

Eureka Journal of Health Sciences & Medical Innovation (EJHSMI)

ISSN 2760-4942 (Online) Volume 2, Issue 4, April 2026



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SIGNS OF OCULAR DAMAGE IN PATIENTS WITH DM BY OPTICAL COHERENCE TOMOGRAPHY

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Abstract

Diabetes mellitus (DM) is one of the most significant medical and social problems of our time, leading to systemic complications and serious damage to the eye. Diabetic retinopathy (DR) is not only a leading cause of blindness and low vision, but can also be an indicator of more severe complications. Despite the progress of diagnostic methods and treatment, the prevalence of DM complications is progressing, which is associated with an increase in the life expectancy of patients, insufficient compensation for hyperglycemia and late access to ophthalmic care. Due to the high growth of DM (more than 537 million patients with DM in the world; IDF, 2023), early detection and monitoring of ophthalmic complications is of particular importance. Current imaging techniques, such as optical coherence tomography (OCT), make it possible to detect preclinical changes in the retina even before complaints appear in the patient. However, the problem of insufficient preventive diagnosis remains in clinical practice, especially in regions with limited access to high-tech ophthalmic care. The study aims to fill these gaps and may help optimize screening algorithms and dynamic follow-up of patients with DM to prevent irreversible visual impairment.

Keywords: Diabetes mellitus, diabetic retinopathy, OCT, macular edema, RNFL

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Purpose of the study:

Analysis of structural and functional changes in the eye in patients with DM with varying degrees of compensation and systemic parameters and ophthalmological parameters.

Materials and methods:

The study included data from 40 patients with DM, the average age was 52 ± 12.1 years, the duration of DM was from 1 to 23 years). Routine ophthalmological studies were performed: visometry, tonometry, optical coherence tomography with macular thickness assessment (Average thickness MZ, Central thickness MZ), retinal volume (Total volume MZ), nerve fiber layer thickness (RNFL thickness), optic nerve disc assessment (Disc area, Cup area, Rim area, C/D ratio), as well as laboratory tests: HbA1c, glycemia, lipid profile, creatinine.

Results

65% of patients had macular thickening (mean MZ thickness: 268.1-304.6 μm), which correlates with the duration of DM ($r = 0.42$, $p < 0.05$). A decrease in RNFL thickness (mean: 90-130 μm) was observed in patients with DM duration > 10 years. However, only 30% of patients had signs of diabetic retinopathy (microaneurysms, hemorrhages).

Visual acuity reduction to 0.7 ± 0.12 correlated with glycated hemoglobin levels in less than 9% of patients. All patients with intraocular pressure > 21 mmHg were excluded from the study. Significant thinning of retinal sensorineural layers (mean macular thickness 247-281 μm vs. 290-315 μm in the control, $p < 0.05$) was observed in patients with DM duration of more than 10 years. The central retinal thickness (fovea) correlated with HbA1c (* $r = -0.48$, $p = 0.003$ *), indicating the influence of chronic hyperglycemia to neuronal degeneration. 32% of patients with neurodegeneration showed a decrease in the thickness of the ganglion cell layer (GCL+) in the upper temporal quadrant (72 ± 8 μm vs. $92 \pm$

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6 μm normal, $p < 0.01$). Global thinning of the RNFL was recorded in 45% of patients with DM, even in the absence of clinically significant retinopathy. The highest losses were noted in the upper and lower quadrants (respectively $112 \pm 12 \mu\text{m}$ and $118 \pm 10 \mu\text{m}$ vs. $135 \pm 8 \mu\text{m}$ in the control, $p < 0.01$). In patients with diabetic neuropathy, RNFL thinning progressed 8-12% faster (* $p = 0.02$ *), which confirms the general neurodegenerative process. An increase in vertical C/D ratio (> 0.7) was detected in 18% of patients, which may indicate a combined effect of diabetic and glaucoma optic neuropathy. A decrease in the area of the neuroretinal girdle (Rim area) correlated with the duration of DM (* $r = -0.36$, $p = 0.04$ *).

Conclusions

Duration and decompensation of DM are key risk factors for ophthalmic complications. OCT and RNFL assessment are highly informative methods for early diagnosis of diabetic retinal involvement. An individualized approach to monitoring patients with DM should include regular ophthalmic examination and monitoring of systemic parameters. The results highlight the need for multidisciplinary management of patients with DM to prevent blindness. It is recommended to include OCT in the standards of clinical examination.