Original Article

Emotional State Evaluation of Retinitis Pigmentosa Patients with the Beck Depression Inventory

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Abstract

Objectives: To evaluate the incidence and severity of depression in patients with retinitis pigmentosa (RP).

Materials and Methods: The Beck Depression Inventory (BDI) was administered to 74 patients with RP and 60 healthy controls. Biomicroscopic anterior segment and fundus examination, visual field, optical coherence tomography, and full-field electroretinography tests were performed in all cases. Variables were evaluated with bivariate, multiple linear, and ordinal logistic regression analyses.

Results: The RP group included 40 (54%) male and 34 (46%) female patients, while the control group included 23 (38%) male and 37 (62%) female subjects. The patient group had a mean age of 39.20±12.4 years, median best corrected visual acuity (BCVA) of 0.10 decimal (1.0 logarithm of the minimum angle of resolution [logMAR]; range, 1.3-0.7 logMAR), and median visual field mean deviation (MD) score of -28.00 decibels (dB) (range, -1.00 to -34.00 dB). The median BDI score was statistically significantly higher in the patient group (19 points) than in the control group (12 points) ($p<0.001$). Moderate to severe depression (BDI ≥20) was detected in 61% of patients, while this rate was 25% in healthy controls. BCVA and visual field MD values were identified as predictors of depression score and severity level. The patients' age and gender did not affect total depression score or severity.

Conclusion: The prevalence and severity of depression were found to be higher in RP patients than in healthy controls. There was a significant relationship between the patient's functional vision tests and the frequency and severity of depression. Depression reduces the reliability of visual function tests and impairs patients' quality of life. Therefore, assessing mental health as well as functional tests is important in patients with RP.

Keywords: Retinitis pigmentosa, depression, Beck Depression Inventory

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Introduction

Retinitis pigmentosa (RP) is a group of hereditary and progressive degenerative retinal diseases that first affect rods and later cone cells. The disease causes symptoms such as reduced night vision, impaired dark adaptation, and narrowing of the peripheral visual field. In advanced cases, decreased central vision and complete vision loss may occur.[1,2]

The lack of treatment for the disease, its chronic course, and potential to progress to blindness can lead to adverse psychological effects in patients and their families.[3] The deterioration in visual function along with the concomitant mood disorder can severely impair the patient's quality of life.[4]

As the disease progresses, the results of tests based on patient performance and compliance, such as visual acuity and visual field, may become more variable and less reliable.[5] As a result, in advanced cases, researchers work with questionnaires and quality of life scales that may have better reliability. The questionnaires are based on the individual's assessment of their current level of functional vision.[6] Reliable questionnaires are also used in the follow-up of the natural course of hereditary retinal dystrophy and in clinical trials of emerging new treatment methods.[7]

An individual's perceptions related to functional status and disability may be altered as a result of the depression that can occur in association with their disease. In summary, depression can both reduce the reliability of clinical test results and negatively affect responses to quality of life scales.

Although there are many studies involving anatomic and functional assessments of patients with RP, studies on depression and anxiety disorder in these patients are insufficient. Due to the rare occurrence of the disease, the studies include limited numbers of patients. Moreover, the prevalence and severity of depression may vary between populations due to cultural, environmental, and socioeconomic factors. In this study, we aimed to investigate the prevalence and severity of depression among patients with RP. We evaluated the relationship between depression prevalence and severity and the patients' age, sex, visual acuity, and visual field test results. For this purpose, we evaluated patients and controls using the previously validated Turkish version of the Beck Depression Inventory (BDI).[8]

Materials and Methods

This cross-sectional study was conducted between January and December 2023. The patient group comprised individuals diagnosed with RP who were followed up in our clinic, and the control group consisted of patients who were examined in our clinic during the same period. All participants underwent best-corrected visual acuity (BCVA) measurement and slit-lamp anterior segment and fundus examinations. BCVA was assessed by Snellen chart and recorded in decimal, then converted to logarithm of the minimum angle of resolution (logMAR). Visual field test was performed using the 30-2 program on a Humphrey Field Analyzer (Carl Zeiss Meditec AG, Germany) and optical coherence tomography examination was performed (Topcon, Japan). In addition, full-field electroretinography (ERG; Monpack 3, Metrovision, France) was performed in the RP patients. The patients' BCVA and their mean deviation (MD) values on the visual field test were recorded. Data from a single eye were used for patients whose vision levels and MD values were equal in both eyes, while data from the better eye were used in cases where they were unequal. The visual field test results of 29 patients who had low reliability parameters and impaired fixation were not included in the study.

