• Investigation •

Influences of personality characteristics and coping modes on anxiety in primary glaucoma patients

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Abstract

● **AIM:** To examine the influences of personality characteristics and coping modes on the anxiety of primary glaucoma patients.

● **METHODS:** A total of 200 individuals, including 50 with primary angle-closure glaucoma, 60 with primary open angle glaucoma and 90 control participants, filled out the State-Trait Anxiety Inventory, NEO Five-Factor Inventory, and Medical Coping Modes Questionnaire. Sociodemographic information was also collected. Data were analyzed *via* the Spearman rank correlation test and stepwise regression.

● **RESULTS:** The personality and coping variables are predictive and jointly account for a significant amount (45.3%-54.2%) of variance across the two subscales of anxiety measures. Notably, neuroticism seems to be most closely related to anxiety disturbances in glaucoma patients. The level of resignation is positively linked to anxiety scores.

● **CONCLUSION:** Some personality factors and coping modes help to predict the process of anxiety disorders in primary glaucoma patients. Recognizing the predictive role of these variables in the patients may further enrich clinical research in glaucoma and help to design more effective interventions involving both ophthalmology and psychiatry.

INTRODUCTION

Glaucoma is a chronic, progressive and irreversible eye disorder characterized by optic neuropathy and visual field loss. Glaucoma is mainly classified by the size of the iridocorneal angle into open angle glaucoma and angle-closure glaucoma, which are both further divided into primary and secondary subtypes[1-2]. Considerable research suggests that glaucoma may be associated with psychological disturbances in addition to its physical aspects[3].

Correlations have been studied between glaucoma and anxiety, which is a common form of psychiatric comorbidity associated with various chronic physical diseases, such as coronary artery disease[4], stroke[5] and diabetes mellitus[6]. Anxiety events become more frequent after the occurrence of glaucoma and especially afflict women versus men and unmarried versus married people[7]. A Singaporean study suggests that glaucoma patients have lower quality-of-life scores as assessed by the Visual Function Questionnaire (VFQ25), which is significantly associated with anxiety disorders[8].

Risk factors related to the prevalence of anxiety disorders in glaucoma patients have been investigated. It is argued that the predictors of anxiety in glaucoma patients include lower mean defects in the worse eye, lower mean VFQ25 scores and a younger age[8-9]. Aberrant personalities and passive coping styles are correlated with anxiety morbidity[10-12]. However, it remains unclear whether personality traits and coping strategies influence the anxiety of primary glaucoma patients.

This study aimed to assess anxiety, personality traits and coping modes in patients with primary open angle glaucoma (POAG) or primary angle-closure glaucoma (PACG) by using the State-Trait Anxiety Inventory (STAI), NEO Five-Factor Inventory (NEO-FFI) and Medical Coping Modes

Questionnaire (MCMQ). We mainly explored how personality characteristics and coping modes impacted the state-trait anxiety of primary glaucoma patients.

SUBJECTS AND METHODS

Ethical Approval This prospective case-control study was conducted in three medical institutions between January and July 2016. The study protocol was approved by the Ethics Committee of East Hospital Affiliated with Tongji University in East China. Written informed consent was obtained from all participants before the investigation.

Participants and Procedure Prior to conducting the study, the sample size was calculated. Using a 2-sided alpha level of 0.01 and a statistical power of 90%, we estimated the need for 80 patients in the glaucoma group and 80 patients in the control group. After estimating 20% lost to withdrawals, missing data, *etc.*, a total of 202 patients were needed. Glaucoma was diagnosed by an ophthalmologist based on glaucomatous cupping of the optic nerve and characteristic visual field defects in one or both eyes, regardless of increased intraocular pressure. The inclusion criteria were age ≥18y and an established clinical diagnosis of PACG or POAG. The exclusion criteria were refusal of psychological assessment, communication problems, depression or other psychiatric disorders (either in the patient's medical history or during the investigation), other types of glaucoma (*e.g.* secondary glaucoma, normal tension glaucoma) or coexisting eye diseases (*e.g.* diabetic retinopathy). Finally, 110 glaucoma patients were included. Ninety sex- and age-matched control subjects with no glaucoma or other ocular diseases except for cataracts were recruited from communities.

All participants were asked to complete a sociodemographic form and the STAI, NEO-FFI, and MCMQ. All participants were requested to complete the questionnaires within a limited amount of time according to the manuals; too long a time might influence the results.

