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QLAUKOMA VƏ MİOPİYA OLAN PASİYENTLƏRDƏ TOR QİŞANIN QANQLİOZ HÜCEYRƏ KOMPLEKSİNİN QİYMƏTLƏNDİRİLMƏSİNDƏ OPTİK KOHERENT TOMOQRAFİYANIN DİAQNOSTİK DƏYƏRİ

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XÜLASƏ

Məqsəd – qlaukoma və aksial miopiyanın birgə rast gəlindiyi hallarda qanqlioz hüceyrə kompleksində (QHK) dəyişikliklərin xarakterini müəyyən etmək.

Material və metodlar
Optik koherent tomoqrafiya (OKT) vasitəsilə dörd qrupa bölünmüş (qlaukoma+miopiya, qlaukoma, miopiya, emmetropiya) 55 xəstə müayinə edilmişdir.
Bütün xəstələr vizometriya, biomikroskopiya, qonioskopiya, tonometriya, refraktometriya, paximetriya, oftalmoskopiya və gözün ön-arxa oxunun ölçüsünün (ÖAO) təyini daxil olmaqla standart oftalmoloji müayinələrdən keçmişdilər. Tor qişada və görmə sinirində morfoloji dəyişikliklər oftalmoskopiya və OKT (DRI OCT Triton) vasitəsilə qiymətləndirilmişdir. Bu zaman, OKT məlumatlarına görə, görmə siniri diskinin patoloji dəyişikliklərini xarakterizə edən əsas meyarlar – ekskavasiyanın ölçüsü və sinir lifləri təbəqəsinin qalınlığı olmuşdur.

Nəticələr
Miopiyası olan pasiyentlər qrupunda OKT məlumatlarına əsasən neyroretinal kompleksin vəziyyətinin təhlili sinir lifləri qalınlığının orta hesabla 7% azaldığını göstərmişdir. Pasiyentlərin göz almasının uzunluğuna əsasən qruplaşdırılması nəticəsində, tor qişada QHK qalınlığını xarakterizə edən göstəricilər fizioloji norma daxilində olmuşdur.
Miopiya fonunda qlaukoma və yalnız qlaukoması olan pasiyentlərdə OKT məlumatlarına görə neyroretinal kompleksin vəziyyətinin müqayisəli təhlili aparılmışdır. Qlaukoma və miopiya olan pasiyentlərdə buynuz qişanın qalınlığı orta hesabla 531,2±28,84 mkm, gözdaxili təzyiq (GDT) isə orta hesabla 12,8±3,5 mm c.süt. təşkil etmişdir. Qlaukoma qrupunda GDT orta hesabla 17,3±4,09 mm c.süt. olmuşdur.

Yekun
Miopiyası olan pasiyentlərdə gözün ÖAO uzandıqca tor qişanın QHK qalınlığında ardıcıl azalma müşahidə olunur, lakin bu dəyişikliklər fizioloji norma daxilində qalmışdır. ÖAO 25-26 mm-dən çox olduğu hallarda nəzərə almaq lazımdır ki, QHK qalınlığının ilkin azalması təkcə qlaukomatoz proseslə deyil, həm də aksial miopiyaya xas olan tor qişanın dəyişiklikləri ilə əlaqədar ola bilər.

Açar sözlər: *miopiya, qlaukoma, optik koherent tomoqrafiya*

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DIAGNOSTIC VALUE OF OPTICAL COHERENCE TOMOGRAPHY IN THE ASSESSMENT OF RETINAL GANGLION CELL COMPLEX IN PATIENTS WITH GLAUCOMA AND MYOPIA

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SUMMARY

Purpose – to determine the nature of changes in the ganglion cell complex (GCC) in combination with glaucoma and high myopia.

Material and methods
Using optical coherence tomography (OCT), 55 patients were examined, divided into four groups: glaucoma + myopia, glaucoma, myopia, emmetropia.
All patients underwent a standard ophthalmological examination, including visometry, biomicroscopy, gonioscopy, tonometry, refractometry, paximetry, ophthalmoscopy, and determination of the anterior-posterior (AP) axis of the eye. Morphological changes in the retina and optic nerve were assessed using ophthalmoscopy and OCT (DRI OCT Triton). In this case, the main criteria characterizing pathological changes in the optic disc, according to OCT data, were the size of the excavation and the thickness of the nerve fiber layer.

