Comparison of the effects of telescopic glasses and filtered glasses on functional vision rehabilitation outcomes in patients with retinitis pigmentosa

Gizem Dogan Gokce[1], Hatice Selen Sonmez Kanar[2], Muhammed Nurullah Bulut[3], Saban Simsek[4]

ABSTRACT

Purpose: To compare the functional vision and life quality in Retinitis Pigmentosa (RP) patients with telescopic glasses (TGs) and filtered glasses (FGs).

Materials and Methods: We included 25 RP patients in this prospective study. Comprehensive ophthalmological examination, corrected distance visual acuity (CDVA), corrected near visual acuity (CNVA), contrast sensitivity (CS), reading performance and life quality questionnaires were evaluated by using TGs and FGs. Low Vision Quality of Life (LVQOL) and National Eye Institute Visual Function Questionnaire (NEI VFQ/TR) were applied.

Results: The mean age was 25.4±8.29 years. Patients of 19 were at the moderate stage of RP and 6 of them were in the advanced stage. The mean DVAs were (LogMAR) 0.48±0.29 with TGs and 0.46±0.32 with FGs. The difference was not statistically significant (p=0.65). The mean CS were found higher with FGs (0.44±0.31log) than with TGs (0.68±0.27 log) (p<0.001). There were no statistically significant differences in reading acuities and critical print size but maximum reading speeds were significantly higher with FGs (67.6±28 words/minute) than TGs (52.4±20.15 words/minute) (p =0.028). The total scores of the LVQOL were 53.44 ±11.37 with TGs and 65.16 ±10.66 with FGs and that is a statistically significant difference (p<0.001). FG was found statistically superior to TG in other sub-titles except reading (p=0.069). The scores of the NEI VFQ-25/TR; general health, general vision, role difficulty and colour vision subunits scores were not statistically difference however in NEI VFQ 39/TR; general vision score was statistically higher in FGs. In ocular pain, near and distance vision, mental health, independence and peripherical vision sub-titles, FG was superior to TG.

Conclusion: In low vision RP patents, FGs reduce subjective complaints, provide visual function and increase life quality more than TGs. Using expanded form of the questionnaire gives more accurate results.

Keywords: Filtered glasses, low vision, retinitis pigmentosa, telescopic glass, visual rehabilitation.

INTRODUCTION

Retinitis pigmentosa (RP) is a hereditary disease characterized by the progressive loss of outer retinal cell function, including photoreceptor cells and retinal pigment epithelium.[1] RP affects more than 1.5 million patients worldwide and is the most common hereditary retinal dystrophy. Studies have shown that it ranges from 1/3.000 to 1/5.000.[2]

Retinal degeneration generally begins in rod cells and affects cone cells after peripheral vision loss, causing central vision loss.[3] In the moderate stage, patients become unable to maintain their daily activities due to decreased vison, such as walking at nighttime, driving and outdoor activities. In daylight, they notice that the peripheral visual field is narrowed and complaints of discomfort begin from diffuse bright light.[4] As the disease progresses, only a small residual central vision due to the degree of visual field loss and advanced peripheral visual field loss become unable to perform their daily activities within the home. Their light sensitivity is high, they have many reading

1- MD, Department of Ophthalmology, Kartal Dr. Lutfi Kirdar City Hospital, İstanbul, Türkiye

2- MD, Assoc.Prof., Department of Ophthalmology, Kartal Dr Lutfi Kirdar City Hospital, İstanbul, Türkiye

3- MD, Assoc.Prof., Department of Ophthalmology, Kartal Dr Lutfi Kirdar City Hospital, İstanbul, Türkiye

4- MD, Prof., Department of Ophthalmology, Kartal Dr Lutfi Kirdar City Hospital, İstanbul,Türkiye

Received: 13.07.2023
Accepted: 29.01.2024
J Ret-Vit 2024; 33: 99-105
DOI:10.37845/ret.vit.2024.33.15

Correspondence author:
Gizem Dogan Gokce
Email: gizemdogann05@gmail.com

difficulties and they need help devices to be independent. Additionally, glare is another visual problem and causes serious discomfort.[5]

