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## A Study on the Quality of Life and Psychological Stress of Glaucoma Patients

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Received: 22- June -2023

Revised: 01- July -2023

Accepted: 05- August -2023

### ABSTRACT:

This study was conducted to evaluate the quality of life (QOL) of patients with monocular and binocular glaucoma. The study included 30 normal tension glaucoma (NTG) patients. The patient's QOL was evaluated using the Glaucoma QOL-15 questionnaire. The total score of the QOL showed  $20.8 \pm 7.01$  in monocular glaucoma and  $2.71 \pm 0.91$  in binocular glaucoma. Peripheral vision, glare, and dark adaptation scores did not show significant effects on monocular glaucoma and binocular glaucoma. QOL-15 showed that peripheral vision scored higher with binocular glaucoma than monocular glaucoma. But there is no significant difference in other questions other question for the quality of life including peripheral vision. However, monocular, and binocular glaucoma patients feel certain levels of difficult due to their quality of life. Therefore, it is believed that it can be used as basic data for glaucoma patients.

**Keywords:** Quality of Life-15 Questionnaire (GQL-15), Glaucoma, monocular, binocular

### 1. INTRODUCTION

Glaucoma is a disease in which the optic nerve is gradually impaired and vision is prejudiced. [1] It is a chronic disease that requires ongoing management and treatment due to the nature of the disease that continues to develop. In recent years, glaucoma has been recognized as a leading cause of blindness worldwide, and its prevalence is increasing. Visual impairments accompanying glaucoma, directly and indirectly affect the quality of a patient's life. [2,3] It appears and is known to have no basic difference from primary open angle glaucoma. The glaucoma is a case where there is no glaucoma damage and the intraocular pressure exceeds 21 mmHg, and there is no glaucoma optic nerve dimpair and visual field defect.[4]

Also known as low- or normal-tension glaucoma, the optic nerve degenerates even though the intraocular pressure is in the normal range (less than 22 mm Hg).[5] On anterior segment examination, intraocular pressure is measured to be high even though there is nothing to stop the aqueous leakage, and can be as high as 30 to 40 mm Hg. There is a gradual loss of ganglion cells in the retina, accompanied by optic disc depression and visual field defects. Normal-tension glaucoma appears normal on an intraocular pressure test, but glaucomatous damage such as optic nerve papillary depression and visual field defects are observed. With no way to improve visual acuity and residual vision in patients with normal-tension glaucoma, the emphasis is on slowing progression to potentially blinding conditions or controlling risk factors. For this reason, many pathophysiological studies are being conducted on normal intraocular pressure glaucoma, in addition to intraocular pressure, various risk factors such as blood flow disorders and inflammation of the optic papilla are known to be involved in the occurrence of normal intraocular pressure glaucoma.[6] With no way to improve visual acuity and residual vision in patients with normal-tension glaucoma, the emphasis is on slowing progression to potential blindness or controlling risk factors. For this reason, many pathophysiological studies on normal intraocular pressure glaucoma are being conducted. In addition to intraocular pressure, various risk factors such as blood flow disorders and inflammation of the optic papilla are known to be related in the occurrence of normal intraocular pressure glaucoma. Vascular connections, microvascular diseases, and abnormal autonomic nerve function can cause perfusion disorders in the optic papilla, retina, and choroid, and it is assumed that it will affect the progression to glaucoma neuropathy.[5]

Furthermore, glaucoma damage is the death of nerve cells and optic nerve fibers in the retina, where the optic nerve connecting the eye to the brain is damaged, making it impossible to transmit information from the eye to the brain. The optic nerve transmits visual information to the brain by collecting nerve fibers spread in the innermost layer of the retina into the optic papilla and forming bundles in the posterior part. Glaucoma, caused by increased intraocular

pressure and impaired blood supply, causes abnormalities in optic nerve function and visual field defects. Glaucoma visual field defects take a characteristic shape because the optic nerve fiber runs constantly. The first area to be damaged in the optic nerve papilla is the top and bottom, and visual field defects around the gaze point, which corresponds to the optic nerve fiber entering here in the early stages of glaucoma, appear.[7] Also, severe visual field defects can lead directly to blindness, but if there is a slight visual field deficit, even if the visual acuity is normal, it may have an indirect effect on qualitative visual functions such as stereoscopic or contrast sensitivity. Stereoscopic vision is the ability to feel the depth of things and to think in three dimensions by fusing the microscopic differences of the two images entered through each eye in the temporal cortex of the occiput. This decrease in stereopsis can deteriorate the patient's ability to judge the surrounding environment due to the decrease in peripheral vision. [8]

