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COMPARISON OF vBIORETINOMETRIC INDICATORS OF OPTIC NERVE HEAD AND RETINAL NERVE FIBER LAYER THICKNESS IN HEALTHY, OCULAR HYPERTENSION AND NORMAL TENSION GLAUCOMA EYES

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SUMMURY

Purpose – to assess and compare optic nerve head and retinal nerve fiber layer thickness measurements in healthy, ocular hypertension (OHT) and normal tension glaucoma (NTG) subjects using OCT.

Material and methods

The study included a total retrospectively (195 eyes) 98 participants from to 16 to 71 age of the same Azerbaijan ethnicity. I – control group, 25 healthy persons (50 eyes) 16-71 years old (52.2±3.0); II group – 40 persons with normal tension glaucoma (80 eyes) 30-74 years old (56.6±1.8) and III study group-33 participants (65 eyes) 14-80 years old (51.3±2.8) with ocular hypertension.

Results

The thinning of TRNFL OHT group when compared to the control: in the inferior quadrant – 8.2% ($p^1<0,01$) and nasal – 9.1% ($p^1<0,05$), RNFL aver – 6.4% ($p^1<0,01$), I max – 6.4% ($p^1<0,05$) and to the NTG group: the inferior – 8.7% ($p^2<0,05$) and superior quadrants – 8.3 ($p^2<0,05$); RNFL aver – 6.6% ($p^2<0,05$), I max – 7.1% ($p^2<0,05$). Hourly analysis of OHT group when compared to the control showed the thinning of TRNFL at the superior quadrant clock: 1:00 by 19.4%; nasal: 4:00 – 13.2% ($p^1<0,01$) and at 5:00 of the inferior quadrant – 11.7% ($p^1<0,01$). And comparing with the NTG group at the superior quadrant clock: 12:00 – 12.1% ($p^2<0,01$), inferior 5:00 – 11.0% ($p^2<0,05$); 6:00 – 10.2% ($p^2<0,05$). The bioretinometric indicators of ONH, when compared to the control, was a 38.6% increase in the cup area ($p^1<0,01$), cup/disk area ratio – 25.1% ($p^1<0,05$); II group: vert inteq rim area (vol) a 31,2% increase ($p^2<0,05$).

Conclusion

A significant difference in the group's OHT was revealed in the quadrantly, hourly study of TRNFL and bioretinometric parameters. No gender differences were found.

Key words: *ocular hypertension; normal tension glaucoma; optical coherence tomography; retinal nerve fiber layer; optic nerve head*

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OPTİK SİNİRİN VƏ SİNİR LİFİ QATININ QALINLIĞININ BİORETİNOMETRİK GÖSTƏRİCİLƏRİNİN SAĞLAM, OFTALMOHİPERTENZİYA VƏ NORMAL TƏZYİQLİ QLAUKOMALI GÖZLƏRDƏ FƏRQİ

XÜLASƏ

Məqsəd – OKT vasitəsilə sağlam, oftalmohipertenziya (OHT) və normal təzyiqli qlaukoma (NTG) xəstələrində optik sinir başı və retinal sinir lifi təbəqəsinin qalınlığının qiymətləndirilməsi və müqayisəsi.

Material və metodlar

Tədqiqata retrospektiv olaraq 16 yaşdan 71 yaşa qədər etnik Azərbaycanlı olan (195 göz) 98 iştirakçı daxil edilmişdir: I – nəzarət qrupu, 25 sağlam insan (50 göz) 16-71 yaş (52.2±3.0); Normal təzyiqli

qlaukoma – II qrup 40 nəfər (80 göz) 30-74 yaş (56.6±1.8) və III tədqiqat qrupu 33 iştirakçı (65 göz) oftalmohipertenziya ilə 14-80 yaş (51.3±2.8).