Results
Analysis of the neuroretinal complex state according to OCT data in a group of patients with myopia showed a decrease in the thickness of nerve fibers by an average of 7%. When distributing patients depending on the length of the eyeball, it was revealed that the indicators characterizing the thickness of the retinal GCC were within the physiological norm.
A comparative analysis of the neuroretinal complex state according to OCT data was performed in patients with glaucoma against the background of myopia and patients with glaucoma. The corneal thickness in the glaucoma + myopia group of patients averaged 531.2 ± 28.84 μm. Intraocular pressure (IOP) in this group of patients averaged 12.8±3.5 mm Hg. In patients with glaucoma the average IOP was 17.3 ± 4.09 mm Hg.

Conclusion
In patients with myopia, a consistent decrease in the thickness of the retinal GCC is observed as the axial length of the eye lengthens, but within the physiological norm. In cases where the AP axis exceeds 25-26 mm, it is important to consider that the initial decrease in the thickness of the iris can be caused not only by the glaucomatous process, but also by changes in the retina characteristic of myopia.

Key words: *myopia, glaucoma, optical coherence tomography*

Myopia and primary open-angle glaucoma (POAG) are multifactorial ocular conditions influenced by both genetic predisposition and environmental factors [1].

Myopia is the most prevalent form of refractive error, affecting approximately 1.4 billion individuals globally – equivalent to around one-quarter of the world's population. By 2050, the global number of individuals with myopia is expected to reach 5 billion [2]. For comparison, in 2000, 22.9% of the global population was affected by myopia; by 2050, this figure is forecast to rise to 49.8%. Moreover, by 2050, nearly 1 billion people are expected to be affected by high myopia – a severe form of the condition typically defined by a refractive error greater than (−)6.00 diopters or an axial length exceeding 26.5 mm [3].

In Azerbaijan, 18.6% of the population is affected by myopia. Over the past decade, the prevalence of the condition has increased sharply by 13%.

According to statistics, young people of working age constitute the majority of myopia cases, accounting for 43.26% [4 – 7].

POAG, in turn, is characterized by progressive degeneration of the optic nerve, ultimately leading to irreversible blindness. POAG is frequently associated with elevated intraocular pressure (IOP), which is the primary modifiable risk factor for its development and progression [8].

The global prevalence of glaucoma among individuals aged 40 to 80 is estimated at 3.5%. In 2020, approximately 76 million people worldwide were affected by glaucoma [9]. Given the growing number of elderly individuals in the global population, it is estimated that 111.8 million people will be affected by glaucoma by 2040 [10 – 12].

It is widely accepted that the risk of developing glaucoma increases with the severity of myopia [13]. Patients with axial myopia have a sixfold greater risk of sustaining glaucomatous optic nerve damage [14].

According to numerous studies, the risk of developing glaucoma increases by 2.5 times with mild myopia, 3 to 5.5 times with moderate myopia, and 6.5 to 14.5 times with high myopia, compared to individuals with emmetropia or hyperopia [14]. However, diagnosing glaucoma in patients with myopia is particularly challenging due to the anatomical characteristics of the optic disc, which is typically large, obliquely inserted, physiologically enlarged, and often accompanied by peripapillary choroidal atrophy.

Purpose – to determine the characteristics of GCC changes in patients presenting with both glaucoma and axial myopia.

Material and methods

Fifty-five patients were observed and divided into four groups. The first group comprised 12 patients diagnosed with POAG in combination with high myopia. The mean age of patients in the first group was 49.4 ± 5.21 years. The average axial length of the eye was 24.2 ± 1.04 mm, and IOP exceeded 21 mmHg.

The second group comprised 20 patients diagnosed with POAG with elevated intraocular pressure. The mean age was 52.2 ± 5.23 years, the mean axial length of the eye was 21.9 ± 0.9 mm, and IOP exceeded 26 mmHg. The indicators for the study groups were as follows: visual acuity of at least 0.5; optic nerve excavation of up to 0.7 - 0.8 D; optic disc area according to OCT data of 2.1 ± 0.4 mm². The third group included 13 patients diagnosed with high myopia, whose average age was 45.8 ± 5.2 years, with an average axial length of 25.8 ± 1.01 mm, IOP less than 21 mmHg, optic nerve excavation up to 0.6 - 0.7 D, symmetrical in both eyes.

The fourth group included patients with emmetropia, with an average age of 42.6 ± 4.71 years, an axial length of 23.6 ± 0.7 mm, IOP less than 21 mm Hg, and optic disc excavation of up to 0.4 - 0.5 DD, symmetrical in both eyes.