Currently, there is no established treatment modality to stop the progression of photoreceptor degeneration. However, numerous treatment options, such as gene therapy, retina pigment epithelium (RPE) cell transplants, stem cell transplants and retinal prosthesis treatments, have been implemented and are still undergoing development.[6] Low vision rehabilitation (LVR) aims to increase the quality of life by enabling patients with RP to live more actively and have a vacation or skill with which they can support their working life. For this purpose, some devices known as low vision aid (LVA) are used. These devices increase the vision level and vision quality of RP patients with low vision.[7]

Telescopic glasses (TGs), microscopes, magnifiers, filtering glasses (FGs) and electro-optical systems have been used to increase the distance and near vision of patients with RP. Telescopes increase the image size; however, these devices also have some disadvantages, such as being difficult and dangerous to use when moving due to narrowing of the visual field, challenging in achieving binocularity, being expensive and potentially causing esthetic concerns.[8] The narrowing of the visual field and the restriction of lighting can complicate locating and focusing in some way, limiting focal depth. Conversely, filtered spectacle lenses may be a rational approach that does not increase the existing visual field narrowing in these patients and can help reduce the problem of glare. The filtering lenses protect against ultraviolet rays and filter light to minimize vision loss and color differentiation. Patients with low vision are protected from ultraviolet, infrared, and visible excess and harmful rays to increase visual quality by reducing glare.[9]

In this study, we compared the effects of LVAs on functional vision with filter glasses FGs and TGs in patients with RP who needed LVA to be independent first in the literature. Additionally, we compared the quality of life subjectivity with the LVQOL, NEI VFQ-25 and NEI VFQ-39 questionnaires in two LVA devices.

MATERIALS AND METHODS

This study adhered to the principles outlined in the Declaration of Helsinki and received approval from the local ethics committee. All participants were provided with both oral and written information regarding the study, and each participant subsequently signed a written informed consent form.

The study enrolled twenty-five patients with Retinitis Pigmentosa (RP) who were under the care of the Low Vision Aid (LVA) department. Demographic information, family history, financial status, and educational background were documented for each participant. All patients had previously utilized telescopic glasses (TGs) but expressed dissatisfaction with them due to issues related to visual quality, glare, esthetic concerns, and difficulties in use.

A comprehensive ophthalmological examination was conducted for all patients, encompassing autorefraction measurements, corrected distance visual acuity (CDVA), corrected near visual acuity (CNVA), contrast sensitivity (CS), reading performance, and posterior segment findings. The stage of RP was assessed based on fundus examination findings.

Following the correction of refractive errors, CDVAs were measured at a distance of four meters using the Snellen chart and subsequently converted to Log MAR for statistical analysis. In cases where patients could not read from this distance, 0.3 Log MAR units were added to the Log MAR value for each meter reduction in distance, up to 2 meters, with an additional 0.6 Log MAR units added when the distance was reduced to 1 meter.

CNVA and reading performance were evaluated using the Turkish version of the MNREAD reading card. CS levels were measured binocularly from a distance of 1 meter using Pelli-Robson CS charts. These measurements were conducted both with and without TGs. For patients prescribed with FGs, these parameters were assessed one month after the prescription.

To assess the impact on the patients' quality of life and daily activities, the LVQOL and NEI VFQ questionnaires were administered. These questionnaires were completed by the patients while they were using TGs and were repeated one month after the introduction of FGs. All LVQOL, NEI VFQ-25, and NEI VFQ-39 scores were administered by the same clinician (G.D.G) and documented accordingly.

RESULTS

Of the 25 patients, 19 (76%) were men and 6 (24%) were women. Their mean age was 25.4±8.29 years (ranging from 14 to 39 years) and the mean age when the complaints began was 17.25±8.39 years. Seventeen patients (68%) had hereditary RP inheritance, while 8 (32%) of them had sporadic RP. Table 1 shows the demographic information and examination findings of the study group.

Table 1: *Characteristics and demographic data of the study group.*

Age (years)	25.4 ± 8.29
Gender (n/ %)	
female	6(%24)
male	19(%76)
Marital Status (n/ %)	
married	4(%16)
single	21(%84)
Education (n/ %)	
No education or primary school	2(%8)
Secondary school	18(%72)
High school or university	5(%20)
With whom live (n/ %)	
Alone	2(%8)
Husband or wife	2(%8)
Children	2(%8)
Mother or father	17(%68)
Other	2(%8)
Economic Situation (n/ %)	
Low	7(%28)
Middle	15(%60)
High	3(%12)
RP in Family (n/ %)	
None	8(%32)
Mother	2(%8)
Father	6(%24)
Sister or Brother	3(%12)
Child	-
Uncle or Auntie	9(%36)
Mean value of refractive error	
Spheric (mean)	-2.24±0.47 D
(range)	(+0.75, -3.25 D)
Cylindrical (mean)	-0.29±0.22
(range)	(+0.25, -1.00 D)
Mean of Best Corrected Visual Acuity (BCVA) (log MAR)	0.65±0.27
Lens Status	
Cataract	13(%52)
Pseudophakia	12(%48)
Stage of RP	
Early	-
Middle	19(%76)
Late	6(%24)