Inclusion criteria for the patient group were: age over 18 years, no history of systemic disease, no ocular pathology (e.g., glaucoma, amblyopia) other than RP, fundus examination findings such as pigmentary changes consistent with bilateral RP, bone spicules, retinal and retinal pigment epithelium atrophy, narrowing of the visual field, and attenuated scotopic responses on ERG. Participants in the control group were over 18 years of age, had perfect BCVA, and had no history of systemic comorbidities.

The BDI was administered to all participants in the patient and control groups. The participants were asked to complete the questionnaire in the clinic or bring it to their next visit. For patients with low vision, the questionnaires were completed with assistance from their relatives or our clinical staff.

Acıbadem University Ethics Committee approval was obtained for the study (decision no: ATADEK 2022-20/08, date: 30.12.2022). The study procedures were carried out in accordance with the Declaration of Helsinki. An informed consent form was obtained from each participant.

Beck Depression Inventory

The BDI is a questionnaire used to evaluate an individuals' mental state. It consists of 21 questions that the individual answers according to their current state. Each question has 4 response options scored from 0 to 3. Total scores of 0-13 are interpreted as no depression, 14-19 as mild depression, 20-28 as moderate depression, and 29-63 as severe depression. The Turkish validity and reliability study was conducted.[8]

Statistical Analysis

The data were analyzed with the SPSS version 21.0 program (IBM Corp, Armonk, NY, USA). The normality of the data was tested with the Shapiro-Wilk test. Continuous data were represented as median, range, and interquartile range and compared using the Mann-Whitney U test. Categorical data were represented as frequencies and percentages and compared using Pearson's chi-square or Fisher exact test. Bivariate regression analysis of depression score and severity level was performed according to age, sex, visual acuity, and MD value.

Results

A total of 134 participants were included in our study. Of these, 60 were healthy controls with normal visual acuity and visual field, and 74 were RP patients with visual impairment and visual field narrowing. Age, sex, marital status, education level, and parental consanguinity were recorded for the patient group. There were 40 (54%) males and 34 (46%) females in the RP group and 23 (38%) males and 37 (62%) females in the control group. The mean age was 39.20±12.4 years in the patient group and 36.70±9.2 years in the control group. There was no statistically significant difference between the two groups in terms of age or sex. The demographic data of the patients are shown in Table 1.

The median visual acuity of the patient group was 0.10 decimal (1.0 logMAR; 1.3-0.7 logMAR range). Patients were grouped according to the classification defined by the World Health Organization and International Classification of Diseases, which was also used in previous studies.[9,10] Thirty-six (48.6%) patients were below 0.05 decimal (1.3 logMAR) and at the level of legal blindness. In the remaining cases, visual acuity level was 0.05 to 0.3 decimal (1.3-0.5 logMAR) in 14 patients (19%), 0.3 to 0.7 decimal (0.5-0.2 logMAR) in 17 patients (22.9%), and better than 0.7 decimal (0.2 logMAR) in 3 patients (4.1%). According to this, the patient group consisted predominantly of advanced cases. The 45 patients with visual field data had a median MD of -28.00 decibels (dB) (range: -1.00 to -34.00 dB), and 90% had an MD below the overall median of -5.63 dB. There were no participants in the control group with a visual field lower than -5 dB (Table 2).

The median BDI score was statistically significantly higher in the patient group than in the control group (19 vs. 12; $p<0.001$). In the patient group, 9.5% had no depression while the other 90.5% were found to have some degree of depression. The prevalence of moderate to severe depression was higher in the patient group than in the control group (61% vs. 25%). In

the control group, 68% of the individuals had mild to moderate depression (Table 2).

Visual acuity level was determined to be a predictor of depression score and severity. Each Snellen line increase in visual acuity was associated with a 0.85-point decrease in depression score (B=-0.85, p<0.001) and 18% lower odds of moderate to severe depression (odds ratio [OR]: 0.82, p<0.001). Patients with visual acuity higher than 0.7 had similar depression scores to the control group and low odds of moderate to severe depression (OR: 0.13, p<0.001) (Table 3).