All patients underwent a standard ophthalmological examination, which included visometry, biomicroscopy, gonioscopy, Goldmann applanation tonometry, refractometry, pachymetry, fundus ophthalmoscopy, and measurement of the optic disc size.

Morphological changes in the retina and optic nerve were assessed using ophthalmoscopy and OCT (DRI OCT Triton).

At the same time, according to OCT data, the main criteria characterizing pathological changes in the optic disc were the size of the

excavation and the thickness of the nerve fiber layer (NFL). Visualization and assessment of the condition of the retinal GCC was performed at 15° from the fixation point. The following indicators were taken into account: average thickness, superior thickness, and inferior thickness.

The Mann-Whitney U test was used to assess differences between two independent groups. Due to the limited sample size, the distribution of variables was non-normal. Statistical significance was defined at a threshold of $p< 0.05$. All data are presented as mean ± standard deviation (mean ± SD).

Results

In the first stage, the condition of the neuro-retinal complex was analyzed using OCT data in groups of patients with myopia and emmetropia. This enabled assessment of the potential influence of axial eye length on changes in GCC in myopia. Analysis of the neuro-retinal complex using OCT data in patients from this group revealed an average reduction in nerve fiber thickness of 7%. When patients were classified according to axial length, the parameters characterizing the thickness of the retinal GCC were found to be within physiological norms.

In the second stage, a comparative analysis of the neuroretinal complex using OCT data was conducted in patients from the first and second groups.

The mean corneal thickness in patients from the first group was 531.14 ± 28.84 µm. In patients from the second group, the mean corneal thickness was 553.85 ± 43.11 µm.

The results indicate that, in patients with glaucoma, the corneal thickness was 22.65 µm greater than in the first group ($p = 0.12$) (the difference between the groups is not statistically significant).

The mean IOP was 12.8 ± 3.5 mmHg in patients with both glaucoma and myopia, compared to 17.3 ± 4.09 mmHg in patients with glaucoma alone. According to Goldman applanation tonometry, IOP was 5 units lower ($p=0.01$) in patients with glaucoma against a background of myopia compared to glaucoma without myopic refraction.

Comparative analysis of OCT data assessing the condition of the optic disc and GCC revealed no significant differences between the groups on average (**Figure 1, Figure 2**).

Discussion

The relationship between refractive errors and glaucoma has long been a subject of debate and controversy. The data from clinical studies on the relationship between myopia and glaucoma that exist in the world literature are contradictory. On the one hand, some studies have found no significant association between myopia and POAG [15]. On the other hand, the majority of studies have reported that patients with myopia are at an increased risk of developing POAG [16]. Extensive epidemiological data have been published confirming the comorbidity between myopia and POAG. In addition, it is known that between 6% and 29% of patients with POAG have myopia.

Our findings are consistent with the

Table 1. *Comparative analysis of biometric characteristics of the eyeball, morphometric features of the optic nerve, and GCC thickness in patients with emmetropic and myopic refractions, M+/-s*

Parameter (unit of measurement)	*Group III (n=13)*	*Group IV (n=10)*	*P, Mann - Whitney*
Eye length (mm)	25.8±1.01	23.6±0.7	0.0001
Disk area (mm²)	1.8±0.2	1.96±0.1	0.51
Excavation/Disc E/D	0.6±0.15	0.5±0.012	0.5
Average thickness of GCC, (µm)	95.84±8.2	104.1±5.2	0.02
Thickness of the upper segment of GCC (µm)	96.02±5.61	94.8±2.13	0.81
Thickness of the lower segment of GCC, (µm)	96.1±5.56	98.32±2.38	0.2

literature, which indicates that the risk of developing glaucoma increases with the degree of myopia [14, 15, 17, 18]. Furthermore, patients with axial myopia have a sixfold increased risk of developing glaucomatous optic nerve damage.

A meta-analysis conducted by a group of researchers led by Marcus M.W. et al. in 2011 showed that the chance of developing glaucoma in patients with mild myopia is 1.65, while in patients with moderate and severe myopia it is 2.46 [17].