State-Trait Anxiety Inventory The STAI (Form Y), created based on the theory that anxiety consists of a state-trait distinction, is a popular self-reported questionnaire that measures trait and state anxieties[13-14]. The subscale of state anxiety requires a subject to rate his/her transient feelings of arousal subjectively experienced as anxiety, while the subscale of trait anxiety asks the subject to rate his/her day-to-day feelings about the more enduring characteristics of this emotion[15]. These two subscales both comprise 20 items, each of which has four response options scored from 1 (never/almost never) to 4 (always/almost always). Each subscale has a total score from 20 (minimal anxiety) to 80 (maximal anxiety), and some negatively crucial items are reverse-scored. The fair to excellent internal consistency coefficient of STAI ranges from 0.86 to 0.95, and its test-retest reliability ranges from 0.65 to 0.75[13].

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Sample items include the following: "I feel calm", "I feel safe", "I feel pleasant", and "I feel nervous."

NEO Five-Factor Inventory The NEO-FFI, as well as its revised version, is a self-reported scale that evaluates personality characteristics on the basis of a five-factor model that consists of Neuroticism (N), Extraversion (E), Openness (O), Agreeableness (A), and Conscientiousness (C)[16-17]. NEO-FFI was significantly modified in 2004: NEO-FFI items 6, 12, 27, 42, 3, 8, 28, 38, 9, 19, 24, 29, 34 and 15 were replaced by NEO-PI-R items 186, 127, 7, 32, 123, 48, 213, 133, 189, 169, 84, 139, 184 and 95, respectively[18]. The latest version was updated in 2010[19]. The instrument consists of 60 items (12 items for each factor), each of which has five possible responses scored 1, 2, 3, 4 and 5, indicating "strongly disagree", "disagree", "neutral", "agree" and "strongly agree", respectively. Accordingly, each factor is scored on a 12- to 60-point scale. The NEO-FFI has an internal consistency from 0.68 to 0.86[17] and satisfactory two-week retest reliability from 0.86 to 0.90 for the five factors[20].

Example of NEO-FFI items are as follows: "I am not a worrier" and "I like to have many people around me."

Medical Coping Modes Questionnaire This wide used scale assesses three illness-related coping strategies: confrontation, avoidance and acceptance-resignation[21-22]. The MCMQ typically consists of 19 items, but its Chinese version has one more item[23]. Each item is answered on a four-point continuum (*e.g.* "never" to "all the time", "very little" to "very much"). For each of the three coping strategies, a higher score indicates that the participant is more likely to use this specific strategy to address medical events. The MCMQ has good internal consistency (0.63-0.72)[24] and favorable four-week retest reliability (0.66-0.85)[25].

Sample questions include the following: "How often do you ask your doctor for advice about what to do with your illness?" and "How often do you try to talk about your illness with friends or relatives?"

Statistical Analysis The sociodemographic characteristics were described as the mean±standard deviation (SD) or as frequencies with percentages according to the nature of the specific variable. The three groups (PACG, POAG, and control subjects) were compared by independent samples *t*-test and one-way analysis of variance (ANOVA). The correlations among the three questionnaires were analyzed by the Spearman rank correlation test and described by correlation coefficients. The predictors of anxiety in glaucoma patients were screened out *via* stepwise regression analysis involving the variables of demographic characteristics, personality factors and coping modes. All analyses were performed on SPSS 15.0, with $P<0.05$ being statistically significant.

Table 1 Sociodemographic characteristics of all participants   *n* (%)

Parameters	PACG (*n*=50)	POAG (*n*=60)	Control (*n*=90)	*P*
Age (mean±SD), y	64.26±11.59	53.24±16.85	52.55±14.48	0.122
Sex				0.187
Male	19 (38.0)	30 (50.0)	36 (40.0)	
Female	31 (62.0)	30 (50.0)	54 (60.0)	
Marital status				0.292
Married	40 (80.0)	36 (60.0)	54 (60.0)	
Single	5 (10.0)	20 (33.3)	23 (25.6)	
Divorced	1 (2.00)	1 (1.67)	7 (7.78)	
Widowed	4 (8.00)	3 (5.00)	6 (6.67)	
Education				0.800
No university	30 (60.0)	26 (43.3)	44 (48.9)	
University	20 (40.0)	34 (56.7)	46 (51.1)	
Economic status[a]				0.087
Poor (<5000)	4 (8.00)	3 (5.00)	9 (10.0)	
Average (5000-9999)	38 (76.0)	43 (71.7)	61 (67.8)	
Well-off (10000-19999)	7 (14.0)	14 (23.3)	19 (21.1)	
Wealthy (≥20000)	1 (2.00)	0	1 (1.11)	

PACG: Primary angle-closure glaucoma; POAG: Primary open angle glaucoma. [a]Economic status was evaluated according to family month income (RMB).