Contrast sensitivity is mainly the ability of rod cells of the retina to distinguish light of different intensities. This lowering of contrast sensitivity is likely to result in the limitation of activity in dark places due to the ability to distinguish objects according to brightness. [9]

More over, this glaucoma vision defect is also known to affect the binocular vision function that integrates information on both eyes into one. In order for the images of both eyes to fuse into one, each visual information transmitted from the retina must be similar and optically good. In addition, fine motor coordination of both eyes, simultaneous perception of the retina, and sensory fusion functions should all be possible, but in the case of glaucoma patients, nerve tissue deficiency slowly progresses in both eyes. Due to the damage in retina nerve cells, diffuse defects and scotoma of the visual field occur asymmetrically in the monocular or both eyes, which is a major factor in binocular vision function, which is responsible for the ability to fuse the both damage to the optic nerve transmitted to the frontal lobe can further degrade binocular vision function. [10-12]

Vision is an important sense that not only provides information on surrounding situations, but also affects daily physical and social activities and emotions, and it is said that the decrease in vision affects not only the individual's functional state but also the quality of life. In addition, the QOL involved to visual impairment is lower in binocular glaucoma patients than monocular glaucoma patients. [13] In a study related to the binocular vision function of glaucoma patients, a survey was conducted on the quality of life of glaucoma patients, outdoor activities, difficulties in supermarkets, and three-dimensional effects.

However, most of the preceding studies have been conducted on elderly patients and have not been conducted on relatively young patients in their 20s and 50s. Although previous studies have evaluated of rates visual field between binocular and monocular in glaucoma patients. Therefore, in this study, we evaluated the effect of glaucoma on the quality of life of patients with monocular glaucoma and binocular glaucoma.

## **2. METHOD**

### **2.1 Study Subjects**

This study was conducted on all subjects who wanted to participate in this study. All the study patients were raised at the eye hospital in the of Korea. The subjects were 30 participants with a diagnosis of normal tension glaucoma (NGT). Those who have signs and symptoms in one eye were classified as the monocular group, while those who had symptoms in both eyes were classified as binocular group, all patients were advised in writing of the purpose of the study, and only those who gave written informed consent were register in the study. Subjects with cataract and macular degeneration, myopia greater than 6.00D, history of amblyopia, induced ocular diseases and systemic disease affect visual field were excluded.

### **2.2 Eye Examination**

#### **The examination included the following tests**

- 1) Visual acuity and refractive error assessments were performed on all subjects. Visual acuity was examined by at a 3-meter distance marker (ACP-8 Topcon, Japan), followed by refraction. Refraction was measured three times consecutively for each eye using an autorefractor (HRD-8100 Huvitz, Korea).
- 2) Intraocular pressure was measured as the average of 3 measurements using a tonometer (NCT, CT-80, Topcon, Japan). Also, Visual field examination was measured using the SITA Fast 24-2 standard strategy using a Humphrey auto-optometer (AII-750I, Carl Zeiss, Germany). Thickness measurements were made using optical coherence tomography (OCY, 4000, Carl Zeiss, Germany).

### 2.3 A Research Survey

The GQL-15 survey consists in 15 questions. The questions work response for each factor is on a 5-point Likert grade (a difficulty-free average of 1 and a difficulty average of 5). The total grade is figures as the total grade of all item-level response mark. It is judged that the higher the grade, the lower the quality-of-life Likert scale. In addition, the sub score is the average of the total score of the item-level sub-sell response. [14]

### 2.3 Data Analysis

Completed examination data were collected and analyzed. The standard deviation and average of each item were derived using SPSS (version 21.0 for Windows, SPSS Inc., Chicago, IL, USA).