Nəticə

OHT nəzarət qrupu ilə müqayisədə TRNFL incəlməsi - aşağı kvadrantda 8.2% ($p^1<0,01$), burunda 9.1% ($p^1<0,05$), RNFL orta – 6.4% ($p^1<0,01$), I maks – 6.4% ($p^1<0,05$). NTG qrupu: aşağı hissədə 8.7% ($p^2<0,05$), yuxarı kvadrantlarda – 8.3 ($p^2<0,05$), RNFL orta – 6.6% ($r^2<0,05$), I maks – 7.1% ($p^2<0,05$). Saat təhlili OHT nəzarət qrupu ilə müqayisədə TRNFL incəldiyini yuxarı kvadrantın: 1:00-da 19.4%; burun kvadrantının: 4:00

– 13.2% ($p^1<0,01$) və aşağı kvadrantın 5:00-da – 11.7% ($p^1<0,01$). NTQ qrupu ilə: yuxarı kvadrantın: 12:00 – 12.1% ($p^2<0,01$), aşağı kvadrantda 5:00-da 11,0% ($p^2<0,05$); 6:00 – 10.2% ($p^2<0,05$). ONH-nin bioretinometrik göstəricilərinin nəzarət qrupu ilə müqayisədə: cup area 38.6% ($p^1<0,01$), cup/disk area ratio 25.1% ($p^1<0,05$), NTQ ilə vert inteq rim area (vol) 31.2% ($p^2<0,05$).

Yekun

OHT digər qruplar ilə müqayisədə nəzərə çarpan əhəmiyyətli fərqlər RNFL kvadrantlarda, həmdə hər saatda və bioretinometrik göstəricilərinin tədqiqi zamanı aşkar edilmişdir. Cins fərqləri aşkar edilmədi.

Açar sözlər: *oftalmohipertenziya, normal təzyiqli qlaukoma, optik koherent tomoqrafiya, sinir lifi qatının qalınlığı, optik sinirin başı*

Эфендиева М.Э.

СРАВНЕНИЕ БИОРЕТИНОМЕТРИЧЕСКИХ ПОКАЗАТЕЛЕЙ ГОЛОВКИ ЗРИТЕЛЬНОГО НЕРВА И ТОЛЩИНЫ СЛОЯ НЕРВНЫХ ВОЛОКОН СЕТЧАТКИ В ЗДОРОВЫХ ГЛАЗАХ, А ТАКЖЕ С ОФТАЛЬМОГИПЕРТЕНЗИЕЙ И НОРМОТЕНЗИВНОЙ ГЛАУКОМОЙ

РЕЗЮМЕ

Цель – оценить и сравнить толщину слоя нервных волокон диска зрительного нерва и сетчатки у здоровых людей, с офтальмогипертензией (ОГТ) и нормотензивной глаукомой (НГ) с использованием по результатам ОКТ.

Материал и методы

В исследование были включены результаты ретроспективного (195 глаз) исследования 98 человек в возрасте от 16 до 71 азербайджанской национальности: I – контрольная группа, 25 здоровых лиц (50 глаз) в возрасте от 16 до 71 (52.2±3,0); II группа с нормотензивной глаукомой 40 человек (80 глаз) в возрасте 30–74 (56.6±1.8) и III группа исследования – 33 человека (65 глаз) с офтальмогипертензией в возрасте 14–80 (51.3±2.8).

Результаты

Истончение ТСНВ ОГТ группы в сравнении с контрольной составило в нижнем квадранте – 8.2% ($p^1<0,01$), носовом – 9.1% ($p^1<0,05$, СНВС ср

