FEATURES OF THE MORPHOMETRIC PARAMETERS OF THE LIGHT-REFRACTING PARTS OF THE EYE AND THE ELEMENTS OF THE FUNDUS IN CHILDREN OF THE SECOND PERIOD OF CHILDHOOD WITH DIABETES MELLITUS AND MYOPIA

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https://doi.org/10.5281/zenodo.7376649

Abstract. *Type 1 diabetes mellitus (DM) is the most common endocrine pathology in children. Acute complications, severe chronic complications, premature death at a young age put diabetes on a par with the most important problems in medicine. The aim of our work was to study the features of the morphometric parameters of the light-refracting parts of the eye and the elements of the fundus in children of the second period of childhood with diabetes mellitus and myopia. The data of the survey of morphometric parameters of the light-refractive parts of the eye and elements of the fundus in children with diabetes mellitus with myopia, 166 sick children from 7 to 18 years old, for the period from 2019-2022, were analyzed, and 60 children without diabetes mellitus with myopia and 40 healthy children were also examined. children (comparison group) of the same age and sex.*

Keywords: *diabetes mellitus, myopia, morphometry, fundus.*

ОСОБЕННОСТИ МОРФОМЕТРИЧЕСКИХ ПОКАЗАТЕЛЕЙ СВЕТОПРЕЛОМЛИТЕЛЬНОЙ ЧАСТИ ГЛАЗА И ЭЛЕМЕНТОВ ГЛАЗНОГО ГЛАЗА У ДЕТЕЙ ВТОРОГО ПЕРИОДА ДЕТСТВА С САХАРНЫМ ДИАБЕТОМ И БЛИЗУМОЙ

Аннотация. *Сахарный диабет (СД) 1-го типа — это наиболее часто встречающаяся эндокринная патология у детей. Острые осложнения, тяжелые хронические осложнения, преждевременная смерть в молодом возрасте ставят сахарный диабет в один ряд с важнейшими проблемами медицины. Целью нашей работы являлось изучить особенности морфометрических параметров светопреломляющих частей глаза и элементов глазного дна у детей второго периода детства сахарным диабетом и миопией. Проанализированы данные обследования морфометрических параметров светопреломляющих частей глаза и элементов глазного дна у детей сахарным диабетом с миопии 166 больных детей от 7-года до 18 лет, за период с 2019-2022 годы и было обследовано также 60 детей без сахарного диабета с миопией и 40 здоровых детей (группа сравнения) аналогичного возраста и пола.*

Ключевые слова: *сахарный диабет, миопия, морфометрия, глазное дно.*

Relevance

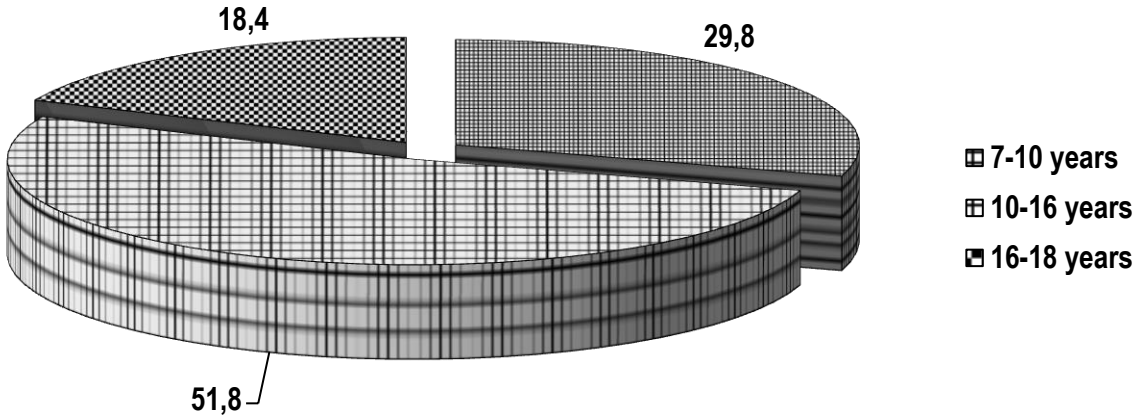
Diabetes mellitus (DM) is one of the most common chronic diseases in the world, recognized as the most important medical and social problem of our time. According to the International Diabetes Federation (IDF), the number of people with diabetes increased to 463 million in 2019, compared with 108 million in 1980(15). According to the forecasts of the same IDF, by 2045 the number of patients with DM may increase to 630 million. DM is expected to become the 7th cause of death worldwide (20). Type 1 diabetes mellitus (DM) is the most common endocrine pathology in children. Acute complications, severe chronic complications,