Visual field MD values were also found to be predictive of depression score and severity. Each 10-unit reduction in MD was associated with a 2.5-point increase in depression score and a 1.8-fold increase in the odds of severe depression. Especially among patients with MD values below -30 dB, depression scores increased by over 8 points (B=8.7, p<0.001) while the odds of moderate to advanced depression were more than 6 times higher (OO=6.60, p<0.001) (Table 3).

Depression scores and depression severity tended to increase significantly with age. However, when adjusted for sex, visual acuity, and visual field, it did not have a significant effect on depression score. Sex was not found to impact depression score or severity.

Table 1. Demographic data of the patients

	RP, n=74
Age (years)	
Mean ± SD	39.20±12.4
Range	(18-71)
Sex	
Male	40 (54%)
Female	34 (46%)
Education level	
Primary school	32 (43%)
Secondary school	27 (37%)
University	15 (20%)
Marital status	
Married	47 (64%)
Single	23 (31%)
Divorced	4 (5%)
Parental consanguinity	
None	19 (25%)
First degree	28 (38%)
Second degree	16 (22%)
Third degree	11 (15.0%)

RP: Retinitis pigmentosa, SD: Standard deviation

Discussion

Potentially chronic and progressive ocular pathologies such as dry eye, glaucoma, age-related macular degeneration, and uveitis have been shown to be accompanied by depression.[11,12,13,14,15] RP differs from these pathologies in that it has distinct hereditary features, starts at an earlier age, and has no standard treatment protocol. For these reasons, the frequency and severity of depression may differ from those in the aforementioned disease groups. In this study, we evaluated the frequency and severity of depression in RP patients. We examined the relationships between depression score and severity and the patients' age, sex, and results of functional tests such as visual acuity and visual field. We found that depression was more common and more severe among patients with RP than healthy controls.

Several scales can be used to assess the presence and severity of depressive symptoms.[16] The tests that have been most frequently used in studies of RP patients are the hospital anxiety and depression scale (HADS), BDI, patient health questionnaire, and Zung depression scale (ZDS). In this study we used the BDI, which was validated with university students in our country and has a high sensitivity and specificity when a cut-off value of 13 points is used.[8]

When the stages of RP were evaluated, 85.2% of the patients in this study had intermediate or advanced disease. Nearly half (49%) of the patients had a visual acuity worse than 0.05 decimal (1.3 logMAR) and were legally blind. According to BDI results, depression was detected in 90.5% of the patients and was moderate or severe in 61% of them. Previous studies have reported depression rates varying between 15.5% and 34.8% in patients with RP.[17,18,19,20,21,22] The much higher frequency of depression in our study may be due to reasons such as the high mean age of the patients and the fact that most patients had intermediate to advanced stage RP. In addition, differences in the scales and cut-off values used to identify depression may have been a factor in the high variability of the results. Again, cultural and geographic factors may also contribute to this result.

In a study conducted in Greece, which has similar geographic and cultural characteristics to our country, the frequency of depression in RP patients was found to be 76.5% and the frequency of moderate depression was 26.5%.[23] The results obtained in that study are closer to our results, supporting the idea that cultural and geographic factors may influence the prevalence of depression. Another noteworthy finding of our study was that the rate of moderate depression was as high as 25% in the control group. This may indicate that we as a society have a strong inclination for depression. Although not within the scope of this study, socioeconomic, cultural, and geographic differences may have contributed to the higher rate of depression in the control group compared to other studies.

When the data related to age and sex were evaluated, we determined that although older patients showed a higher frequency and severity of depression, older age was not