## 3. RESULTS

### 3.1. Common Characteristics of Research Participants

The results showed that out of 30 participants, 16 participants were diagnosed with monocular glaucoma, and 14 participants have binocular glaucoma. The mean values of VA for monocular glaucoma were  $0.002 \pm 0.10$ , and  $0.006 \pm 0.24$  for binocular glaucoma. SE was  $-2.23 \pm 1.99$  in the monocular glaucoma and  $-1.83 \pm 2.73$  for binocular glaucoma. Table 1 shows the general distribution of parameters in mean and standard deviation for each group.

**Table 1.** The typical distribution of the mean and standard deviation of the parameters.

	<b>Monocular</b>	<b>Binocular</b>	<b><i>p</i></b>
<i>N</i>	16	14	-
Age	$43.1 \pm 10.9$	$47.1 \pm 10.8$	0.322
SE(D)	$-2.23 \pm 1.99$	$-1.83 \pm 2.73$	0.652
VA(log MAR)	$0.002 \pm 0.10$	$0.006 \pm 0.24$	0.555
SE: Spherical Equivalent, VA: Visual Acuity			

### 3.2. Intraocular pressure, visual field and RNFL thickness of monocular and binocular glaucoma

IOP is  $16.8 \pm 4.21$  mmHg in the monocular and  $14.6 \pm 2.30$  mmHg in the binocular glaucoma. There was no significant difference between the relevant. Visual field tests revealed that the MD was significantly lower in the with monocular glaucoma relevant ( $5.13 \pm 2.62$  dB) than in the binocular ( $5.66 \pm 2.82$ ). Thus, with monocular glaucoma ( $2.90 \pm 4.45$ ) shown the visual field index (VFI) were lower than binocular ( $3.11 \pm 4.87$ ) and also, RNFL thickness is  $14.8 \pm 14.9 \mu\text{m}$  in the monocular glaucoma and  $24.7 \pm 24.1 \mu\text{m}$  in the binocular. (Table 2)

**Table 2.** Eye examination results of participants

	<b>Monocular</b>	<b>Binocular</b>	<b><i>p</i></b>
IOP (mmHg)	$16.8 \pm 4.21$	$14.6 \pm 2.30$	0.145
MD (dB)	$5.13 \pm 2.62$	$5.66 \pm 2.82$	0.652
VFI (%)	$2.90 \pm 4.45$	$3.11 \pm 4.87$	0.901
RNFL ( $\mu\text{m}$ )	$14.8 \pm 14.9$	$24.7 \pm 24.1$	0.185
IOP: Intraocular Pressure, MD: Mean Deviaion, VFI: Visual Field Index, RNFL: Retinal Nerve Fiber Layer			

### 3.3 Distribution QOL-15

Table 3 shows the QOL-15 scores in the monocular and binocular glaucoma patients. Based on the results, binocular glaucoma patients have difficulty walking after dark, adjusting to bright lights, crossing the road, and finding dropped objects. For monocular glaucoma patients, they have difficulty with reading newspapers, dark lighting adjustment, falling over objects, stair/step walk, and determining foot-to-curve distance.

**Table 3.** Distribution QOL-15 scores.

Does your vision give you any difficulty, even with glasses, with the following activities?	Monocular	Binocular	<i>p</i>
Reading newspapers	1.67±0.778	1.27±0.458	0.055
Walking after dark	1.58±0.793	1.63±0.806	0.089
Seeing at night	1.75±1.055	1.75±0.931	0.899
Walking on uneven ground	1.25±0.622	1.25±0.577	0.899
Adjusting to bright lights	1.83±1.030	1.94±1.063	0.770
Adjusting to dim lights	1.92±1.084	1.38±0.619	0.772
Going from light to dark room or vice versa	1.83±0.937	1.75±0.577	0.924
Tripping over object	1.42±0.793	1.13±0.342	0.926
Seeing objects coming from the side	1.25±0.622	1.25±0.577	0.229
Crossing the road	1.00±0.000	1.31±0.602	0.173
Walking on step/stairs	1.50±0.798	1.31±0.704	0.792
Bumping into objects	1.17±0.577	1.25±0.577	0.797
Judging distance of foot to step/curb	1.58±0.996	1.25±0.577	0.585
Finding dropped objects	1.08±0.289	1.25±0.577	0.466
Recognizing faces	1.25±0.866	1.38±0.719	0.512