premature death at a young age put diabetes on a par with the most important medical problems and require close attention of health authorities.Myopia is perhaps the most common eye disease, better known as myopia.(5)We can assume that the first mention of myopia is found in the 4th century BC - by Aristotle. He noted that some people, wanting to examine an object, are forced to bring it close to their eyes, and at the same time they often squint. The cause of myopia is a modified form of the eyeball. It becomes more like an oval than a circle. As a result of this, a refraction error occurs, due to which the light rays pass through the eyeball and are focused before reaching the retina. This is the reason for the "blurring" of distant objects. In normal vision, light is focused directly on the retina (6). The first signs of myopia appear between the ages of 7 and 12 and progress to 20 years in women and 22 years in men. In the future, as a rule, vision stabilizes, but may deteriorate further. With an increase in the anterior-posterior axis of the eye, retinal cells located in the zone of maximum light sensitivity are thinned out like a mesh stocking that is pulled over the leg, which can lead to other diseases. (7) The complex of ophthalmological studies was supplemented by optical coherence tomography (OCT). Time-domain OCT devices that operate in the near infrared range allow non-invasive, real-time diagnosis of changes in the anatomy of the posterior segment of the eye. With a resolution of 1-10 microns, imaging of the optic nerve head (OND), the peripapillary retinal nerve fiber layer (RRNF), and the macula can be obtained.(19)

Target: to study the features of the morphometric parameters of the light-refracting parts of the eye and the elements of the fundus in children of the second period of childhood with diabetes mellitus and myopia.

Materials and methods: The data of the survey of morphometric parameters of the light-refractive parts of the eye and elements of the fundus in children with diabetes mellitus with myopia, 166 sick children from 7 to 18 years old, for the period from 2019-2022, were analyzed, and 60 children without diabetes mellitus with myopia and 40 healthy children were also examined. children (comparison group) of the same age and sex.

All children underwent a comprehensive examination, including ophthalmological, clinical and laboratory, echobiometry, optical coherence tomography, ophthalmoscopy, biomicroscopic and other studies.



Rice. 2.1. Distribution of children by age and health status
1 - subgroup - 49 (29.8%) children aged 7 to 10 years;
2 - subgroup - 86 (51.8%) children aged 10 to 16 years;
3 - subgroup - 31 (18.4%) children aged 16 to 18 years.

Table 1

Distribution of sick children with diabetes mellitus and without diabetes mellitus, taking into account the severity of myopia

The severity of myopia	**Children with diabetes mellitus with myopia (n=166), main group**	**Children without diabetes mellitus with myopia (n=60), control group**
Weak up to 3.0^{D}	32(19,2%)	27(54%)
Average up to 6.0^{D}	43(26%)	21(35%)
High - above 6,0^{D}	91(54,8%)	12(11%)

Table 2.

Distribution of healthy children and children with diabetes, taking into account age and gender

Sex		Children's age						Total	
		От 7до 10 лет		От 10 до16		От 16 до 18			
		абс	%	Абс	%	абс	%	Абс	%
Children with diabetes and myopia	Boys	25	15,0	38	22,8	28	16,8	91	54,8
	Girls	23	13,9	35	21,0	17	10,2	75	45,2
Healthy children	Boys	5	12,5	8	20	8	20	21	52,5
	Girls	5	12,5	7	17,5	7	17,5	19	47,5

It is noteworthy that in all the studied age groups, depending on gender, the number of boys out of the total number of children prevails, mainly at the age of 16-18 years. It is difficult to explain this regularity, apparently, the reason lies in the biological sexual characteristics of the child's organism that are still unclear to us.

Results: The study showed that in boys of the second period of childhood (7-10 years old) with diabetes mellitus, mild myopia, the length of the vitreous body varied in the right eye from 14.9 to 16.4 mm on average 15.6, in the left eye from 14.78 up to 16.5 mm average 15.6