– 6.4% ($p^1<0,01$), I max – 6.4% ($p^1<0,05$). В сравнении с НТГ: в нижнем – 8.7% ($p^2<0,05$), верхнем – 8.3 ($p^2<0,05$); RNFL aver – 6.6% ($p^2<0,05$), I макс – 7.1% ($p^2<0,05$). Почасовой анализ ОГТ группы с контрольной показал истончение ТРНВС на часах верхнего: 1:00 на 19.4%; носового: 4 часа – 13.2% ($p^1<0,01$) и 5 часах нижнего квадранта – 11.7 % ($p^1<0,01$); с группой НТГ в верхнем квадранте: 12:00 часов – 12.1% ($p^2<0,01$), в нижнем 5:00 – 11.0% ($p^2<0,05$); 6:00 – 10.2% ($p^2<0,05$). Биоретинометрические показатели ОГТ по сравнению с контрольной увеличение cup area – 38.6 % ($p^1<0,01$), cup/disk area ratio – 25.1% ($p<0,05$), с НТГ vert inteq rim area (vol) –31.2% ($p^2<0,05$).

Заключение

Существенное отличие ОГТ группы было выявлено в поквадрантном, почасовом изучении ТСНВ и биоретинометрических показателей. Гендерных различий не обнаружено.

Ключевые слова: *офтальмогипертензия, нормотензивная глаукома, оптическая когерентная томография, слой нервных волокон сетчатки, головка зрительного нерва*

Ocular hypertension (OHT) is regarded as a condition with intraocular pressure (IOP) exceeding 21 mm Hg. It is not limited to the specific time frame when the elevated pressure was measured, and it does not manifest itself in any glaucomatous changes. Increased IOP can be observed in one or both eyes in all (2 and more) subsequent measurements [1-4]. Approximately every tenth out of a hundred patients over 40 age has a pressure higher than 21 mm Hg, but glaucoma develops only in 1 patient out of these people [2-4].

Ocular hypertension occurs 10-15 times more frequently than primary open-angle glaucoma. Unfortunately, pathomechanism and etiology of OHT development still remain unstudied [5].

Long-term studies (since 1994) of American and European scientists within the framework of programs The Ocular Hypertension Treatment Study (OHTS) and European Glaucoma Prevention Study (EGPS) have revealed that in 9.5% cases in patients with untreated ocular hypertension glaucoma developed within 5 years, in 13 years the frequency was 22% or about 2% per year, while with timely treatment the risk of development decreased by about 50%.

It has also been found that the risk of glaucoma development can increase:
- with age (by 26% for every decade)
- with IOP increase (by 9% for each 1 mm Hg)
- with a change in cup-to-disc ratio (Vertical and horizontal cup-to-disc ratio). And the risk increases by 19% with a 0.1 increase in size [1,2,5-8].

Glaucoma is the second leading cause of blindness worldwide. Approximately 2% - 2.5% of the world's population currently suffer from glaucoma [9-11].

Many times glaucomatous progression by field of vision is detected only after significant RNFL loss has already occurred. RNFL measurements using repeated OCT scans at different time points (months or years) are needed to detect glaucoma progression, which can appear earlier than field of vision changes. Measuring RNFL thickness by OCT enables an objective and quantitative assessment of glaucomatous structural loss [12-14].

Optical coherence tomography (OCT) is nowadays an important diagnostic tool for retinal diseases in the clinical practice. It provides cross-sectional or three-dimensional images by measuring the echo time delay and magnitude of backscattered or back-reflected light. OCT gives a kind of optical biopsy with quantitative and reproducible measurements of RNFL thickness parameters using near-infrared light [14-17].

Among the latest technologies recently used for structural evaluation of ONH and RNFL, OCT is the most interesting one regarding the possibility of simultaneous study of retinal parameters and ONH. As practice shows sometimes it is not enough to use routine research methods for early diagnosis, so in 50% cases the disease remains undiagnosed even after a full-scale conventional study (tonometry, perimetry, ophthalmoscopy) (5,12,18-20).

The importance of TRNFL determination in the early diagnosis of glaucoma cannot be overstated, because RNFL thinning may in theory be the earliest structural change clinically detectable and has been shown to precede functional loss by as much as 5 years [14-17, 22-24].