### 3.4 Subscale scores of Monocular and Binocular Glaucoma

Table 4 shows the subscale scores of monocular and binocular glaucoma. The total score of monocular glaucoma is 20.8±7.01 and binocular glaucoma is 21.7±2.75. The total score is higher for binocular glaucoma. The peripheral vision scores were higher with binocular glaucoma than with monocular glaucoma. Central and near vision was 2.68±1.35 for monocular glaucoma and 2.71±0.91 for binocular glaucoma. The score of the glare and dark adaptations for monocular glaucoma is 9.37±3.53, and 9.85±1.95 for binocular glaucoma. Outdoor mobility score was 1.12±0.50 for monocular glaucoma and 1.21±0.42 for binocular glaucoma.

**Table 4.** QOL-15 summary and subscale scores of monocular and binocular glaucoma

	Monocular	Binocular	<i>p</i>
QOL-15 summary	20.8±7.01	21.7±2.75	0.652
Central and near vision	2.68±1.35	2.71±0.91	0.951
Peripheral vision	7.68±2.86	8.00±2.54	0.756
Glare and Dark adaptation	9.37±3.53	9.85±1.95	0.654
Outdoor mobility	1.12±0.50	1.21±0.42	0.165

## 4. DISCUSSION

Glaucoma is one of the leading causes of blindness worldwide, and is defined as optic neuropathy, which irreversibly causes loss of visual function due to the influence of intraocular pressure and various other factors, narrowing the field of vision. The transmission of visual stimulation through the optic nerve is achieved by constantly moving numerous molecules through the axon of the nerve fiber in the optic nerve (axoplasmic flow), and some of them transmit information by nerve cells. In the case of glaucoma patients, axonal flow can be disrupted by high intraocular pressure, and as a result, information from photoreceptors is not transmitted to ganglion cells in the retina, and neurotransmitters such as glutamate, which act as messengers, pass through the retina. [3-5] Excessive accumulation in cells can lead to ganglion cell death. The disappearance of these ganglion cells reduces visual information from the optic nerve to the brain, causes confusion in fusing the images of both eyes and affects the

formation of stereoscopic vision, affecting daily life such as driving and distance. This decrease in stereoscopic vision is likely to have a significant impact on the patient's motor ability, agility, and difficulty in driving, along with a decrease in the peripheral vision of glaucoma patients.[9] Contrast sensitivity is the ability to distinguish light of different intensities mainly by the function of rod cells in the retina. This decrease in contrast sensitivity is likely to cause restrictions on activity in the dark due to a decrease in the ability to distinguish objects according to brightness.[2]

Increased intraocular pressure is important in glaucoma damage, but most of the glaucoma patients had no difference in intraocular pressure between normal eyes, and some high-pressure glaucoma patients had low intraocular pressure for treatment purposes. Damage to ganglion cells and visual field defects caused by glaucoma are known to reduce binocular vision function, and it has been reported that the deflection angle of glaucoma patients can cause changes due to characteristic visual field defects such as cancer points, nose cancer points, and bow cancer points around the gaze point.[12] In general, a person integrates the visual stimuli given to the two eyes. Since the two eyes are judged and have complementary functions, they should be evaluated based on integrated two-eye vision and visual function when evaluating the effect of patients' visual functional abnormalities on the QOL.[13]

Normal intraocular pressure glaucoma has few symptoms of self-awareness and is often found after the disease progresses considerably because it is not accompanied by an increase in intraocular pressure. Normal tension glaucoma occurs frequently in Koreans. As a common form, it accounts for more than 75% of open-angle glaucoma and causes an upper visual field defect before primary open-angle glaucoma, which can be different from the previously known decline in QOL open-angle glaucoma.[15] In previous studies, it was reported that the prevalence of open-angle glaucoma, including normal intraocular glaucoma, was 3.5% among those aged 40 or older, of which normal intraocular glaucoma accounted for about 77%. Since Korea has a higher prevalence of normal intraocular glaucoma than Western studies, attention is focused on research on normal intraocular glaucoma. [16]