Table 2 Scores of examined variables using the STAI, NEO-FFI, and MCMQ among the 3 groups   mean±SD (range)

Variables	PACG (*n*=50)	POAG (*n*=60)	Control (*n*=90)	*F*	*P*[a]
STAI					
State anxiety	41.52±12.51 (20-67)	40.22±13.31 (22-79)	36.9±8.89 (20-57)	2.593	0.078
Trait anxiety	44.57±11.81 (22-68)	43.74±11.12 (25-73)	39.15±9.45 (20-59)	4.62	0.011
NEO-FFI					
Openness	33.96±5.99 (22-49)	34.52±7.02 (22-50)	39.11±5.67 (28-51)	12.63	0.000
Conscientiousness	49.52±6.63 (38-63)	49.66±7.08 (23-65)	49.85±6.25 (33-63)	0.03	0.966
Extraversion	36.28±6.54 (24-53)	38.52±6.09 (17-52)	39.38±4.94 (28-51)	4.008	0.020
Agreeableness	42.13±6.72 (28-57)	43.76±6.36 (26-58)	42.77±5.17 (29-56)	0.97	0.383
Neuroticism	33.96±7.77 (16-49)	32.07±7.81 (19-52)	31.58±4.94 (20-45)	1.77	0.173
MCMQ					
Confrontation	19.04±3.94 (12-27)	17.71±3.47 (11-25)	18.86±3.11 (12-22)	2.46	0.088
Avoidance	16.22±2.7 (11-23)	15.59±2.2 (12-21)	16.46±2.76 (10-19)	1.92	0.149
Resignation	10.24±3.12 (5-18)	9.19±2.87 (5-17)	8.69±2.77 (5-15)	4.02	0.02

PACG: Primary angle-closure glaucoma; POAG: Primary open angle glaucoma. [a]Comparison among the three groups.

RESULTS

Characteristics of Participants The sociodemographic characteristics of all included participants are summarized in Table 1. The total sample included 50 PACG patients (25%), 60 POAG patients (30%), and 90 control subjects (45%). As shown in Table 1, there is no significant difference in age, sex, marital status, education, or economic status among the three groups.

Preliminary Analysis The scores of the scales are listed in Table 2. The anxiety disturbances among the three groups were evaluated by STAI. First, one-way ANOVA revealed significant differences among the three groups in trait anxiety (*F*=4.62, *P*=0.011) but not in state anxiety (*F*=2.593, *P*=0.078).

We further performed independent *t*-tests among groups. As depicted in Figure 1, both PACG and POAG groups have higher mean scores of trait anxiety compared with the control group (both *P*<0.05), while for the subscale of state anxiety, only the PACG group has significantly higher scores compared with the control group (*P*<0.05).

The personality characteristics of all participants were assessed by the NEO-FFI. Of the five factors, only the scores of openness and extraversion are significantly different (*F*=12.63, *P*=0.00; *F*=4.008, *P*=0.02; Table 2). The results of the independent *t*-test are shown in Figure 2. Both the PACG and POAG groups had significantly higher scores of openness than the control group (both *P*<0.001). For the subscale of extraversion, the

Table 3 Correlations among measures of personality, medical coping modes and state-trait anxiety

| Items	Openness	Conscientiousness	Extraversion	Agreeableness	Neuroticism	Confrontation	Avoidance	Acceptance-resignation	A-State	A-Trait
Openness	1.000	-	-	-	-	-	-	-	-	-
Conscientiousness	0.245[b]	1.000	-	-	-	-	-	-	-	-
Extraversion	0.335[b]	0.357[b]	1.000	-	-	-	-	-	-	-
Agreeableness	-0.100	0.295[b]	0.229[b]	1.000	-	-	-	-	-	-
Neuroticism	-0.088	-0.418[b]	-0.453[b]	-0.420[b]	1.000	-	-	-	-	-
Confrontation	0.120	0.010	0.024	-0.159[a]	0.167[a]	1.000	-	-	-	-
Avoidance	0.062	0.010	0.078	0.079	-0.133	0.177[a]	1.000	-	-	-
Acceptance-resignation	-0.278[b]	-0.256[b]	-0.326[b]	-0.279[b]	0.381[b]	0.161[a]	-0.070	1.000	-	-
A-State	-0.193[a]	-0.322[b]	-0.425[b]	-0.289[b]	0.568[b]	0.155[a]	-0.184[a]	0.514[b]	1.000	-
A-Trait	-0.184[a]	-0.341[b]	-0.446[b]	-0.279[b]	0.635[b]	0.090	-0.189[a]	0.493[b]	0.842[b]	1.000