OCT has proven itself as one of the most sensitive and specific methods used to diagnose glaucoma [18,26-30]. At the same time, if the method sensitivity at quadrant study is equal to 14.8%, at hourly study it is 85. 2-95%, and the specificity of the method ranges from 86.6 to 92.5% [31]. A Kiernan D.F., Hariprasad S.M. (2010) believe that the sensitivity and specificity of Stratus OCT is equal to 80% and 94% respectively [32].

In view of the said above, the purpose of this research is to evaluate and compare TRNFL in peripapillary zone and ONH in the patients with ocular hypertension by means of optical coherent tomography - OCT (Stratus OCT 3000).

Material and methods

The retrospective study included out patient records and examination protocols of 98 Caucasian patients (195 eyes) from 16 to 71 age of the same Azerbaijan ethnicity.

Among them there were 36 women and 62 men with the average age of the patients of 50.0±3.2. The examined were divided into 3 groups. The first control group consisted of 25 healthy persons (50 eyes); 16-71 years (a mean of 52.2 ± 3.0 y). The selection criteria were: IOP not exceeding 21 mm Hg; no marked lens opacity (e.g. back capsular cataract); no ocular pathology, congenital ONH abnormalities or neurological symptoms in the history.

The second group with normal tension glaucoma was composed of 40 persons (80 eyes) 30-74 years of old (a mean of 56.6 ± 1.8 y). The selection criteria were: IOP not exceeding 25 mmHg, gonioscopically

– open anterior chamber angle, glaucoma-specific changes in the field of vision and ONH, no history of myopia, congenital ONH abnormalities or neurological symptoms.

The third group consisted of 33 patients (65 eyes) with ocular hypertension. The selection criteria were: IOP exceeding 21 mmHg, (IOP ≤ 24 mm Hg in 2 cases at least), gonioscopically – open anterior chamber angle, no glaucoma-specific changes in the field of vision and ONH, no signs of hemorrhage, incision, notching or RNFL defect, no history of myopia, congenital ONH abnormalities or neurological symptoms.

All clinical material was collected at the National Centre of Ophthalmology named after acad. Zarifa Aliyeva, the observation period was 2010-2013. All the patients underwent a complete ophthalmologic examination that included both standard and additional methods of examination: Visometry, Refractometry, Biomicroscopy, Biomicroophthalmoscopy (Ocular HighMag 78 D), Tonometry (applanation tonometry according to Maklakov). There was also a study of peripapillary TRNFL using OCT (Stratus OCT 3000 software v.4.0.2; Carl Zeiss Meditec, Inc., Dublin, CA) under the program «RNFL Thickness Average Analysis Report, 3.4 mm scan protocol», and assessment and comparison of optic nerve head (ONH) parameters under the program of "Optic Nerve Head Analysis". The following criteria were used to statistically process the observation results: parametric Student's t-test (and estimation of difference between the lobes) was used to preliminary estimate difference between variation rows, and non-parametric Wilcoxon's U-test was used to verify and refine the results obtained.

Results and discussion

In total, there were 3 groups with almost the same average age of all the examined, but men outnumbered women. In the first group the average age was 52.2±3, of them 17 men (68%) and 8 women (32%); in the second group – 56.6±1.8, of them 23 men (57.5%) and 17 (42.5%) women and in the third group 51.3±2.8, of them 22 men (71.1%) and 11 women (28.9%), respectively. The average value of intraocular pressure in the control group was equal to 17.8±0.3 (12.2-21.4) mm Hg, with normal tension glaucoma – 19,7±0,3 (13-25) mm Hg and with ocular hypertension – 19.2±0.3 (12-25) mm Hg accordingly. Statistically significant third group difference with the first group indices was ($p^1 < 0,001$) and second group – was ($p^2 < 0,01$).

As it can be seen from Table 1 visual acuity in three groups with and without correction was relatively equal.