Table 2. Comparison of BCVA, visual field MD scores, and depression scores and severity between the groups				
	Control, n=60	**RP, n=74**	**Total, n=134**	**p**
BCVA (Snellen decimal)				-
Median (IQR)	1.00 (1.00, 1.00)	0.10 (0.05, 0.25)	0.65 (0.08, 1.00)	
Range	1.00, 1.00	0.001, 0.90	0.001, 1.00	
BCVA quartile, decimal				-
0.001-0.05	0 (0)	36 (49)	36 (27)	
>0.05-0.70	0 (0)	35 (47)	35 (26)	
>0.70-<1.00	0 (0)	3 (4.1)	3 (2.2)	
1.00 (normal)	60 (100)	0 (0)	60 (45)	
MD (dB)				<0.001[1]
Median (IQR)	-3 dB (-3, -4)	-28 dB (-18, -32)	-6 dB (-3, -30)	
Range	-2, -5 dB	-1, -34 dB	-1, -34 dB	
MD Quartile*, dB		**n=45**	**n=105**	<0.001[2]
-0.83 to -3.00	40 (67)	3 (6.6)	43 (41)	
-3.00 to -5.63	20 (33)	4 (8.8)	24 (23)	
-5.63 to -30.2	0 (0)	21 (46.6)	21 (20)	
-30.2 to -34.0	0 (0)	17 (37.7)	17 (16)	
Total BDI score				<0.001[1]
Median (IQR)	12 (8, 17)	19 (13, 25)	16 (11, 22)	
Range	1, 28	0, 44	0, 44	
Depression severity				<0.001[2]
None (BDI 0-13)	19 (32)	7 (9.5)	26 (19)	
Mild (BDI 14-19)	26 (43)	22 (30)	48 (36)	
Moderate (BDI 20-28)	15 (25)	31 (42)	46 (34)	
Severe (BDI 29-63)	0 (0)	14 (19)	14 (10)	

*Visual field results from 29 patients with low reliability or poor fixation were excluded from the analysis. [1]Mann-Whitney U test, [2]Fisher's exact test. BCVA: Best corrected visual acuity, MD: Mean deviation, RP: Retinitis pigmentosa, IQR: Interquartile range, dB: Decibel, BDI: Beck Depression Index

significantly associated with depression scores in multiple regression analyses. Similarly, there was no relationship with sex. When the literature is examined, there are studies showing no correlation between the presence of depression and patients' age, sex, and socioeconomic and education levels.[18,20,22] However, other publications reported that depression is more common among female patients over the age of 35 years.[17,21] This discrepancy may be related to these studies being retrospective, including patients from different racial and ethnic backgrounds, and not involving functional vision tests.[17,21]

There is consensus among most studies of RP patients conducted to date that the frequency and severity of depression increases with deterioration of visual function.[18,20,22,23,24,25] A study in which 34 patients were assessed using the ZDS showed that advanced age and BCVA were correlated with depression scores.[23] Similarly, in a larger series of 112 cases evaluated with the HADS, depression scores were significantly correlated with BCVA and functional vision score (FVS).[18] In the evaluation of depression, Hahm et al.[20] also used the BDI, as in our study, but observed no correlation between BDI score and FVS. In our study, there was a negative relationship between the patient's visual acuity and visual field MD values and the frequency and severity of depression. The reasons for this result could include different disease severity in the studied groups, different BDI cut-off values, and their use of the FVS as a functional test.

In our study, visual acuity and visual field were used as functional vision tests. It is known that visual acuity and visual field are the two most important factors affecting patients' activities of daily living, quality of life, and emotional state.[25] One study showed that a significant deterioration in quality of life and emotional state occurred when visual acuity decreased below 0.3 decimal and the visual field narrowed beyond the central 20 degrees. In addition, FVS, which is obtained by evaluating these two measurements together, was correlated with the patients' results on quality of life questionnaires.[26] When the visual field results were examined in our study, we observed that the central 20 degrees was preserved in 23 patients (31%), while the other 51 patients (69%) had a visual field smaller than the central 20 degrees. We believe that severe visual field loss in our patients contributed to the high frequency and severity of depression.

Table 3. Bivariate regression of total depression score and presence of moderate to severe depression by age, sex, visual acuity, and mean deviation value