Table 2. *Comparative assessment of eyeball parameters, IOP, and optic disk and GCC measurements in patients with glaucoma alone and glaucoma with coexisting myopia*

Parameter (unit of measurement)	*Group I (n=12)*	*Group II (n=20)*	*P, Mann - Whitney*
Eye length (mm)	24.2±1.04	21.9±0.9	0.34
IOP, mmHg	12.8 ±3.5	17.3± 4.09	0.02
disk area (мм²)	2.05 ±0.42	2.03± 0.38	0.7
Excavation/Disc E/D	0.6 ±0.18	0.6±0.15	0.8
Average thickness of GCC, (µm)	86.1±13.1	86.5±11.2	0.8
Thickness of the upper segment of the GCC, (µm)	87.3±11.28	89.1±4.62	0.58
Thickness of the lower segment of the GCC, (µm)	89.3±8.85	88.1±11.3	0.7
Corneal thickness (µm)	531.2±28.84	553.85±43.2	0.06

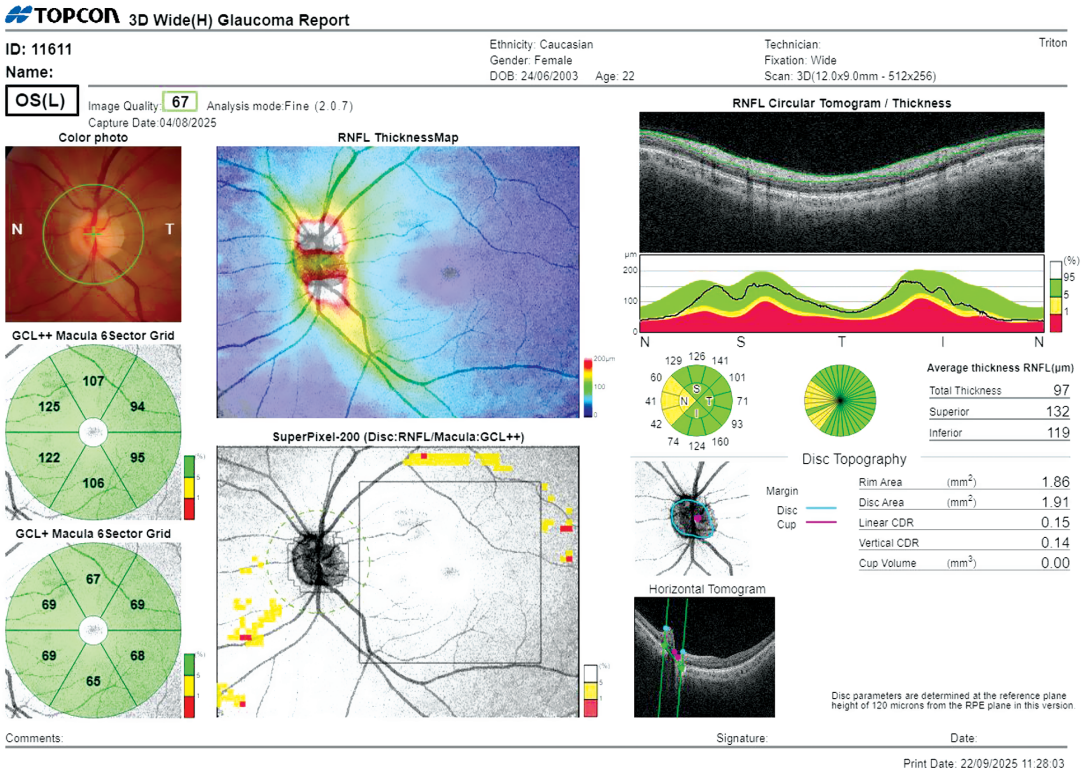

Figure 1. *Patient S. (Group I): Fundus photography shows a myopic disc configuration with peripapillary atrophy. The RNFL thickness map demonstrates thinning predominantly in the inferior quadrant, with corresponding deviation below normative values. Ganglion cell layer (GCL+) analysis indicates moderate thinning in the inferior temporal macular sectors, while other areas remain relatively preserved. Disc topography reveals an enlarged disc (3.01mm2) with marked excavation (vertical cup-to-disc ratio (0.70), indicating a high risk of glaucomatous damage. Interpretation: OCT findings suggest early glaucomatous changes in patient with myopia, characterized by inferior RNFL thinning and focal macular ganglion cell loss.*