[a]$P<0.05$, [b]$P<0.01$.
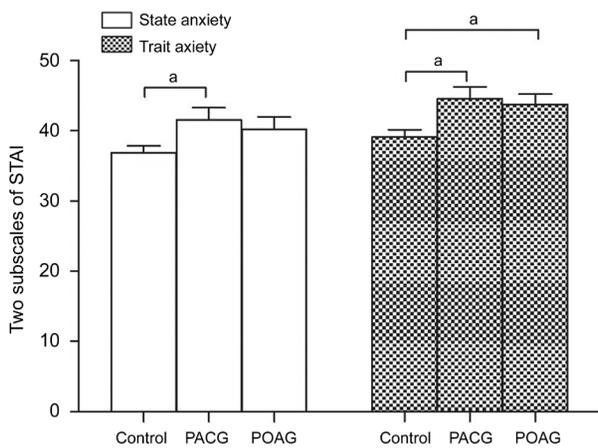
Figure 1 STAI-based comparison of the state-trait anxiety scores among the 3 groups The PACG and POAG groups both have significantly higher scores of trait anxiety, and only the PACG group has significantly higher scores of state anxiety than the control group. STAI: State-Trait Anxiety Inventory; PACG: Primary angle-closure group; POAG: Primary open angle glaucoma. [a]$P<0.05$.
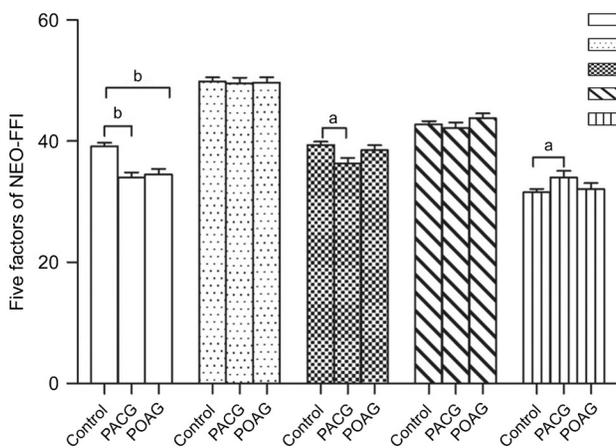

Figure 2 NEO-FFI-based comparison of the personality characteristic subscores The PACG and POAG group have significantly lower scores of O (openness), and the PACG group has significantly lower scores of E (extraversion) and significantly higher scores of N (neuroticism) than the control group. No significant differences were found in the C (conscientiousness) or A (agreeableness) subscales. NEO-FFI: NEO Five-Factor Inventory. [a]$P<0.05$; [b]$P<0.001$.
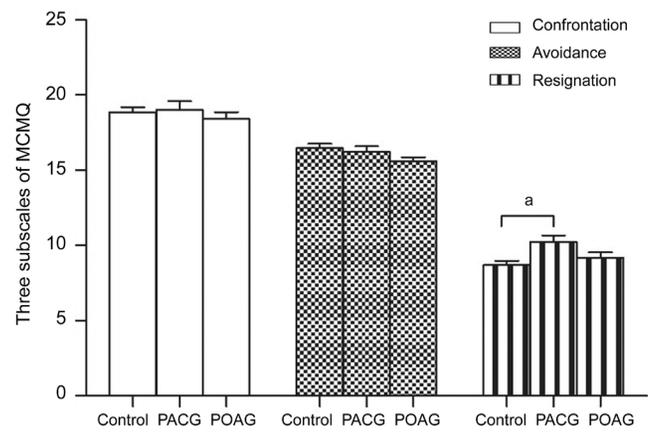
Figure 3 MCMQ-based comparison of the coping mode scores among 3 groups The PACG group had significantly higher scores in resignation than the control group. No significant differences are found in the confrontation or avoidance subscales. MCMQ: Medical Coping Modes Questionnaire. [a]$P<0.05$.