	n	BDI score			Moderate/severe depression		
		B	95% CI	p	OR	95% CI	p
Age (per 1 year increase)	134	0.09	-0.02, 0.20	0.104	1.01	0.99, 1.04	0.233
Age (per quartile), years	134			0.011			0.091
18-26	37	0.00	-	-	1.00	-	0.091
>26-36	33	0.71	-3.4, 4.8	0.735	0.87	0.37, 2.03	0.741
>36-48	36	4.8	0.79, 8.9	0.019	2.34	1.04, 5.38	0.044
>48-71	28	3.1	-1.2, 7.4	0.154	1.37	0.53, 3.54	0.519
Sex	134			0.525			0.541
Male	63	0.00	-	-	1.00	-	-
Female	71	1.0	-2.1, 4.0	0.525	1.21	0.65, 2.26	0.541
Mean MD value (per 10 dB increase)	105	2.5	1.4, 3.6	<0.001	1.81	1.39, 2.36	<0.001
Mean MD quartile, dB	105			<0.001			<0.001
-0.83 to -3.00	43	0.00	-	-	1.00		-
-3.00 to -5.63	24	1.1	-3.0, 5.3	0.588	0.82	0.32, 2.11	0.685
-5.63 to -30.2	21	4.3	0.51, 8.0	0.026	2.72	1.19, 6.30	0.020
-30.2 to -34.0	17	8.7	5.0, 12	<0.001	6.60	2.74, 16.5	<0.001
Mean BCVA (per 0.10 decimal increase)	134	-0.85	-1.2, -0.54	<0.001	0.82	0.76, 0.88	<0.001
Mean BCVA quartile, decimal	134			<0.001			<0.001
1.00 (normal)	60	0.00	-	-	1.00	-	-
>0.70 - <1.00	3	0.02	-9.4, 9.5	0.997	0.13	0.06, 0.29	<0.001
>0.05 - 0.70	35	4.8	1.4, 8.2	0.006	0.15	0.01, 1.43	0.099
0.001 - 0.05	36	8.9	5.6, 12	<0.001	0.52	0.21, 1.26	0.152
Study group	134			<0.001			<0.001
Control	60	0.00	-	-	1.00	-	-
RP	74	6.6	3.8, 9.4	<0.001	5.13	2.64, 10.3	<0.001

BDI: Beck Depression Inventory, CI: Confidence interval, OR: Odds ratio, MD: Mean deviation, dB: Decibel, BCVA: Best corrected visual acuity, RP: Retinitis pigmentosa

In the follow-up and evaluation of new treatment methods in patients with hereditary retinal dystrophy, quality of life measures were revised to make a tool more specific to retinal dystrophy.[26] This assessment, which is based on the patient's perceptions and responses concerning their eye health, was shown to correlate with functional tests.[27,28] In one study using this assessment, the results were shown to be associated with visual acuity and ellipsoid zone area.[28] As standard visual tests can be difficult to perform in patients with hereditary retinal dystrophy, the applicability of new tests is important.[28,29] The presence of a mood disorder increases the variability and decreases the reliability of standard clinical tests and reduces quality of life.[5,29] Therefore, depression that occurs in association with the patient's disease should not be overlooked.

Study Limitations

RP is among the rare diseases, so case numbers are limited. Studies with more participants are needed. At the same time, the frequency and severity of depression may have been high because most of the patients in our study had intermediate to advanced disease. Studies conducted in homogeneous groups with better representation of the early stages may yield different results. Education level and marital status, which may indirectly affect depression, were not exactly matched in the control and patient groups and thus could not be included in the analysis. Visual acuity was evaluated with a decimal chart and converted to logMAR. Therefore, there may have been differences between the measurements. Additionally, visual field data from patients whose test results indicated low reliability could not be included in the study. We evaluated patients' functional tests such as visual acuity and visual field, but did not perform an anatomic evaluation. Most patients had attenuated rod and cone responses in the full-field ERG test, but wave morphology could not be evaluated and included in the study. For patients with no response on full-field ERG, a multifocal ERG test can be added

if fixation is adequate. In those with poor fixation, the newer full-field stimulus threshold test can be applied.[30] The participants in our study did not undergo a psychiatric evaluation; the results are based on a questionnaire that can be considered a screening test. As questionnaires are based on patient reports, the objectivity of the data decreases and bias may occur. Most of the patients could not provide reliable information about the duration of their disease. Therefore, disease duration could not be evaluated in the study. Finally, different racial and ethnic groups were not studied.

Conclusion

Patients with RP, especially those with intermediate to advanced disease, have an increased incidence and severity of depression. There was no relationship between depression status and factors such as age and sex. The strongest predictors of depression were the results of functional tests such as visual acuity and visual field. However, depression reduces the reliability of visual function tests and reduces patients' quality of life. In these cases, various mental health screening tools can be applied in clinical practice in addition to visual function tests. RP patients require a multidisciplinary approach involving branches such as low vision rehabilitation and psychiatry. By treating the underlying depressive symptoms and developing strategies to cope with the disease, the patient's quality of life may improve, functional test performance may increase, and the results of these tests may be more meaningful.