When glaucoma vision loss progresses, it is known to significantly reduce the quality of life of patients. In addition to the degree of visual field defect, the location of visual field defect is also known to have a different effect on the quality of life related to the vision of glaucoma patients. Normal tension glaucoma is a disease that can slow screening and is very difficult to diagnose because the intraocular pressure is in the normal range, so the importance of early diagnosis has been emphasized. [17] Vision not only provides information on surrounding situations, but also affects daily physical and social activities, and it is known that a decrease in vision affects an individual's functional state or quality of life. Among the diseases that can affect vision, glaucoma is known to cause lesions in the optic nerve due to various factors as well as increased intraocular pressure, resulting in changes in vision and, in severe cases, blindness.

Glaucoma is a disease that causes optic nerve damage and characteristic visual impairment due to mechanical factors such as intraocular pressure and hemodynamic factors, and early diagnosis and prevention are important. The diagnosis of glaucoma damage is conducted through intraocular pressure measurement, visual examination, and visual nerve papillary examination, but the test is subjective, so there may be differences in results depending on the examiner, and it is difficult to recognize early changes. In the case of normal-tension glaucoma, the probability of missing early diagnosis unlike glaucoma with high intraocular pressure or other ophthalmic diseases because the intraocular pressure is within the normal range be high in. [18] Therefore, this study attempted to conduct how these glaucoma diseases affect an individual's quality of life. Glaucomatous vision loss is known to have a significant influence on daily activities such as reading and driving, and previous studies have reported that binocular glaucoma is associated with lower overall visual function satisfaction, central vision, pre- and postoperative vision, light and dark adaptation, and outdoor activities than monocular glaucoma.[10] In this study, similar results were found in binocular glaucoma patients because follow-up questions were difficult or difficult, such as walking after dark, adapting to bright light, crossing the street, and finding fallen objects. As a result, binocular glaucoma is believed to lower the satisfaction of subjects' quality of life than monocular glaucoma. In addition, QOL-15 showed that peripheral vision scored higher in binocular glaucoma than monocular glaucoma. In this study, it was found that the life satisfaction of binocular glaucoma subjects was lower than that of monocular glaucoma in Central and near vision, Peripheral vision, Glare and Dark adaptation, and Outdoor mobility. In previous studies, it was reported that binocular glaucoma has lower overall visual function satisfaction, central vision, peristalsis, peripheral vision, light compliance, cancer compliance, and outdoor activities than monocular glaucoma. In addition, glaucoma vision loss is reported to have a serious impact on daily life such as reading and driving. [20,21]

Normal intraocular pressure glaucoma is a disease that can slow screening and is very difficult to diagnose because the intraocular pressure is in the normal range, so the importance of early diagnosis has been emphasized. In the case of normal tension glaucoma, because the intraocular pressure is within the normal range, there is a high possibility that early diagnosis will be missed, unlike glaucoma with high intraocular pressure or other ophthalmic diseases.[20]

In this study, we wanted to find out the quality of life of normal intraocular pressure glaucoma subjects, and it was found that subjects with normal intraocular pressure glaucoma had lower quality of life than monocular normal pressure glaucoma subjects. So, in glaucoma patients, the quality-of-life test is used to determine the overall number of subjects.

## 5. CONCLUSION

This study investigated the effect of glaucoma on the quality of life in young adults who were diagnosed with normal tension glaucoma. The quality-of-life score was higher in cases with binocular normal tension glaucoma than in cases monocular normal tension glaucoma, and binocular normal tension was found that it was difficult for both normal intraocular glaucoma and peripheral vision. In addition, in outdoor activities, it was found that binocular normal tension glaucoma scored higher than the monocular normal tension glaucoma, making it difficult to perform. In addition to the binocular vision function test values for glaucoma screening tests, it is believed that overall visual function satisfaction, light compliance, and cancer compliance can be useful through the GQL-15 survey test.

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