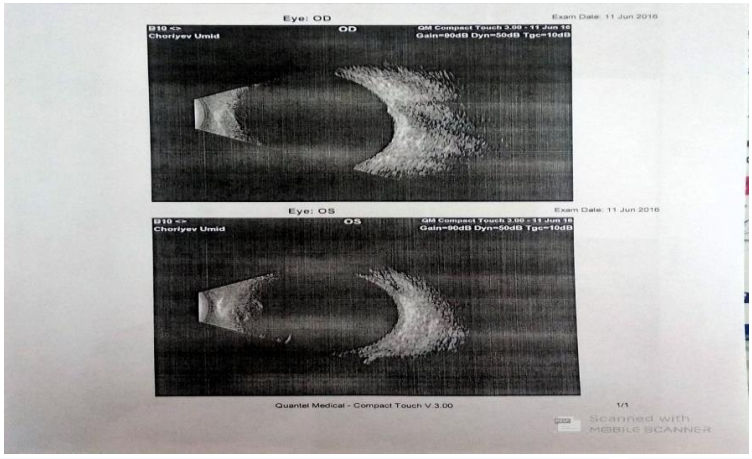
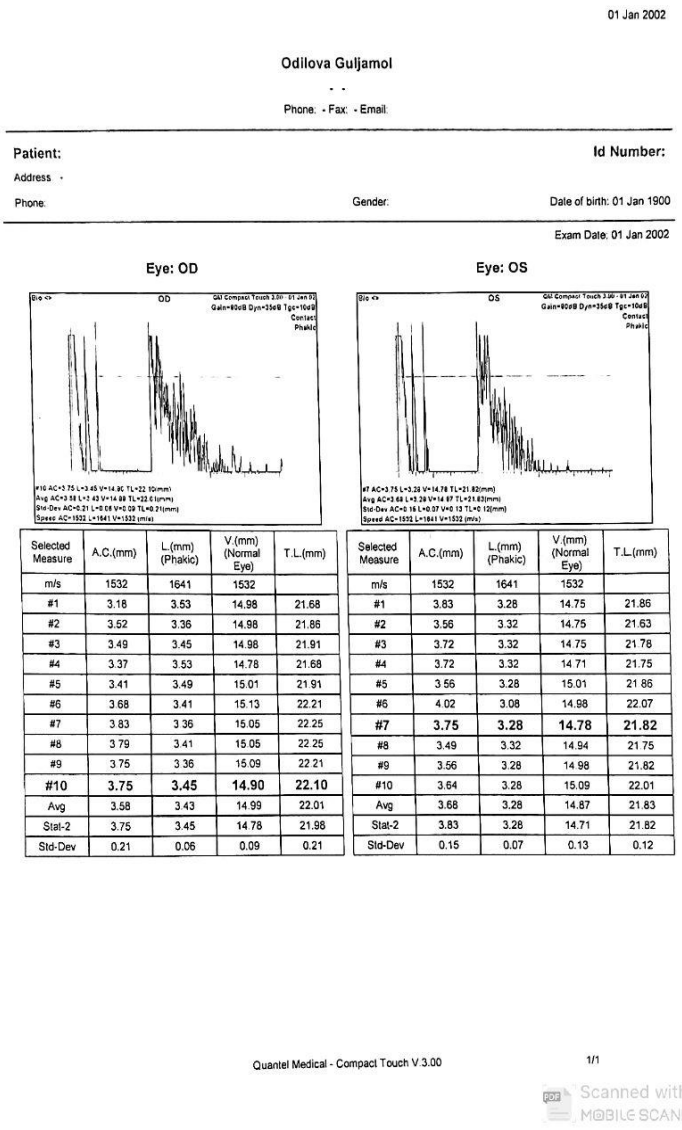


Fig. 1 Morphometric parameters of the vitreous body. Patient C.U. 10 years old, diagnosed with type 1 diabetes mellitus, mild myopia.

Anterior chamber distance in this group of boys OD ranges from 2.38 to 3.75 with an average of 3.20 and in OS from 2.64 to 3.75 with an average of 3.265

The length of the lens in this group of girls is OD in the range from 3.31 to 4.47 mm, on average 3.73, OS from 3.28 to 4.59 mm, on average 3.78. The anterior-posterior axis of the eyeball in boys of this group fluctuates OD in

range from 21.42 to 23.0 mm, on average 22.6, OS from 21.71 to 23.3 mm, in average 22.61.



01 Jan 2002

Odilova Guljamol

- -

Phone: - Fax: - Email:

Patient: Id Number:

Address -

Phone: Gender: Date of birth: 01 Jan 1900

Exam Date: 01 Jan 2002

Eye: OD

Eye: OS

Selected Measure	A.C.(mm)	L.(mm) (Phakic)	V.(mm) (Normal Eye)	T.L.(mm)
m/s	1532	1641	1532	
#1	3.18	3.53	14.98	21.68
#2	3.52	3.36	14.98	21.86
#3	3.49	3.45	14.98	21.91
#4	3.37	3.53	14.78	21.68
#5	3.41	3.49	15.01	21.91
#6	3.68	3.41	15.13	22.21
#7	3.83	3.36	15.05	22.25
#8	3.79	3.41	15.05	22.25
#9	3.75	3.36	15.09	22.21
#10	3.75	3.45	14.90	22.10
Avg	3.58	3.43	14.99	22.01
Stat-2	3.75	3.45	14.78	21.98
Std-Dev	0.21	0.06	0.09	0.21

Selected Measure	A.C.(mm)	L.(mm) (Phakic)	V.(mm) (Normal Eye)	T.L.(mm)
m/s	1532	1641	1532	
#1	3.83	3.28	14.75	21.86
#2	3.56	3.32	14.75	21.63
#3	3.72	3.32	14.75	21.78
#4	3.72	3.32	14.71	21.75
#5	3.56	3.28	15.01	21.86
#6	4.02	3.08	14.98	22.07
#7	3.75	3.28	14.78	21.82
#8	3.49	3.32	14.94	21.75
#9	3.56	3.28	14.98	21.82
#10	3.64	3.28	15.09	22.01
Avg	3.68	3.28	14.87	21.83
Stat-2	3.83	3.28	14.71	21.82
Std-Dev	0.15	0.07	0.13	0.12

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Fig 2 Morphometric parameters are the distance of the anterior chamber, the length of the lens, the vitreous body and the eyeball. Patient C.U. 10 years old, diagnosed with type 1 diabetes mellitus, mild myopia.

The study also showed that in boys of this group, the thickness of the cornea OD ranges from 536.8 to 636.7 mm, the radius of the cornea is from 8.00 to 8.14 mm, an average of 8.07, OS from 555.42 to 529.29 mm, the radius cornea 7.81 to 8.56 mm, 8.1 on average.