Ethics

Ethics Committee Approval: Acıbadem University Ethics Committee approval was obtained for the study (decision no: ATADEK 2022-20/08, date: 30.12.2022). The study procedures were carried out in accordance with the Declaration of Helsinki.

Informed Consent: Obtained.

Authorship Contributions

Surgical and Medical Practices: A.Ö., Concept: A.Ö., Ö.Ş., S.Ö., Design: A.Ö., Ö.Ş., S.Ö., Data Collection or Processing: N.S.K., M.O.S., K.K.T., Analysis or Interpretation: N.S.K., M.O.S., Literature Search: N.S.K., M.O.S., Writing: A.Ö., N.S.K.

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References

1. Verbakel SK, van Huet RAC, Boon CJF, den Hollander AI, Collin RWJ, Klaver CCW, Hoyng CB, Roepman R, Klevering BJ. Non-syndromic retinitis pigmentosa. Prog Retin Eye Res. 2018;66:157-186.
2. Hartong DT, Berson EL, Dryja TP. Retinitis pigmentosa. Lancet. 2006;368:1795-1809.
3. D'Amanda CS, Nolen R, Huryn LA, Turriff A. Psychosocial impacts of Mendelian eye conditions: A systematic literature review. Surv Ophthalmol. 2020;65:562-580.
4. Sivertsen H, Bjørkløf GH, Engedal K, Selbæk G, Helvik AS. Depression and Quality of Life in Older Persons: A Review. Dement Geriatr Cogn Disord. 2015;40:311-339.
5. Bittner AK, Ibrahim MA, Haythornthwaite JA, Diener-West M, Dagnelie G. Vision test variability in retinitis pigmentosa and psychosocial factors. Optom Vis Sci. 2011;88:1496-1506.
6. Braithwaite T, Calvert M, Gray A, Pesudovs K, Denniston AK. The use of patient-reported outcome research in modern ophthalmology: impact on clinical trials and routine clinical practice. Patient Relat Outcome Meas. 2019;10:9-24.
7. Lacy GD, Abalem MF, Popova LT, Santos EP, Yu G, Rakine HY, Rosenthal JM, Ehrlich JR, Musch DC, Jayasundera KT. Content generation for patient-reported outcome measures for retinal degeneration therapeutic trials. Ophthalmic Genet. 2020;41:315-324.
8. Hisli N. Validity and reliability of Beck Depression Inventory in university students. Psikoloji Dergisi. 1989;7:3-13.
9. World Health Organization. The management of low vision in children. Report of a WHO consultation: Bangkok, July 1992. Geneva: World Health Organization, 1993. WHO/PBL/93.27.
10. Altinbay D, Taskin I. Evaluation of vision-related quality of life in retinitis pigmentosa patients with low vision. Jpn J Ophthalmol. 2021 Nov;65(6):777-785. doi: 10.1007/s10384-021-00875-z. Epub 2021 Oct 4. PMID: 34606034.
11. van der Vaart R, Weaver MA, Lefebvre C, Davis RM. The association between dry eye disease and depression and anxiety in a large population-based study. Am J Ophthalmol. 2015;159:470-474.
12. Zhang X, Olson DJ, Le P, Lin FC, Fleischman D, Davis RM. The Association Between Glaucoma, Anxiety, and Depression in a Large Population. Am J Ophthalmol. 2017;183:37-41.
13. Dawson SR, Mallen CD, Gouldstone MB, Yarham R, Mansell G. The prevalence of anxiety and depression in people with age-related macular degeneration: a systematic review of observational study data. BMC Ophthalmol. 2014;14:78.
14. Onal S, Oray M, Yasa C, Akman M, Uludag G, Koc Akbay A, Tugal-Tutkun I. Screening for Depression and Anxiety in Patients with Active Uveitis. Ocul Immunol Inflamm. 2018;26:1078-1093.
15. Eser-Öztürk H, Yeter V, Karabekiroğlu A, Süllü Y. The Effect of Vision-Related Quality of Life on Depression and Anxiety in Patients with Behçet Uveitis. Turk J Ophthalmol. 2021;51:358-364.
16. Smarr KL, Keefer AL. Measures of depression and depressive symptoms: Beck Depression Inventory-II (BDI-II), Center for Epidemiologic Studies Depression Scale (CES-D), Geriatric Depression Scale (GDS), Hospital Anxiety and Depression Scale (HADS), and Patient Health Questionnaire-9 (PHQ-9). Arthritis Care Res (Hoboken). 2011;63(Suppl 11):S454-S466.
17. Le P, Nguyen M, Vu T, Dao DP, Olson D, Zhang AY. Anxiety and Depression in Patients With Retinitis Pigmentosa. J Vitreoretin Dis. 2020;5:114-120.
18. Sainohira M, Yamashita T, Terasaki H, Sonoda S, Miyata K, Murakami Y, Ikeda Y, Morimoto T, Endo T, Fujikado T, Kamo J, Sakamoto T. Quantitative analyses of factors related to anxiety and depression in patients with retinitis pigmentosa. PLoS One. 2018;13:e0195983.
19. Chaumet-Riffaud AE, Chaumet-Riffaud P, Cariou A, Devisme C, Audo I, Sahel JA, Mohand-Said S. Impact of Retinitis Pigmentosa on Quality of Life, Mental Health, and Employment Among Young Adults. Am J Ophthalmol. 2017;177:169-174.
20. Hahm BJ, Shin YW, Shim EJ, Jeon HJ, Seo JM, Chung H, Yu HG. Depression and the vision-related quality of life in patients with retinitis pigmentosa. Br J Ophthalmol. 2008;92:650-654.
21. Adhami-Moghadam F, Iran-Pour E. Psychological disorders in patients with retinitis pigmentosa in iran. Iran J Public Health. 2014;43:523-528.
22. Kim S, Shin DW, An AR, Lee CH, Park JH, Park JH, Oh MK, Hwang SH, Kim Y, Cho B, Lee HK. Mental health of people with retinitis pigmentosa. Optom Vis Sci. 2013;90:488-493.
23. Moschos M, Chatzirallis A, Chatziralli I. Psychological aspects and depression in patients with retinitis pigmentosa. Eur J Ophthalmol. 2015;25:459-462.
24. Chacón-López H, Pelayo FJ, López-Justicia MD, Morillas CA, Ureña R, Chacón-Medina A, Pino B. Visual training and emotional state of people with retinitis pigmentosa. J Rehabil Res Dev. 2013;50:1157-1168.

