author.

Ethics Approval

This study was approved by the Ethics Committee of Tianjin Medical University General Hospital (approval number: IRB2022-YX-172-01). Our study complies with the Declaration of Helsinki.

Acknowledgments

The authors thank all study participants for their willingness to provide data for this research project and are indebted to all coworkers for their enthusiastic commitment.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

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