Assessment and comparison of the peripapillary TRNFL was performed in four quadrants and 12 hours according to Table 2.

As follows from Table 3, a significant thinning of TRNFL (95% confidence interval) OHT group when compared to the control group – in the inferior quadrant by 8.2% ($p^1 < 0,01$) and nasal one by 9.1% ($p^1 < 0,05$) as well as RNFL aver – 6.4% ($p^1 < 0,01$) and I max – 6.4% ($p^1 < 0,05$). And when compared to the NTG group it was detected in the inferior by

Table 1

Distribution of IOP and visual acuity ratio in the study groups

Groups	IOP, mm Hg	Visual acuity without correction	Visual acuity with correction
1 – Control (n=50)	17,8±0,3 (12,2–21,4)	0,638±0,052 (0,1 – 1,0)	0,847±0,039 (0,4 – 1,0)
2 – Normal tension glaucoma (n=80)	19,7±0,3 (13–25) ***	0,524±0,039 (0,01 – 1,0)	0,715±0,036 (0,4 – 1,0)
3 – Glaucoma suspicion (n=76)	19,2±0,3 (12–25) **	0,510±0,042 (0,01 – 1,0)	0,758±0,045 (0,4 – 1,0)

Note: statistically significant difference with indicators:
*control group: * – p <0,05; ** – p <0,01; *** – p <0,001*

Table 2

Diagnostic reference points for the Quadrant and Hourly Distribution of RNFL Thickness

Quadrants		Degrees	Hours
T	Temporal	$316-45^0$	$8^{00}, 9^{00}, 10^{00}$
S	Superior	$46-135^0$	$11^{00}, 12^{00}, 1^{00}$
N	Nasal	$136-225^0$	$2^{00}, 3^{00}, 4^{00}$
I	Inferior	$226-315^0$	$5^{00}, 6^{00}, 7^{00}$

8.7% ($p^2 < 0,05$) and superior quadrants – 8.3 ($p^2 < 0,05$); RNFL aver – 6.6% ($p^2 < 0,05$) and I max – 7.1% ($p^2 < 0,05$) [33].

Bowd Ch. et al. have published similar results. They have obtained the following results: the average RNFL was significantly thinner (by 15%) in the eyes with ocular hypertension than in the normal eyes (the control group) - 72.8 µm (66.4-78.1 µm) and 85.8 µm (80.2-91.7 µm), respectively. In the temporal quadrant, the RNFL was significantly thinner in glaucomatous eyes, 41.6 µm (33.7-49.3 µm) than in OHT eyes, 58.8 µm (50.6- 67.0 µm) and normal eyes, 66.2 µm (61.3-71.2 µm). Retinal nerve fiber layer thickness in the temporal quadrant was similar in OHT eyes and normal eyes. In the superior quadrant, the RNFL was significantly thinner in glaucomatous eyes, 56.5 µm (45.7-67.4 µm) than in OHT eyes, 101.4 µm (93.6-109.2µm) and normal eyes, 105.7 µm (98.0-112.6 µm). Retinal nerve fiber layer thickness in the superior quadrant was similar in OHT and normal eyes. In the nasal quadrant the RNFL was thinnest in glaucomatous eyes, 29.2 µm (21.2-37.1 µm) and increased significantly in OHT eyes, 44.1 µm (37.5-51.7µm) and normal eyes, 61.8 µm (53.0-65.6 µm). Finally, in the inferior quadrant, the RNFL was thinnest in glaucomatous eyes, 49.2 µm (39.2-59.2 µm) and increased significantly in OHT eyes, 84.8 µm (75.6-94.0 µm) and normal