All patients were used to utilize Gallian type TG for distance vision and they were wearing high additions on their glasses for near vision. For use in both indoor and outdoor settings, one or two different types of FGs were prescribed. Nineteen (76%) of the patients preferred one type of FG and six patients (24%) preferred two different FGs. The most preferred filter glass nm values were 540 nm, 550 nm and 500 nm. In the moderate-stage RP groups, 12 patients preferred 540 nm, five preferred 550 nm, and two preferred 500 nm and 540 nm FGs. In addition, four patients with late-stage RP preferred 500 and 550 nm FGs, and two patients with late-stage RP preferred 540 nm FGs.

The mean CDVA with TGs was 0.44±0.29 LogMAR and the mean CDVA was 0.53±0.32 LogMAR with FGs. There was no statistically significant difference in CDVA between the two LVAs (p=0.055). The mean CS with TGs was 0.44±0.31 log and it was 0.68±0.27 log with FGs. This difference was statistically significant (p<0.001).

Regarding the evaluation of MNREAD reading performance, the mean reading acuity was 0.82±0.27 LogMAR with TG and 0.85±0.33 LogMAR with FG, the mean critical print size was 1.00±0.30 LogMAR and 1.00±0.47 LogMAR. In addition, the mean maximum reading speed was 52.4±20.15 word/minute with TGs and 67.6±28.40 word/minute with FGs. There was no significant difference in reading acuity and critical print size with two glasses (p=0.77). However, the mean number of words read per minute was statistically higher with FGs than TGs (p=0.028).

The total scores in the LVQOL questionnaire for TGs and FG were 53.44±11.37 and 65.16±10.66, respectively, with a significant difference (p<0.001). The distance vision subtitle with TGs was significantly higher than that with FGs (p<0.001). The comfortability and daily living activities scores were significantly higher with FGs than TGs (p<0.001 and p<0.001, respectively). There were no significant differences in the reading and fine works subtitle between the two LVAs (p=0.069). Table 2 shows the comparison of LVQOL questionnaire scores between the two LVAs.

In the NEI VFQ-25, the mean general health subtitle score and general vision score were not significantly different between the two LVAs (p=0.343 and p=0.17). In the NEI VFQ-39 questionnaire results, there was no statistically significant difference between the two LVAs in the general health subtitle, but the mean general vision score was significantly higher in the FGs.

In the NEI VFQ-25 subtitle of eye pain, the mean score was 43.05±11.02 with TGs and 36.50±17.95 with FGs. This difference was significant (p=0.016).

Table 2: *Comparison of LVQOL total and subscale scores between TGs and FGs*

	(TGs)	(FGs)	P value
Total score	53.44±011.37	65.16±10.46	**0.00**
Distance vision	27.60±6.27	36.92±5.96	**0.00**
Adjustment	12.36±2.48	14.12±1.98	**0.00**
Reading and Fine work	13.48±14.12	14.12±3.35	0.69
Activities of daily living	10.56±2.34	12.28±2.22	**0.00**

Abbreviations: FG: filtered glass; LVQOL:Low Vision Quality of Life Questionnaire; TG: telescopic glass

The mean scores of near and far vision were 43.05±11.02 and 39.16±17.14 with TGs and 47.00±13.28 and 41.63±11.13 with FGs, respectively. The differences in near and far vision subtitle scores between the two LVA scores were statistically significant. (p=0.022, p<0.001, respectively).