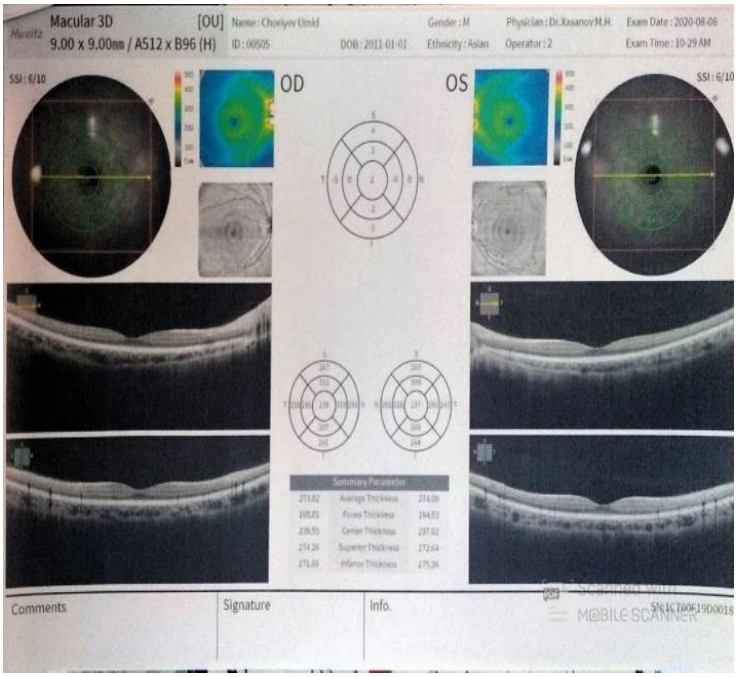
Fig 3

Morphometric parameters of the cornea thickness. Patient C.U. 10 years old, diagnosed with type 1 diabetes mellitus, mild myopia.

In the boys of this group, the study showed the following parameters of the macula of the right eye, from 265.38 to 300.54 mm, an average of 284.7, the thickness of the fossa of the macula from 201.21 to 213.06 mm, an average of 206.2, and OS the thickness of the macula is from 266.58 to 300.75 mm, an average of 285, and the thickness of the fossa of the macula is from 203.65 to 215.62 mm, an average of 206.2.

Fig 4

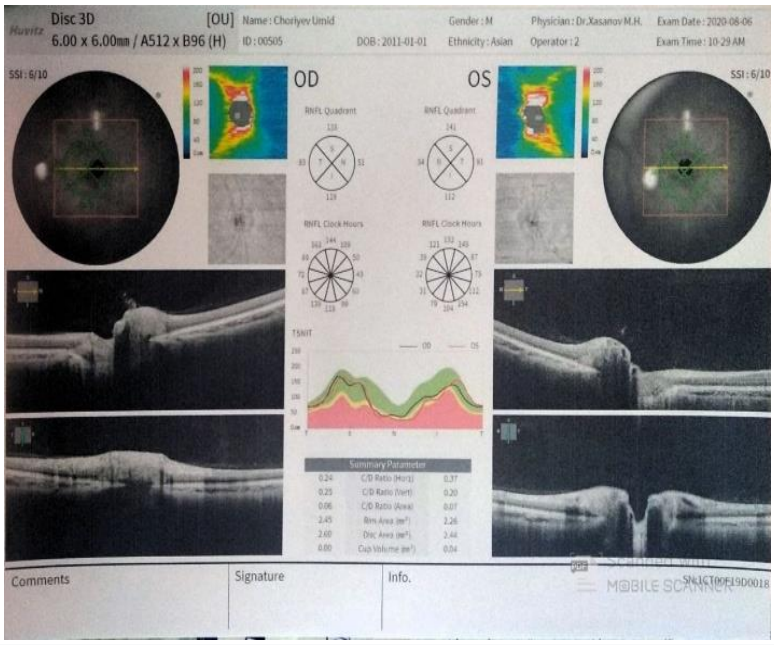
Morphometric parameters of the macula. Patient C.U. 10 years old, diagnosed with type 1 diabetes mellitus, mild myopia.



The parameters of the optic disc in this group of boys were OD diameter from 0.34 to 0.71 mm, area of the optic disc from 2.94 to 2.45 mm, area of the neuroretinal rim from 1.59 to 2.45 mm, on average 1.92, and OS diameter from 0.35 to 0.43 mm, area of the optic disc from 2.42 to 2.91 mm, area of the neuroretinal rim from 2.44 to 2.94 mm, on average 2.67.