Table 3

Distribution of Average values of RNFL Thickness by Quadrants in Research Groups

Indicators	Groups			Statistically significant difference with control group indicators	
	Control group	Normal tension glaucoma	Ocular hypertension	P^1	P^2
I	132,1±2,1 (109 – 164)	111,6±3,1 (39 – 157)	121,3±2,5 (44 – 158)	<0,01	<0,05
S	123,1±2,3 (86– 148)	109,6±3,1 (46 – 160)	118,7±2,1 (66 – 146)	>0,05	<0,05
N	82,4±2,5 (47– 121)	73,2±2,0 (43 – 106)	74,9±2,0 (47 – 117)	<0,05	>0,05
T	71,9±2,0 (50– 110)	65,4±1,7 (32 – 104)	67,5±1,6 (32 – 103)	>0,05	>0,05
RNFL aver	102,4±1,5 (79,49–125)	89,9±2,1 (47,6 –120,14)	95,9±1,7 (51,96-127)	<0,01	<0,05
I max	165,2±2,9 (125– 206)	144,3±3,9 (53 – 203)	154,7±3,0 (63 – 196)	<0,05	<0,05
S max	151,5±3,2 (101– 189)	139,0±3,7 (56 – 197)	146,0±2,3 (96 – 181)	>0,05	>0,05

eyes, 107.6 μm (99.3-115.9 μm). Given the racial differences in measuring the parameters of optic nerve disk and RNFL, the authors indicate that the patients participating in the study were mostly Caucasian (88%) [34].

Myung G. Choi et al. mention the thinning only in the inferior quadrant. In addition to ethnic differences another reason for that could be probably the age of the patients which was in the following proportions: 41.7±6.5 in the group of healthy patients and 45.5±8.5 in the patients with OHT [35].

Patel D et al. reported that the best parameter to differentiate ocular hypertension at risk from normal eyes was found to be TRNFL in superior quadrant in SD-OCT RNFL thickness parameters [36].

Chen H-Y et al. in course of TRNFL study in patients with ocular hypertension (32 eyes; mean age 32.88±15.55, Chinese) on Stratus 3000 OCT found the following quadrant distribution: mean TRNFL (RNFL aver.) was 108.81±9.08; temporal – 98.06±21.91; superior – 129.75±12.73; nasal – 73.41±13.73 and inferior – 133.91±19.35, that considerably did not differ from the control group and conform to the following data: RNFL aver. 110.48±9.79, T - 97.00±20.75, S - 135.92±15.03, N - 73.90±17.05 and I - 135.24±17.8 [26].

Given the size of the optic nerve disc and corneal thickness Vessani R.M. et al. showed no significant difference in the CCT, and RNFL values are present between the OHT and control groups [37].

Table 4

Hourly distribution of RNFL Thickness in study groups

Hours	Groups			Statistically significant difference with control group indicators	
	Control group	Normal tension glaucoma	Ocular hypertension	P^1	P^2
1^{00}	118,0±2,9 (71 – 169)	105,2±3,5 (41 – 163)	113,8±2,7 (57 – 159)	>0,05	<0,05
2^{00}	96,9 ± 3,5 (47 – 147)	85,9±2,7 (46 – 129)	89,1±2,8 (42 – 141)	>0,05	<0,05
3^{00}	66,8 ± 2,4 (37 – 113)	61,2±1,7 (37 – 91)	61,6±2,1 (31 – 112)	>0,05	>0,05
4^{00}	83,7 ± 2,7 (54 – 128)	72,5±2,2 (38 – 112)	72,7±2,2 (34 – 116)	<0,01	>0,05
5^{00}	117,2 ± 3,2 (75 – 158)	93,2±2,9 (12 -135)	103,4±2,9 (29 – 154)	<0,01	>0,05
6^{00}	139,8 ± 3,1 (100 – 181)	118,7±3,7 (35 – 180)	130,8±3,3 (50 – 181)	>0,05	>0,05
7^{00}	139,5 ± 4,0 (85 – 193)	121,7±4,0 (29 – 177)	129,4±3,0 (55 – 173)	<0,05	>0,05
8^{00}	75,9 ± 2,8 (51 – 121)	67,3±2,2 (32 – 122)	71,1±1,9 (35 – 127)	>0,05	>0,05
9^{00}	56,3 ± 1,5 (40 – 82)	52,8±1,3 (25 – 183)	53,7±1,1 (29 – 79)	>0,05	<0,05
10^{00}	83,5 ± 2,6 (50 – 140)	75,8±2,5 (27 – 125)	79,2±1,9 (32 – 125)	>0,05	<0,05
11^{00}	126,6 ± 3,5 (83 – 172)	114,2±3,7 (40 – 86)	119,6±2,8 (52 – 173)	>0,05	>0,05
12^{00}	124,7 ± 3,0 (80 – 164)	109,5±3,7 (32 – 176)	122,8±2,7 (73 – 169)	>0,05	>0,05

