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Evaluation of retinal changes in diabetic retinopathy by optical coherence tomography

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The importance of optical coherence tomography (OCT) examination in the evaluation of the retina in the neoproliferation stage of diabetic retinopathy (DR) has been studied with the conducted research. In the present study, while fulfilling the goal set for 2020-2022 according to clinical and laboratory criteria, 100 patients with diabetic retinopathy (200 eyes) ((average age 50-70) were examined. The control group consisted of 50 patients (100 eyes) with diabetes but diabetic retinopathy was not yet detected. For many years, fluorescence angiography was considered the gold standard in the diagnosis of diabetic retinopathy. In modern ophthalmology, an examination method called optical coherence tomography is used to perform a cross-sectional image of the retina. The results of the conducted research allow the detection of changes in the thickness of the macular part of the retina in the early stage of OCT diabetic retinopathy. It has been determined that the initial damage due to diabetes is observed in most cases between 6-10 years, which depends on the hyperglycemic index in many cases. In the diagnosis of DR, OCT examination plays an important role in the selection of treatment tactics, it facilitates the measurement of macular thickening, the detection of diffuse and cystic macular edema, and the detection of vitreoretinal tractions.

Keywords*: Diabetic retinopathy, optical coherence tomography, diabetes, retina, diabetic macular edema*

INTRODUCTION

There are approximately 347 million people with diabetes mellitus (DM) in the world (Varma et al., 2014). By 2030, the worldwide prevalence of DM is predicted to reach 430 million patients (Korobelnik et al., 2014). Diabetic retinopathy (DR) is characterized by diabetic micro-angiopathy, retinal microaneurysms, capillary non-perfusion and ischemia (Adhi et al., 2013**;** Hwang et al., 2016; Hwang et al., 2015; Ishibazawa et al., 2015). It can cause a number of complications such as diabetic macular edema (DME) and diabetic macular ischemia (DMI) (Varma et al., 2014; Elman et al., 2010; Agemy et al., 2015; Conrath et al., 2015). is considered to be a serious process. Although fluorescence angiography (FA) is considered the gold standard in the diagnosis of DR, the fact that the examination method is invasive has got contraindications and the duration of the examination is about 10-15 minutes which limits its use.

Optical coherence tomography (OCT) was first used to visualize the eyeball more than 20 years ago and still remains an indispensable diagnostic method in ophthalmology. With the help of OCT, it turned out to be possible to non-invasively obtain optical sections of tissues with a higher resolution than when using other visualization methods. Currently, OCT allows refinement of the structure of the tissue or its pathology at the level of 1-15 microns, which is more accurate than ultrasound examination, MRI,

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or CT (Ishibazawa et al., 2015). Currently, OCT is successfully used for screening, monitoring and diagnosis of eyeball diseases, as well as for conducting scientific research (Hwang et al., 2015; Ishibazawa et al., 2015; Agemy et al., 2015). According to the studies of various authors, modern optical coherence tomography is undoubtedly the "gold standard" in the study of the fundus; it has great diagnostic possibilities and prospects for development, which will allow the detection of diseases at subclinical stages in the future (Puliafito et al., 1995).

The purpose of this research was to clarify the role of OCT examination in the evaluation of the retina in the neoproliferation stage of diabetic retinopathy.

MATERIALS AND METHODS

Our observational study was conducted at the Teaching Surgery Clinic of Azerbaijan Medical University. In the present study, 100 diabetic retinopathy patients (200 eyes) (average age between 50-70) were examined while fulfilling the goal set in 2020-2022 according to clinical and laboratory criteria. Patients in the stage of neoproliferation were involved in the study. After biomicroscopy, visometry, tonometry, ultrasound examination, ophthalmoscopy the patients were sent for OCT examination. Retinal thickness measurements were performed on an OCT device. The control group includes 50 patients (100 eyes) with diabetes but diabetic retinopathy has not yet been detected. The examination was performed on the RS 330 Nidek OCT device (Japan) for 4-5 minutes (two eyes).

RESULTS AND DISCUSSION

In our observational study, we analyzed the dependence of the dynamic changes in different areas of the retina on the duration of diabetes (Table 1).

As can be seen from the table, according to the state of illness with diabetes mellitus, primary damage is observed in most cases between 6-10 years, which depends on the hyperglycemic index in many cases.

According to our results, there was no noticeable change between the control group and the main group. In the control group, the thickness of the foveola corresponded to its anatomical thickness of 120-200 microns. Foveal thickening was observed in 4 patients. According to some scientists, although no morphological changes are observed in the OCT protocol, the thickening of the foveola may be a sign of early edema **(**Korobelnik et al., 2014; Hwang et al., 2016**).** In addition, vitreoretinal traction was observed in 2 patients in the main group.