In the social interaction subtitle, the mean scores were 38.75±9.22 and 51.25±9.23 for TGs and FGs, respectively. There were no statistically significant differences between the two LVA scores (p=0.008). In the mental health subtitle, the mean scores were 22.05±13.68 for TGs and 31.85±14.91 for FGs. The difference between the two LGA scores was significant (p=0.003). In the color vision subtitle, the mean scores with the TGs and FGs were 52.50±7.90 and 55.00±10.54, respectively. The difference between the two LVA scores was not significant (p = 0.343). In the peripheral vision subtitle scores of patients with TGs and FGs, which were 24.90±11.78 and 50.00±11.87, respectively, the mean peripheral scores with FGs were higher than those with TGs (p<0.001). In the dependency subtitle scores, the mean score was 35.83±13.63 for TGs and 48.33±13.49 for FGs. There was a significant difference between the LVA scores. (p=0.012). Table 3 shows the summary of NEI VFQ 25/TR total and subscale scores.

According to the NEI VFQ 39 results, there was no difference between the use of telescopic glass (61.70±5.34) and filtered glass (59.05±4.42) in the general health subheading (p=0.13). However, the mean of the data in the general vision subheading was 31.75±8.75 in the TG group and 41.50±9.21 in the FG group, difference was found significantly (p=0.036).

In the subheadings of near and far vision, the mean scores were 35.34±13.57 and 45.41±9.74 with telescopic glass and 45.41±9.74 and 46.21±10.14 with filtered glass, respectively. The difference between the mean values of near and far vision subheadings was significant (p=0.014 and p<0.001, respectively). There was a significant difference between the mean scores of 33.33±9.62 and 49.16±6.14 for TGs and FGs, respectively under the title of visual-related social interaction (p=0.001). The visual-related mental health subheading scores were 21.60±13.62 and 30.00±14.90 for TGs and FGs, respectively, with significant differences between the two values (p=0.004). The mean scores of the subtitle for vision-related role difficulties for TGs and FGs were 24.52±7.93 and 30.62±8.56, respectively, with no significant difference between the two values (p=0.01).

As a result of the subtitle data of addiction to other people due to vision, the mean scores for TGs and FGs were 36.25±12.77 and 49.10±10.85, respectively, with a significant difference between the two values (p<=0.006).

DISCUSSION

In this study, we compared the effect of TGs and FGs on vision and reading performance with the LVQOL, NEI VFQ-25 and NEI VFQ-39 questionnaires in RP patients. Our major findings were as follows: (1) CDVA with TGs was higher than CDVA with FGs, but the differences were not significant. (2) The CS and the mean number of words read per minute were higher in FGs compared to TGs. (3) According to LVQOL and NEI VFQ25 questionnaire scores, FGs were related to higher quality of life, higher adjustment, more comfort in daily living activities, less ocular pain, higher social functioning, higher mental health and more independence compared to TGs.

Clinicians should evaluate the visual field, CS, color vision, binocularity and stereopsis when applying LVAs to protect patients' independent living. One of the most frequently used LVA devices is TGs, which increase the level of distance vision but also cause narrowing of the visual field, difficulty in daily life and cosmetic problems.[10] Therefore,

Table 3: *Comparison of NEI VFQ 25/TR total and subscale scores between TGs and FGs*

	TGs	FGs	P value
General Health	57.50±12.07	55.00±10.54	0.343
General Vision	26.50±9.44	36.50±17.95	0.17
Ocular Pain	43.05±11.02	58.33±8.83	**0.016**
Near Activities	39.16±17.14	47.00±13.28	**0.022**
Distance Activities Vision	26.66±9.46	4.63±11.13	**0.00**
Social Functioning	38.75±9.22	51.25±9.23	**0.008**
Mental Health	22.05±13.68	31.85±14.91	**0.003**
Role Difficulties	27.75±12.60	31.20±13.47	0.64
Dependency	35.83±13.63	48.33±13.49	**0.012**
Color Vision	52.50±7.90	55.00±10.54	0.343
Peripheral Vision	24.90±11.78	50.00. ± 11.87	**0.00**

Abbreviations: FG: filtered glass; NEI VFQ 25/TR: National Eye Institute Visual Function Questionnaire; TG: telescopic glass.

we investigated the application of FGs, which may be an alternative to TGs for increasing vision functioning and daily activities.