Figure 5

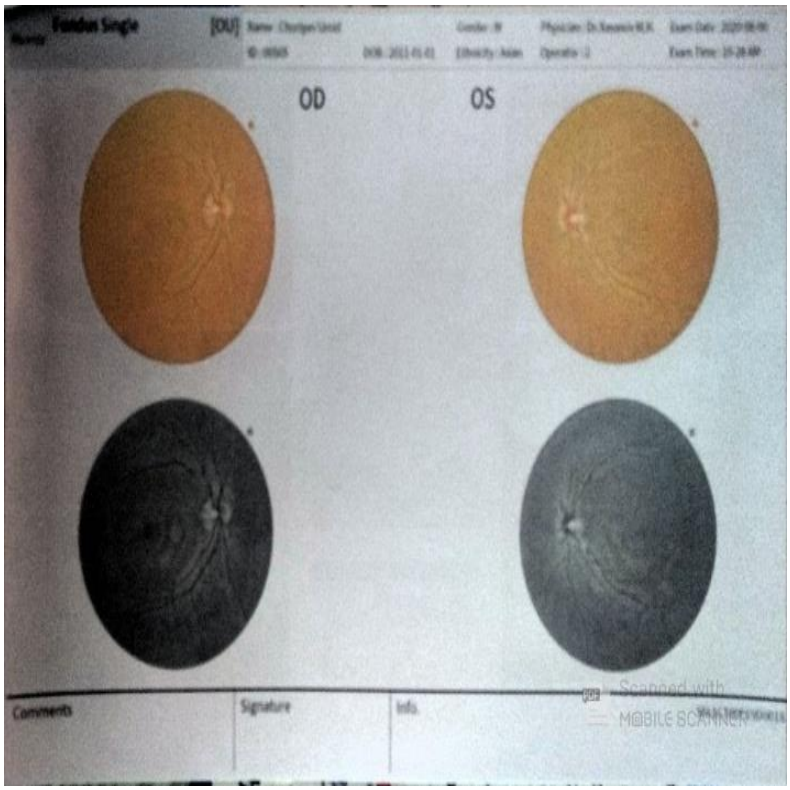
Morphometric parameters of the optic nerve head. Patient C.U. 10 years old, diagnosed with type 1 diabetes mellitus, mild myopia.



The condition of the retinal vessels in boys of this group ranges from 86.89 µm to 102.8 µm in vein OD, 138.76 µm to 138.76 µm in arteries, on average 143.09, vein OS from 138.76 µm to 167.00 µm, on average 149.8 microns, arteries from 89.7 to 102.7 microns, on average 96.31

Fig 6

Morphometric parameters of retinal vessels. Patient C.U. 10 years old, diagnosed with type 1 diabetes mellitus, mild myopia

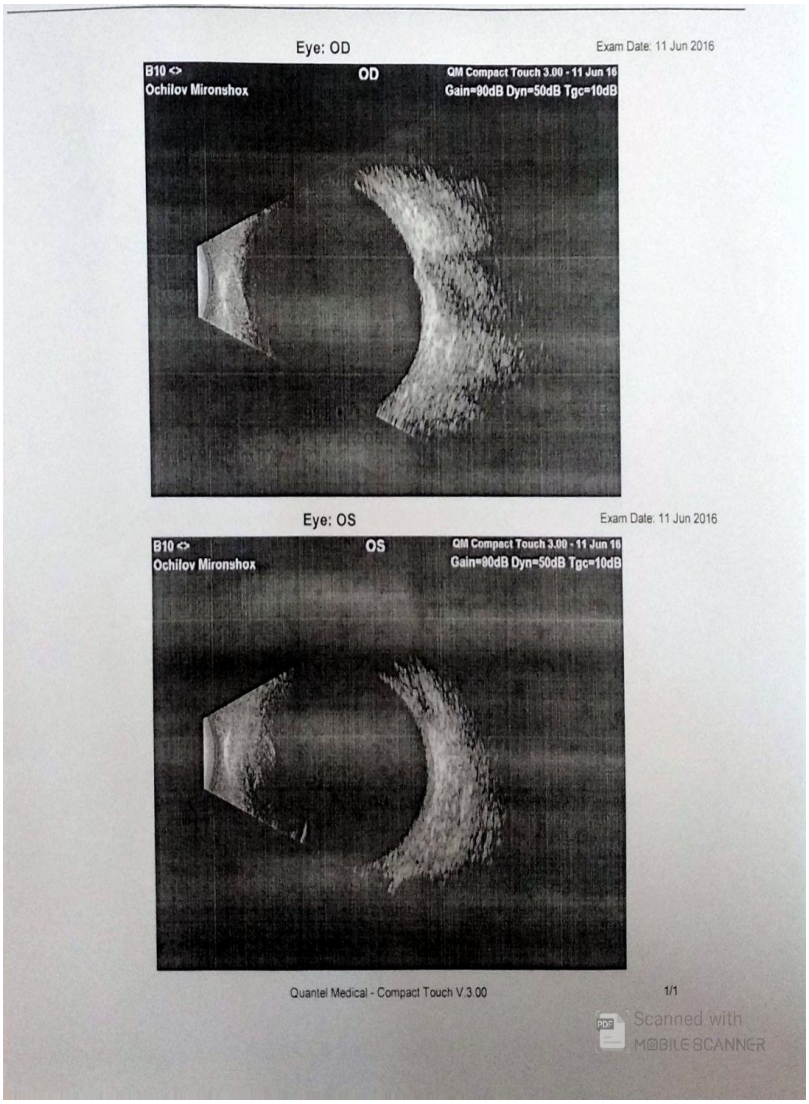


In children of boys of the second period of childhood (7-10 years) with diabetes mellitus and moderate myopia, the study showed that the length of the vitreous body varied in the right

eye from 16.43 to 18.31 mm, on average 17.2 mm, in the left eye from 16 .51 to 18.42 mm with an average of 17.33 mm.