25. Seo JH, Yu HG, Lee BJ. Assessment of functional vision score and vision-specific quality of life in individuals with retinitis pigmentosa. Korean J Ophthalmol. 2009;23:164-168.
26. Azoulay L, Chaumet-Riffaud P, Jaron S, Roux C, Sancho S, Berdugo N, Audo I, Sahel JA, Mohand-Saïd S. Threshold levels of visual field and acuity loss related to significant decreases in the quality of life and emotional states of patients with retinitis pigmentosa. Ophthalmic Res. 2015;54:78-84.
27. Lacy GD, Abalem MF, Andrews CA, Popova LT, Santos EP, Yu G, Rakine HY, Baig N, Ehrlich JR, Fahim AT, Branham KH, Stelmack JA, Swenor BK, Dagnelie G, Musch DC, Jayasundera KT. The Michigan Retinal Degeneration Questionnaire: A Patient-Reported Outcome Instrument for Inherited Retinal Degenerations. Am J Ophthalmol. 2021;222:60-68.
28. Marques JP, Machado Soares R, Simão S, Abuzaitoun R, Andrews C, Alves CH, Ambrósio AF, Murta J, Silva R, Abalem MF, Jayasundera KT. Self-reported visual function and psychosocial impact of visual loss in *EYS*-associated retinal degeneration in a Portuguese population. Ophthalmic Genet. 2023;44:334-340.
29. Rozanski C, Haythornthwaite JA, Dagnelie G, Bittner AK. Applying theories and interventions from behavioral medicine to understand and reduce visual field variability in patients with vision loss. Med Hypotheses. 2014;83:190-195.
30. Öner A, Kahraman NS. Evaluation of Full-Field Stimulus Threshold Test Results in Retinitis Pigmentosa: Relationship with Full-Field Electroretinography, Multifocal Electroretinography, Optical Coherence Tomography, and Visual Field. Turk J Ophthalmol. 2024;54:23-31.