Wavelength filtering glasses have been used in several ocular diseases, such as cataracts, diabetic retinopathy, age-related macular degeneration, choroidoretinal dystrophies and optic disc diseases.[11] Wolffsohn et al. reported that yellow filters lead to an increase in VA in patients with age-related macular degeneration.[12] A recent study has reported that short wavelength light absorbance filters increase visual discrimination capacity in low lighting conditions in patients with RP.[13] Rosenblum et al. evaluated the efficacy of FGs in the low vision patient population and found increased VA with FGs in 11% of the patients and contrast sensitivity in 34%. They also reported that the filters increased the comfort of the patients by reducing photofopia.[14] Virgili et al. indicated that reading function was impaired in relation to contrast sensitivity, VA and visual field in patients with RP. They also believed that high-magnification devices such as LVA may not be suitable due to further narrowing of the visual field.[15] Conversely, Eperjesi et al. found a decline in VA and CS with Corning photochromic filters, including CPF450, CPF511 and CPF527, and the authors attributed this to a reduction in retinal illuminance caused by filters and a gradual decline in visual acuity, contrast sensitivity and reading with increasing CPF absorption. They also evaluated the efficacy of the CPF 550 lens in RP patients by using the NEI VFQ 25 questionnaire and reported that the adaptation time to dark and light was associated with less headache, greater ocular comfort, better visual functionality, detail recognition and contrast discrimination.[16] Our results showed that FGs increased contrast sensitivity and higher reading speed in RP patients compared to TGs. We believe that FGs might be a suitable and mindful option for patients with glare problems and reading difficulty due to RP. Additionally, the use of FGs subjectively reduced the complaints of eye pain and showed a positive effect on the quality of life. In another study, the authors evaluated the visual quality of life by using NEI-VFQ 25 in patients with RP and they revealed that the only modifiable factor affecting the quality of life was that visual quality of life was positively correlated with the degree of central VF and mean total score, general vision, near and far activities, social functioning, mental health and color vision scores, while negativity correlated with role difficulties addiction.[17] As a result of our study on the general healthy subunits, there was no significant difference between TGs and FGs of the generally healthy subunit of NEI VFQ 25 and 39, but there was a significant difference when evaluated with NEI VFQ 39 in general vision subunits. We would like to emphasize that the expanded form of the questionnaire might be more meaningful in evaluating the quality of life in patients with low vision. As a result of a study conducted by İdil et al., the LVQOL, the other questionnaire we applied in our study, showed that the mean LVQOL score in these patients increased by 6.8±15.6 (17%) points with the rehabilitation methods applied in the low vision patient group. They stated

that LVQOL is a consistent, reliable and fast method to measure the vision-specific quality of life of the visually impaired in a clinical setting.[18] As a result of our study**,** the mean LVQOL score in these patients increased from 53.44±11.37 to 65.16±10.46 with the application of FGs, but this difference was not significant. The decrease in the visual field of patients with TGs and the fact that they require very close working distance for daily work may be the reason for having a lower average score than filtered glasses. However, as İdil et al. stated, since the LVQOL questionnaire did not include items related to the daily living activity subunit self-care, it could cause an error in the evaluation of daily living activities.[18] People with RP reported having difficulty undertaking the activities of daily living and independence due to the limitations in their work, so they have psychosocial burdens and high levels of depression.[19] Based on the scores from the daily activities subunit of the LVQOL, the FGs found it easier to perform activities of daily living than the TGs.

Our study had some limitations. First, the study group was relatively small. Second, the patients were evaluated after one month of FG usage; therefore, we did not evaluate the long-term effect of these methods. Because the study did not include the quality of life data of the patients using TGs before using LVA, the effect of TGs on the quality of life could not be reflected objectively. Third, we evaluated visual acuity with the Snellen chart and we converted it to LogMAR. However, our study is one of the rare studies on this subject in the literature, which provides comprehensive data with the comparative results of two different questionnaires, examination findings, as well as the effects of two different LVAs on the functional vision and the quality of life of RP patients who need an LVA device.

In conclusion, TGs have been used for a long time for patients with low vision to maintain their individual life, to increase their distant vision functions and to improve their quality of life. The narrowed visual field and decrease in contrast sensitivity in RP patients led to the application of FGs, another form of LVA, to eliminate these disadvantages of TGs. According to our data obtained objectively and subjectively, FGs have more positive contributions to individual life and the quality of life of RP patients with low vision compared to TGs. It is of crucial importance that more detailed data can be obtained by employing expanded forms of the quality of life scale.

Authorship Contributions Concept: G.D.G., H.S.S.K.; Design: G.D.G., H.S.S.K, M.N.B.; Supervision: A.A., Ş.Ş.; Materials: G.D.G.; Data: G.D.G, H.S.S.K., Analysis: H.S.S.K., Literature search: G.D.G. H.S.S.K; Writing: G.D.G.; Critical revision: M.N.B., Ş.Ş.