Fig. 7

Morphometric parameters of the vitreous body. Patient O.M., 8 years old, diagnosed with type 1 diabetes mellitus, moderate myopia.



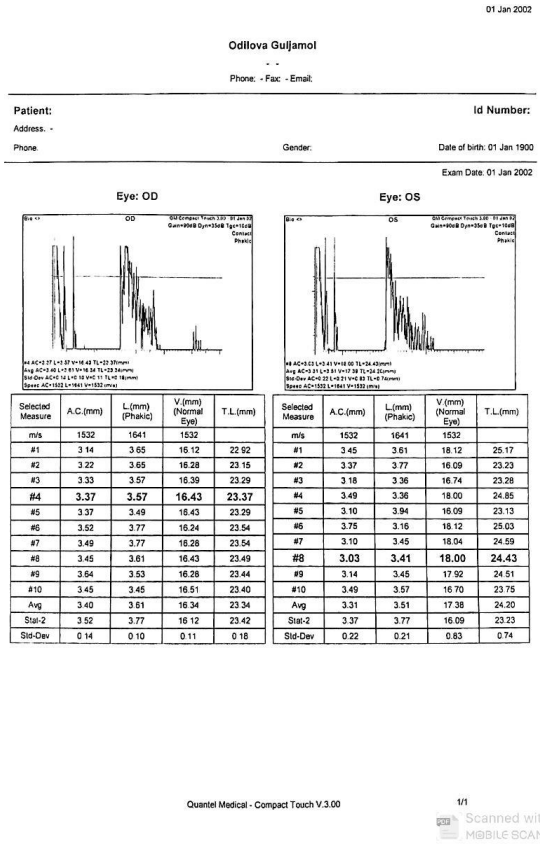
The distance of the anterior chamber in this group of boys OD ranges from 3.37 to 4.32mm with an average of 3.83, and in OS from 3.03 to 4.26mm with an average of 3.73

The length of the lens in this group of girls is OD in the range from 3.62 to 4.45 mm on average 3.85 mm OS from 3.45 to 4.62 mm, on average 3.88 mm.

The anterior-posterior axis of the eyeball in boys of this group ranges from OD 24.37 to 26.02 mm, 24.8 mm on average, OS from 24.03 to 26.32 mm, 25 mm on average

Figure 8

Morphometric parameters are the distance of the anterior chamber, the length of the lens, the vitreous body and the eyeball. Patient O.M., 8 years old, diagnosed with type 1 diabetes mellitus, moderate myopia.



01 Jan 2002

Odilova Guljamol

Phone: - Fax: - Email:

Patient: Id Number:

Address. -

Phone. Gender: Date of birth: 01 Jan 1900

Exam Date: 01 Jan 2002

Eye: OD

Selected Measure	A.C.(mm)	L.(mm) (Phakic)	V.(mm) (Normal Eye)	T.L.(mm)
m/s	1532	1641	1532	
#1	3.14	3.65	16.12	22.92
#2	3.22	3.65	16.28	23.15
#3	3.33	3.57	16.39	23.29
#4	**3.37**	**3.57**	**16.43**	**23.37**
#5	3.37	3.49	16.43	23.29
#6	3.52	3.77	16.24	23.54
#7	3.49	3.77	16.28	23.54
#8	3.45	3.61	16.43	23.49
#9	3.64	3.53	16.28	23.44
#10	3.45	3.45	16.51	23.40
Avg	3.40	3.61	16.34	23.34
Stat-2	3.52	3.77	16.12	23.42
Std-Dev	0.14	0.10	0.11	0.18

Eye: OS

Selected Measure	A.C.(mm)	L.(mm) (Phakic)	V.(mm) (Normal Eye)	T.L.(mm)
m/s	1532	1641	1532	
#1	3.45	3.61	18.12	25.17
#2	3.37	3.77	16.09	23.23
#3	3.18	3.36	16.74	23.28
#4	3.49	3.36	18.00	24.85
#5	3.10	3.94	16.09	23.13
#6	3.75	3.16	18.12	25.03
#7	3.10	3.45	18.04	24.59
#8	**3.03**	**3.41**	**18.00**	**24.43**
#9	3.14	3.45	17.92	24.51
#10	3.49	3.57	16.70	23.75
Avg	3.31	3.51	17.38	24.20
Stat-2	3.37	3.77	16.09	23.23
Std-Dev	0.22	0.21	0.83	0.74

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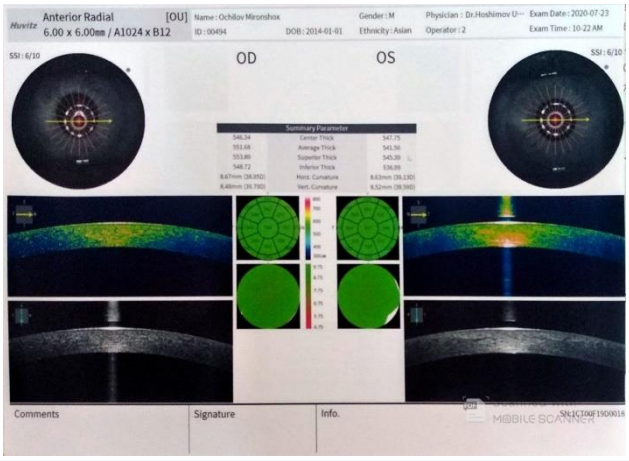
The study also showed that in boys of this group, the thickness of the cornea OD ranges from 548.65 to 618.43 mm, the radius of the cornea is from 7.73 to 8.31, an average of 598.2 mm, OS is from 541.56 to 620.72 mm, the radius cornea 8.11 to 8.94, averaging 8.5mm.