PACG group had significantly lower scores than the control group ($P<0.05$). For the subscale of neuroticism, the PACG group ($P<0.05$) had higher scores than the control group.

The medical coping modes of the three groups were assessed by the MCMQ. As shown in Table 2, only the subscale of resignation is significantly different among the three groups ($F=4.02$, $P=0.02$). The t-tests showed that the PACG group had significantly higher scores in resignation than the control group ($P<0.05$), and no distinct difference was observed between the POAG and the control groups (Figure 3).

Influence of Personality Factors and Coping Modes on Anxiety To explore the influence of personality traits and coping modes on state-trait anxiety in glaucoma patients, we first performed a Spearman rank correlation test. As shown in Table 3, neuroticism is significantly and positively correlated with both state anxiety and trait anxiety ($r=0.568$ and $r=0.635$, respectively; both $P<0.01$). Similarly, openness, conscientiousness, extraversion and agreeableness are significantly and negatively correlated with both anxiety subscales, especially extraversion ($r=-0.425$

and r=-0.446, respectively; both P<0.01). For the coping modes, confrontation and resignation are both significantly and positively correlated with state anxiety, while resignation is significantly and positively correlated with trait anxiety. Conversely, avoidance is significantly and negatively correlated with both STAI subscales.

Next, stepwise regression analysis was conducted to screen out reliable predictors of anxiety from the studied factors. As shown in Table 4, the model involves four variables, including neuroticism, resignation, conscientiousness and education. According to the changes in R^2 in Table 4, neuroticism accounts for 43.5% of the variance in trait anxiety (β=0.665, P<0.001). In step two, adding resignation could estimate 5.2% of the variance of trait anxiety (β=0.282, P=0.004). By entering conscientiousness in the third step, R^2 reaches a significant amount of variance, 52.1% (β=-0.224, P=0.012). For the demographic variables, only education is involved in the model at the last step, and it significantly explains 2.1% of trait anxiety (β=-0.166, P=0.038). Other factors (*e.g.* openness, extraversion, and agreeableness) fail to enter the regression model because they do not contribute to the prediction of trait anxiety.

As presented in Table 5, two variables, neuroticism and resignation, play a role in predicting the state anxiety of glaucoma patients. The first entered factor is neuroticism, which contributes to 38.0% of the variance of state anxiety (β=0.444, P<0.001). The second entered factor is the MCMQ subscale resignation, which has an R^2 change of 7.3% (β=0.334, P=0.001). None of the remaining factors of the NEO-FFI or the MCMQ is a significant predictor of state anxiety in primary glaucoma patients. Notably, demographic factors fail to predict state anxiety in glaucoma patients.

DISCUSSION

Glaucoma, a common chronic eye disease featuring optic nerve damage and visual field defects, underlies the leading cause of bilateral blindness. Many studies have highlighted its psychological factors, including anxiety disorders[8,26-27], abnormal personality characteristics[28] and negative coping modes[29]. Here, we explored the influences of personality characteristics and coping modes on the anxiety of primary glaucoma patients.

Assessment of State-Trait Anxiety Using the STAI Both PACG and POAG patients have significantly higher trait anxiety scores than the control subjects, while for the state anxiety, only the PACG group has significantly higher scores, which agrees with previous findings that anxiety disorders coexist with glaucoma[8,26-27]. In contrast to a Chinese report that PACG patients have significantly more severe anxiety than POAG patients[30], we find no significant difference between the PACG and POAG groups in the STAI scores. This

Table 4 Stepwise regression analysis predicting trait anxiety of patients with primary glaucoma

Predictors	b	β	$\triangle R^2$	t	P
Step 1					
Neuroticism	0.958	0.665	0.435	7.870	0.000
Step 2					
Neuroticism	0.741	0.515	-	5.398	0.000
Resignation	1.014	0.282	0.052	2.962	0.004
Step 3					
Neuroticism	0.619	0.430	-	4.396	0.000
Resignation	0.927	0.258	-	2.790	0.007
Conscientiousness	-0.380	-0.224	0.034	-2.570	0.012
Step 4					
Neuroticism	0.634	0.440	-	4.596	0.000
Resignation	1.064	0.296	-	3.210	0.002
Conscientiousness	-0.361	-0.213	-	-2.495	0.015
Education	-4.088	-0.166	0.021	-2.107	0.038

β: The standardized regression coefficients; $\triangle R^2$: R^2 change.