Table 1. Determination of the duration of diabetes mellitus in the main group

Duration of being sick with diabetes mellitus	Main group	
	Number of patients	Number of eyes
0-1	-	-
2-5	10	20
6-8	25	50
8-10	65	130
Total	100	200

Table 2. Thickness of different areas of the retina in the observed groups

Observed zone	Control group, n=50	Main group, n=100
Foveola	146.74±18.35	160.04±21.07
Fovea	200.02±20.09	185.75±19.70
Temporal inner part	250.45±14.75	259.31±21.56
Temporal outer part	214.12±12.14	216.56±15.19
Upper inner part	268.75±16.03	265.98±12.04
Upper outer part	218.54±11.30	233.45±23.34
Nasal inner part	265.02±19.09	259.00±15.08
Nasal outer part	248.07± 13.00	246.05±21.00
Lower outer part	224.76±12.16	260.13±17.09

In all patients, the condition of diabetes continued for different periods of time. At the same time, the thickening in different parts of the retina was different in these patients. The changes in the retina are observed not only in the macular part, but also around the optic disc.

The results of the study allow OCT to detect changes in the thickness of the macular part of the retina at an early stage during diabetic retinopathy. Also, OCT is an indispensable examination method for determining the direction of the treatment of DR and monitoring the treatment results. OCT helps to monitor the volume of DME and intraretinal damage (Fig. 1,

2, 3, 4). OCT examination remains the main method for early detection of macular edema, selection of treatment of diabetic maculopathy and monitoring of results.

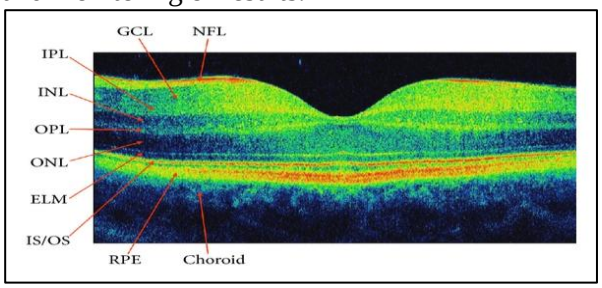

Fig. 1. Cross-sectional view of the retina of the eye with OCT.NFL: nerve fiber layer; GCL: ganglion cell layer; IPL: inner plexiform layer; INL: inner nuclear layer; OPL: outer plexiform layer; ONL: outer nuclear layer; ELM: outer limiting membrane; IS/OS: intra-node and outer photoreceptor segments; RPE: retinal pigment epithelium.

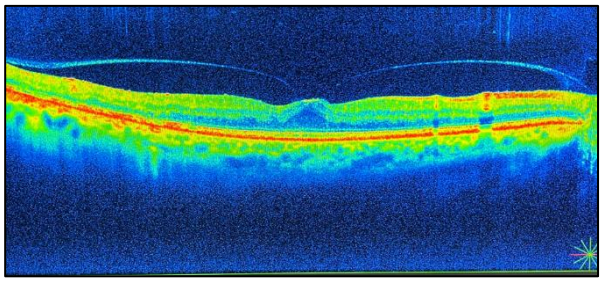

Fig. 2. OCT examination: Image of posterior vitreoretinal traction in a patient with diabetic retinopathy.

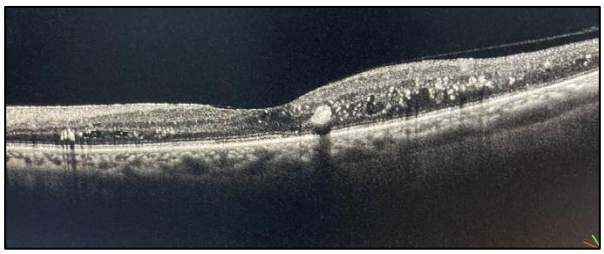

Fig. 3. OCT examination records the relative thickening of the macular part in the retina of the eye and traces of exudates in a patient with diabetic retinopathy.

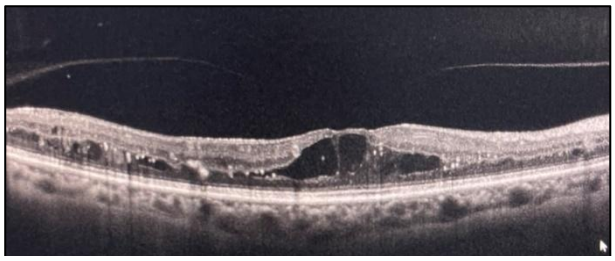

Fig. 4. OCT examination: observation of vitreoretinal traction with macular edema on the retina in a patient with diabetic retinopathy.

CONCLUSION

OCT provides micrometer-level imaging that closely approximates the histological layers of the retina. One of the advantages of OCT is that the examination is non-invasive, there is no need for additional preparation before the examination, and the examination period is short. In patients with diabetic retinopathy, OCT quantifies retinal edema, which can be successfully used as an objective method of monitoring macular thickening before and after therapy. At the same time, OCT is also very useful for vitreous evaluation. It is useful in detecting clinically undiagnosed vitreoretinal traction. OCT should be the number one choice of ophthalmologists to detect diabetic macular edema and monitor treatment progress from focal/grid laser and anti-VEGF therapies and select the next treatment step.

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