Fig 9

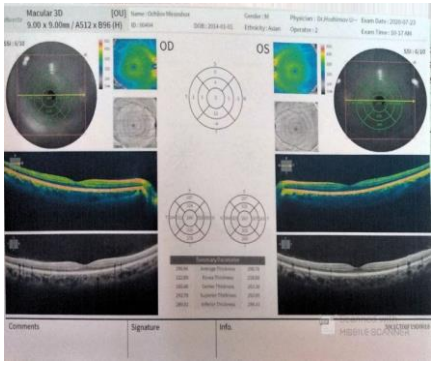
Morphometric parameters of the cornea thickness. Patient O.M., 8 years old, diagnosed with type 1 diabetes mellitus, moderate myopia.



In the boys of this group, the study showed the following parameters of the macula of the right eye, from 273.04 to 298.64 mm, an average of 286.27, the thickness of the fossa of the macula from 173.70 to 176.77 mm, an average of 173.7, and the OS thickness of the yellow spots from 274.02 to 274.09 mm and the thickness of the fossa of the macula from 176.65 to 178.68 mm, on average 176.5

Figure 10

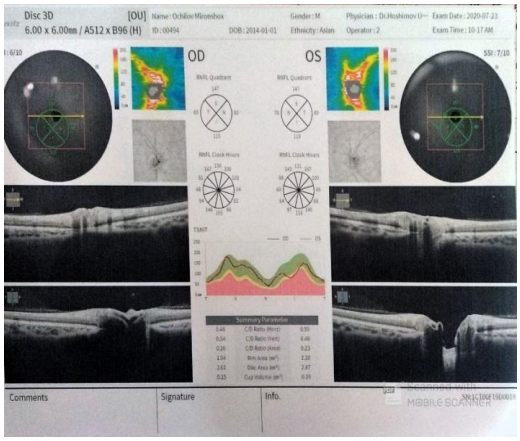
Morphometric parameters of the macula. Patient O.M., 8 years old, diagnosed with type 1 diabetes mellitus, moderate myopia.



The parameters of the optic nerve head in this group of boys were OD diameter from 0.44 to 0.52 mm, area of the optic disc from 2.49 to 2.89 mm, area of the neuroretinal rim from 1.92 to 2.47 mm on average 2.24, and OS diameter is from 0.43 to 0.46 mm, the area of the ONH is from 2.44 to 2.89 mm, the area of the neuroretinal rim is from 1.98 to 2.41 mm, on average 2.26.

Figure 11

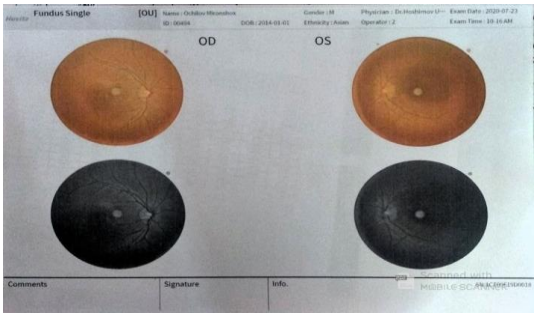
Morphometric parameters of the optic nerve head. Patient O.M. 8 years old, diagnosed with type 1 diabetes mellitus, moderate myopia.



The condition of the retinal vessels in boys of this group ranges from 138.65 μm to 151.54 μm in veins, 89.4 μm to 102.10 μm in arteries, on average 96.66 μm, vein OS from 132.60 μm to 152.54 microns, arteries from 88.54 microns to 102.4 microns, on average 96.66 microns.

Figure 12

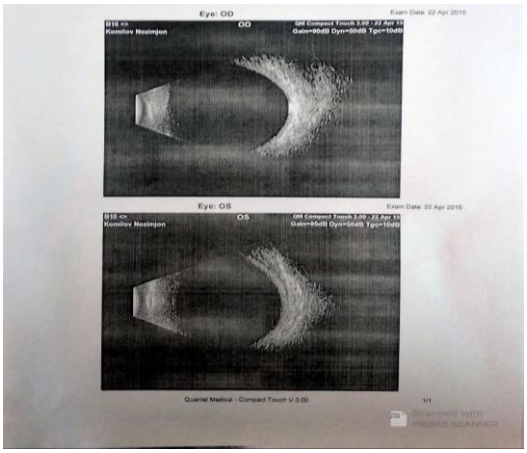
Morphometric parameters of retinal vessels. Patient O.M., 8 years old, diagnosed with type 1 diabetes mellitus, moderate myopia.