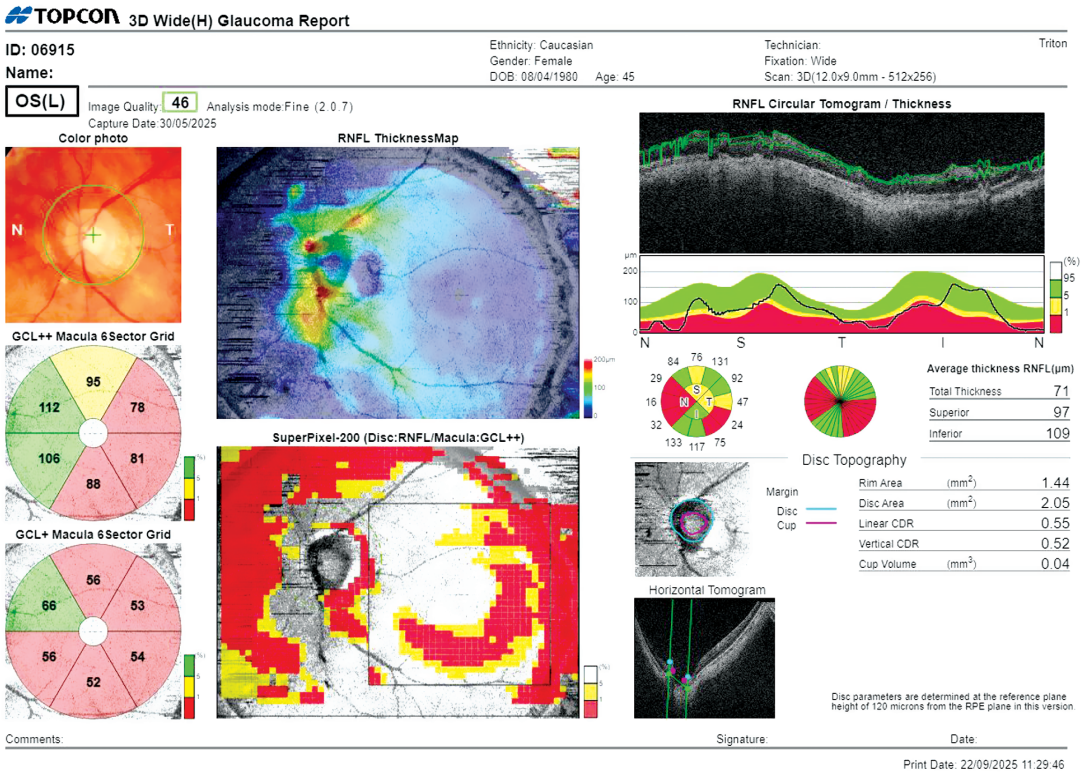

Figure 2. *Patient M. (Group III): color fundus photography demonstrates a myopic optic disc with marked excavation. The RNFL thickness map reveals diffuse thinning, more pronounced in the superior and inferior quadrants, with the RNFL profile largely below the normative range. (GCL+) analysis shows significant reduction in macular thickness, especially in the superior and inferior temporal sectors. Disc topography indicates an enlarged disc area (3.45 mm2) and pronounced cupping, with a cup-to-disc ratio approaching the upper limit of normal. Interpretation: The OCT findings are consistent with glaucomatous optic neuropathy in a patient with high myopia, showing advanced RNFL and (GCL+) thinning across multiple sectors.*

Unfortunately, there is currently insufficient research on the prevalence of myopia and POAG in the eye, which is undoubtedly due to diagnostic difficulties. Published findings from population-based and epidemiological studies across different national and ethnic groups show considerable variability. In a large-scale 2021 study conducted in Northeast Asia on the prevalence of POAG among patients with myopic refraction – including 7,723 individuals with myopia and 1,112 with glaucoma – the prevalence of POAG was reported to be 4.1% [18].

In our study, patients with myopia show a consistent decrease in retinal GCL thickness as the AP axis of the eye lengthens. When axial length is within the range of 24 – 25 mm, these changes may still fall within physiological norms and could serve as a reference point for the early diagnosis of glaucoma. However, when axial length exceeds 25 – 26 mm, it is important to consider that the initial reduction in retinal GCL thickness may result not only from glaucomatous changes, but also from the structural characteristics of myopia.

Conclusion

In patients with myopia, a consistent decrease in the thickness of the retinal GCC is observed as the axial length of the eye lengthens, but within the physiological norm. In cases where the AP axis exceeds 25-26 mm, it is important to consider that the initial decrease in the thickness of the iris can be caused not only by the glaucomatous process, but also by changes in the retina characteristic of myopia. Therefore, when analyzing OCT parameters in patients with myopic refraction, it is essential to consider the influence of axial length and myopia on retinal morphology to avoid misinterpreting physiological variations as pathological changes and to ensure accurate assessment of imaging data.

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