Conflict of Interest

None declared.

Acknowledgements

We would like to thank patients who consenting to participate in the study.

REFERENCES

1. Chizzolini M, Galan A, Milan E, et al. Good epidemiologic practice in retinitis pigmentosa: from phenotyping to biobanking. Curr Genomics 2011;12:260-6. https://doi.org/10.2174/138920211795860071
2. Pagon RA. Retinitis pigmentosa. Surv Ophthalmol 1988;33:137-77. https://doi.org/10.1016/0039-6257(88)90085-9
3. Hamel C. Retinitis pigmentosa. Orphanet J Rare Dis 2006;1:40. https://doi.org/10.1186/1750-1172-1-40
4. Nagy D, Schönfisch B, Zrenner E, et al. Long-term follow-up of retinitis pigmentosa patients with multifocal electroretinography. Invest Ophthalmol Vis Sci 2008;49:4664-71. https://doi.org/10.1167/iovs.07-1360
5. Berson EL. Retinitis pigmentosa. The Friedenwald Lecture. Invest Ophthalmol Vis Sci 1993;34:1659-76.
6. Acland GM, Aguirre GD, Ray J, et al. Gene therapy restores vision in a canine model of childhood blindness. Nat Genet 2001;28:92-5. https://doi.org/10.1038/ng0501-92
7. Raasch TW, Leat SJ, Kleinstein RN, et al. Evaluating the value of low-vision services. J Am Optom Assoc 1997;68:287-95.
8. Watson G. Using low vision effectively. Ophthalmology Monographs 1999;12:61-88.
9. Hyvärinen L, Jacob N. What and how does this child see? Assessment of visual functioning for development and learning. Vistest Limited; 2011.
10. Zhang Q. Retinitis Pigmentosa: Progress and Perspective. Asia Pac J Ophthalmol (Phila) 2016;5:265-71. https://doi.org/10.1097/APO.0000000000000227
11. Dickinson C. Low vision: principles and practice. Butterworth-Heinemann Berwick upon Tweed, UK; 1998.
12. Şahlı E, İdil A. A Common Approach to Low Vision: Examination and Rehabilitation of the Patient with Low Vision. Turk J Ophthalmol 2019;49:89-98. https://doi.org/10.4274/tjo.galenos.2018.65928
13. Wolffsohn JS, Dinardo C, Vingrys AJ. Benefit of coloured lenses for age-related macular degeneration. Ophthalmic

Physiol Opt 2002;22:300-11. https://doi.org/10.1046/j.1475-1313.2002.00036.x

14. Cedrún-Sánchez JE, Chamorro E, Bonnin-Arias C, et al. Visual Discrimination Increase by Yellow Filters in Retinitis Pigmentosa. Optom Vis Sci 2016;93:1537-44. https://doi.org/10.1097/OPX.0000000000000924
15. Rosenblum YZ, Zak PP, Ostrovsky MA, et al. Spectral filters in low-vision correction. Ophthalmic Physiol Opt 2000;20:335-41.
16. Virgili G, Pierrottet C, Parmeggiani F, et al. Reading performance in patients with retinitis pigmentosa: a study using the MNREAD charts. Invest Ophthalmol Vis Sci 2004;45:3418-24. https://doi.org/10.1167/iovs.04-0390
17. Eperjesi F, Fowler CW, Evans BJ. Do tinted lenses or filters improve visual performance in low vision? A review of the literature. Ophthalmic Physiol Opt 2002;22:68-77. https://doi.org/10.1046/j.1475-1313.2002.00004.x
18. Altinbay D, Taskin I. Evaluation of vision-related quality of life in retinitis pigmentosa patients with low vision. Jpn J Ophthalmol 2021;65:777-85. https://doi.org/10.1007/s10384-021-00875-z
19. İdil A, Ozen M, Atak N, et al. Az Görme Yaşam Kalitesi Ölçeğinin (LVQOL) Türkçe Geçerlilik Çalışması. MN Oftalmoloji 2011;18:246-53.
20. Chivers M, Li N, Pan F, et al. The Burden of X-Linked Retinitis Pigmentosa on Patients and Society: A Narrative Literature Review. Clinicoecon Outcomes Res 2021;13:565-72. https://doi.org/10.2147/CEOR.S297287