Microperimetry in Primary Open-Angle Glaucoma Diagnosis

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Diagnosis of glaucoma optic neuropathy is based on defining typical changes in the optic nerve head (ONH) and the corresponding field of view defects [1]. The death of retinal ganglion cells (RGC) occurs long before the appearance of glaucoma changes in the field of view. These structural disorders can appear several years before the first functional changes. Clinically, changes in the field of view in patients with glaucoma are detected with the loss of up to 40% of the retinal nerve fibers [2].

The sensitivity of modern perimeters is quite high. Their advantages are the ability to conduct examinations in various modes and in making follow-up control. Along with this, the most common automated perimeters now have a high variability of the repeated testing results. One of the main factors in this retest variability is errors in fixation of the patient’s gaze [3]. Due to this, the perimeter cannot always reliably reflect the advance of changes in the field of view of the patient [4].

Diagnosis of early manifestations of glaucoma optic neuropathy remains the most crucial issue in ophthalmology. One of the solutions to this problem is to improve methods for assessing functional disorders of the nerve fiber layer that appear as effects of the glaucoma process and, possibly, precede organic changes. One of these early diagnostic techniques is microperimetry.

Modern microperimetry technologies (Macular Integrity Assessment - MAIA) make it possible to evaluate the macula functions by measuring the sensitivity of the field of view [5]. The advantage of using MAIA is to provide a more extensive tracking system with a clear and detailed retinal image. This leads to higher measurement reliability. Moreover, the device is provided with accurate tracking systems of eye movements, which perform a quantitative analysis of the patient’s gaze fixation as to its stability and localization [6]. Microperimetry is mainly used to detect visual field losses in the central field of view, to determine the fixation point and fixation stability in patients with macular pathology.

The issue of the possibility to use microperimetry in the glaucoma diagnosis is debatable in the research literature [7-9].

In our studies with microperimetry examination (Macular Integrity Assessment (MAIA), USA), we establish a statistically significant difference between macular integrity...
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(MI) (29.68 ± 23.18) and average threshold (AvThr) (27.63 ± 3.38 dB) in patients with the early stage of the primary open-angle glaucoma (POAG) and those in the control group (p < 0.01) [10]. MI patients with POAG with the RGC focal loss of volume at optical coherence tomography (OCT) (ρ = 0.642, p < 0.001) had the highest correlations of morphometric parameters and microperimetry parameters. The results are consistent with data from other authors studying the problem of structural-functional correlations in glaucoma.

Thus, Sato S., et al. (2013) using regression analysis studied the relationship between the thickness of ganglion cell complex (GCC), the macular area (Cirrus HD-OCT), and the photosensitivity of the macula (MAIATM microperimeter) in general and 6 sectors of the field of view in patients with POAG and healthy individuals. Statistically significant correlations were found between the RGC thickness and the photosensitivity of the macula on average and each sector of the field of view (p = 0.365 - 0.706, all p < 0.001). The corresponding inferior sectors, especially the inferior temporal ones showed the maximum value of structural-functional associations (ρ = 0.706) [11].

Kazuyuki Hirooka., et al. (2016) conducted a cross-sectional study to examine the correlations between the average photosensitivity of the macula in general, in the superior and inferior sectors with microperimetry (MAIATM; CenterVue, Italy), with fundus perimetry MP-3 (Nidek Technologies Srl, Italy), perimetry on a Humphry field analyzer (HFA, USA) and RGC thickness parameters in 73 POAG patients and 19 healthy individuals [12]. All three perimetry methods showed statistically significant values of the RGC thickness correlation with the average sensitivity in the macular area (ρ = 0.547-0.687, p < 0.001). At the same time, they did not reveal any significant differences for the structural-functional relations of the studied parameters, which allows us to compare all three of these methods equally.

The studies have shown that the total retinal thickness in the macular area determined using OCT, does not provide the same accuracy in the glaucoma diagnosis as the parameters of the peripapillary retinal nerve fiber layer (RNFL) [11,12]. According to the studies [13-15], the RNFL thickness indicator is the most informative, which reflects the thickness of the peripapillary fibers of the retina. It can detect glaucoma at an early stage, at the pre-perimetric stage, even in the absence of changes in the field of view. The following works [13,16] have established that the parameters characterizing the state of the RGC complex, the focal loss of volume (FLV), and the average thickness of RGC contribute to the detection of glaucoma at an earlier stage in comparison with the RNFL parameters. The GCC thickness reflects the state of the macula and makes it possible to diagnose glaucoma in cases where the macula area is more affected. Therefore, conflicting data on the informative value of the GCC and RNFL parameters are rather complementary in glaucoma.

Akopyan VS [17] has established high interrelations of the perimeter mean deviation (MD) parameter and GCC average thickness in OCT (r = 0.787, p < 0.001), FLV (r = -0.618, p < 0.001), the global loss of volume (GLV) (r = -0.781, p < 0.001), as well as of the pattern standard index deviation (PSD) with indicators characterizing GCC: GCC average (r = -0.571, p < 0.001), FLV (r = 0.605, p < 0.001) and GLV (r = 0.523, p < 0.001).

Morphometric and changes in the macular area and ONH in patients with POAG confirming that retinal structures are involved in the pathological process at an early stage. At the same time, microperimetry makes it possible to study disorders in the central field of view, though it cannot assess defects located at the periphery, and therefore cannot be used to solve problems of traditional computer perimetry in the POAG diagnosis. Thus, the combined use of microperimetry and OCT techniques is recommended for assessing the relationship between the structural features of the retina, optic nerve head and the functional state of the macular area in patients with initial manifestations of primary open-angle glaucoma.

**BIBLIOGRAPHY**


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