Mahadevan A. et al. reported that the mean RNFL was 102.12 ± 12.28 μm in the OHT group; RNFL was measured with spectral-domain optical coherence tomography [38].

Brijesh P. et al. showed with Optovue spectral Domain OCT, that mean RNFL thickness was 83.83 ± 26.20 μm in ocular hypertension and 103.27 ± 16.23 μm in normal eyes. In the ocular hypertensive group, RNFL was thinner in the superior (107.40 ± 35.39 μm), inferior (100.80 ± 26.77 μm), nasal (67.10 ± 19.26 μm) and temporal (58.30 ± 24.99 μm) quadrants when compared to normals ($P<0.001$, unpaired 't' test). The RNFL was thinner in glaucomatous eyes in the superior (63.90 ± 35.88 μm), inferior (57.10 ± 34.70 μm), nasal (55.53 ± 26.25 μm) and temporal (47.33 ± 24.09 μm) quadrants when compared to normals ($P<0.001$) [39].

In-depth hourly in-depth analysis of the examined OHT group (Table 4) when compared to the control group showed a significant thinning of TRNFL that was greater at the superior quadrant clock: 1:00 by 19.4%; nasal quadrant clock: 4:00 – 13.2% ($p^1 < 0,01$) and at 5:00 of the inferior quadrant – 11.7% ($p^1 < 0,01$). Moreover, when compared OHT group to the NTG group one showed a significant excellent thickness of TRNFL at the superior quadrant clock: 12:00 – 12.1% ($p^2 < 0,01$) and at the inferior quadrant 5:00 by 11.0% ($p^2 < 0,05$); 6:00 – 10.2% ($p^2 < 0,05$).

Şahli E., Tekeli reported that RNFL global average thickness, average thicknesses in four quadrants and at 1 o'clock, 4 o'clock, 5 o'clock, 6 o'clock, 7 o'clock, 8 o'clock, 9 o'clock, 10 o'clock, 11 o'clock and 12 o'clock areas were significantly lower in POAG patients. At the same time no difference was found between the OHT group and the control group in any OCT parameter in four quadrants and clock hours with scanned Cirrus HD-OC [14].

Bioretinometric (Table 5) indicators of ONH in the third group when compared to the control one revealed that there was a 38.6% increase in the cup area ($p^1 < 0,01$), cup/disk area ratio by 25.1% ($p < 0,05$), cup/disk vertical ratio by 11.7% ($p^1 < 0,05$)