Table 5 Stepwise regression analysis predicting state anxiety of patients with primary glaucoma

Predictors	b	β	$\triangle R^2$	t	P
Step 1					
Neuroticism	1.061	0.622	0.380	7.024	0.000
Step 2					
Neuroticism	0.757	0.444	-	4.516	0.000
Resignation	1.419	0.334	0.073	3.393	0.001

β: The standardized regression coefficients; $\triangle R^2$: R^2 change.

between-study difference may be attributed to the differences in the scales (the other study used the Self-Rating Anxiety Scale) and the studied populations.

Assessment of Personality Traits Using the NEO-FFI Considering the personality factors, we find that glaucoma patients have lower openness and extraversion scores as well as significantly higher levels of neuroticism, which are consistent with a previous report. However, we find no significant between-gender difference in the subscale of extraversion[30] or significantly lower levels of agreeableness and conscientiousness[28]. As expected, the above results indicate that glaucoma patients tend to be withdrawn, introverted, and incapable of managing their emotional reactions properly and experience negative effects when confronted with very minor stressors.

Assessment of Coping Styles Using the MCMQ We evaluated the coping modes of glaucoma patients by using the MCMQ for the first time and found that glaucoma patients had significantly higher scores of resignation compared to the control subjects. We believe that the higher levels of resignation result from the knowledge of lifelong accompaniment with this disease and the potential risk of blindness. Since acceptance-resignation is considered a maladaptive coping strategy[31],

glaucoma patients adopting this coping strategy tend to have minimal expectations of recovery, which intensively mirror the sentiments of inadequate coping and a lack of hope.

Influences of Personality Traits on Anxiety Neuroticism is significantly and positively correlated with both state anxiety and trait anxiety (r=0.568 and r=0.635, respectively; both P<0.01), while openness, conscientiousness, extraversion and agreeableness are significantly and negatively correlated with both anxiety subscales(extraversion: r=-0.425 and r=-0.446, respectively; both P<0.01). The t-tests show that PACG patients have higher levels of neuroticism, indicating that neuroticism might positively influence anxiety disturbance in glaucoma patients, which is consistent with the regression analysis that shows that neuroticism is a potent predictor of anxiety disorders in glaucoma patients. Similarly, correlation analysis shows that lower scores of openness and extraversion might negatively affect the incidence of anxiety disorders, but neither of them has the power to predict anxiety. Moreover, conscientiousness shows the potential to predict anxiety negatively, though we find no difference in this subscale among the three groups. This result disagrees with a previous study that presented a lower level of conscientiousness in glaucoma patients[28].

Influences of Coping Modes on Anxiety The results regarding the effect of coping modes on state-trait anxiety areas expected. Specifically, resignation plays an important role as a predictive factor for anxiety disorders in glaucoma. Resignation, as a maladaptive disease-coping strategy, has been presented as an accountable risk factor for glaucoma progression[29]. Our results suggest that patients with glaucoma would benefit from the introduction or encouragement of a positive coping strategy.

Strengths and Limitations The present study has several strengths. First, the MCMQ was used to assess the coping modes of glaucoma patients. Second, the effects of personality characteristics and coping modes on comorbid anxiety disorders, as well as their predictive roles in glaucoma patients, were also studied. Moreover, participants from three medical institutions were recruited.

However, this exploratory study also has several limitations, including the small sample size. Moreover, most of the patients are elderly adults who have limited understanding and different educational backgrounds. Similarly, the study is based on self-reporting questionnaires, which rely on the accuracy of self-estimating psychological states. Because the participants may have under-or over reported or even lied about their status, there may be potential self-reporting errors and data limitations. Moreover, our study failed to exclude the systemic health status of participants, which might contribute to the psychological disturbances in glaucoma and control

patients. Last but not least, the participants employed in the control group include cataract patients, which might affect the mental state itself, though to a lesser extent compared to glaucoma[32]. In the future, more research with a larger sample size is needed.

In conclusion, glaucoma patients have higher levels of state-trait anxiety, abnormal personality traits and negative coping modes, including higher neuroticism and resignation scores and lower openness and extraversion subscales. Furthermore, higher neuroticism is a strong risk factor for anxiety disorder in glaucoma patients, followed by resignation and conscientiousness. Education is a negative predictor of anxiety. In this regard, glaucoma patients would greatly benefit from a healthier state of personality characteristics and the introduction of a more positive coping strategy. More emphasis should be given to the management of glaucoma from its psychopathic aspects, which require a multidisciplinary management approach involving both ophthalmology and psychiatry.

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