Table 5

Distribution of bioretinometric ONH data by research groups

ONH indicators	Groups			Statistically significant difference with control group indicators	
	Control	Normal tension glaucoma	Ocular hypertension	P¹	P²
Vert. inteq. rim area (vol.)	0,365±0,033 (0,065–1,026)	0,270±0,025 (0,013-1,07)	0,355±0,035 (0,012-1,67)	>0,05	<0,05
Horiz. inteq. rim width (area)	1,637±0,035 (1,154-2,151)	1,502±0,039 (0,586-2,63)	1,62±0,037 (0,79–2,278)	>0,05	<0,05
Disk area	2,363±0,054 (1,804-3,258)	2,530±0,066 (1,429-4,35)	2,570±0,057 (1,769–4,35)	<0,05	>0,05
Cup area	0,832±0,059 (0,167-1,863)	1,225±0,071 (0,113-3,02)	1,153±0,083 (0,07–4,35)	<0,01	>0,05
Rim area	1,529±0,063 (0,742–2,442)	1,310±0,066 (0,28–3,29)	1,416±0,067 (0–3,034)	>0,05	>0,05
Cup/disk area ratio	0,350±0,023 (0,07–0,715)	0,478±0,023 (0,043-0,92)	0,438±0,025 (0,037–1)	<0,05	>0,05
Cup/disk horiz. ratio	0,620±0,023 (0,292 –0,90)	0,702±0,020 (0,233-0,99)	0,674±0,022 (0,19 –1)	>0,05	>0,05
Cup/disk vert. ratio	0,365±0,033 (0,065–1,026)	0,270±0,025 (0,013-1,07)	0,355±0,035 (0,012-1,67)	>0,05	<0,05

and optic nerve disc diameter by 8.8% ($p^1 < 0,05$). Moreover significant differences were found between two groups OHT and second group that there was a vert inteq rim area (vol) a 31,2% increase ($p^2 < 0,05$) and horiz inteq rim width (area) – 7.9% ($p^2 < 0,05$). In addition there was 8.4% decrease in cup/disk area ratio, rim area by 8.1 %. No gender differences were found.

It is interesting to note that the Korean authors (Myung G. Choi et al.) conducted the study of bioretinometric ONH data in the patients with OHT when compared to the control group of healthy people and mention that the difference was observed for all parameters except for the diameter of the optic nerve disc and Disk area. These indicators were almost identical in both study groups, which may be explained by ethnic differences [35].

No distinct gender differences have been found in the study. Vessani R.M. et al. have published the similar results [38].

Conclusions:

1. Distinct thinning of TRNFL (95% confidence interval) OHT group when compared to the control group – in the inferior quadrant by 8.2% ($p^1 < 0,01$) and nasal one by 9.1% ($p^1 < 0,05$) as well as RNFL aver – 6.4% ($p^1 < 0,01$) and I max – 6.4% ($p^1 < 0,05$). And when compared to the NTG group it was detected in the inferior by 8.7% ($p^2 < 0,05$) and superior quadrants – 8.3 ($p^2 < 0,05$); RNFL aver – 6.6% ($p^2 < 0,05$) and I max – 7.1% ($p^2 < 0,05$) .

2. However, hourly in-depth analysis of the study group OHT when compared to the control one showed a significant thinning of TRNFL that was greater at the superior quadrant clock: 1:00 by 19.4%; nasal quadrant clock: 4:00 – 13.2% ($p^1 < 0,01$) and at 5:00 of the inferior quadrant – 11.7% ($p^1 < 0,01$). Moreover, when compared OHT group to the NTG group one showed a significant excellent thickness of TRNFL at the superior quadrant clock: 12:00 – 12.1% ($p^2 < 0,01$) and at the inferior quadrant 5:00 by 11.0% ($p^2 < 0,05$); 6:00 – 10.2% ($p^2 < 0,05$).

3. The study of bioretinometric indicators of ONH in the third group when compared to the control one revealed that there was a 38.6% increase in the cup area ($p^1 < 0,01$), cup/disk area ratio by 25.1% ($p < 0,05$), cup/disk vertical ratio by 11.7% ($p^1 < 0,05$) and optic nerve disc diameter by 8.8% ($p^1 < 0,05$). Moreover significant differences were found between two groups OHT and second group that there was a vert inteq rim area (vol) a 31,2% increase ($p^2 < 0,05$) and horiz inteq rim width (area) – 7.9% ($p^2 < 0,05$). In addition was 8.4% decrease in cup/disk area ratio, rim area by 8.1 %.

4. No distinct gender differences have been found.

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