In children of boys of the second period of childhood (7-10 years old) with diabetes mellitus and high myopia, the study showed that the length of the vitreous body varied in the right eye from 18.35 to 20.53 mm, on average 19.28 mm, in the left eye from 18, 25 to 20.54mm with an average of 19.32mm.

Fig. 13

Morphometric parameters of the vitreous body. Patient K.N. 10 years old, diagnosed with type 1 diabetes mellitus, high myopia.



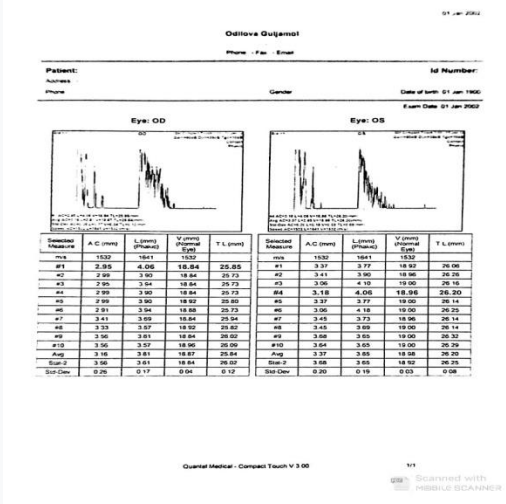
The distance of the anterior chamber in this group of boys OD ranges from 2.96 to 4.21mm with an average of 3.90, and in OS from 3.18 to 4.26mm with an average of 3.96mm.

The length of the lens in this group of girls is OD in the range from 3.98 to 4.87 mm, on average 4.54 mm, OS from 3.87 to 4.84 mm, on average 4.51 mm.

The anterior-posterior axis of the eyeball in boys of this group ranges from OD 26.20 to 29.38 mm, 27.71 mm on average, OS from 26.20 to 29.39 mm, 27.79 mm on average.

Figure 14

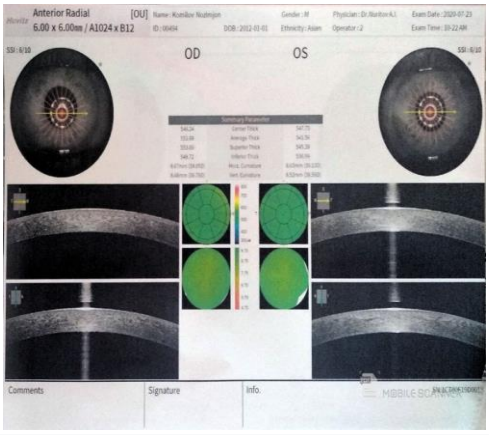
Morphometric parameters are the distance of the anterior chamber, the length of the lens, the vitreous body and the eyeball. Patient K.N. 10 years old, diagnosed with type 1 diabetes mellitus, high myopia.



The study also showed that in boys of this group, the thickness of the cornea OD ranges from 556.87 to 641.4 mm, the radius of the cornea is from 7.73 to 8.31, an average of 8.15, OS is from 563.38 to 642.70 mm, the radius of the cornea 8.11 to 8.94, averaging 8.46.

Figure 15

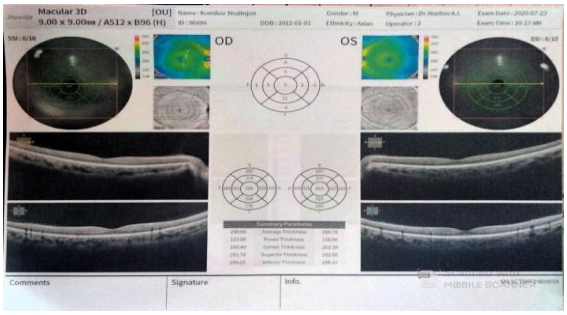
Morphometric parameters of the cornea thickness. Patient KN, 10 years old, diagnosed with type 1 diabetes mellitus, high myopia.



In the boys of this group, the study showed the following parameters of the macula of the right eye, from 290.96 to 326.57 mm with an average of 308.12, the thickness of the fossa of the macula from 173.70 to 176.77 mm, with an average of 172.7, and OS thickness macula from 290.78 to 326.54 mm, and the thickness of the fossa of the macula from 176.65 to 178.68 mm, an average of 177.6.

Figure 16

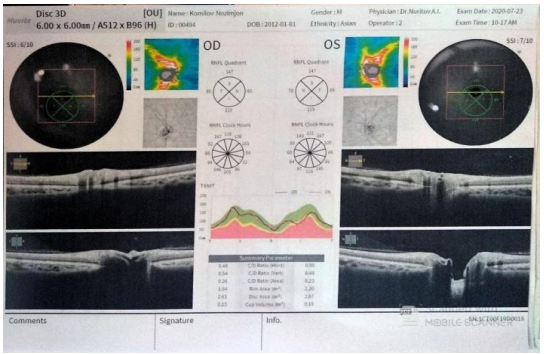
Morphometric parameters of the macula. Patient KN, 10 years old, diagnosed with type 1 diabetes mellitus, high myopia.



The parameters of the optic nerve head in this group of boys were OD diameter from 0.44 to 0.52 mm, area of the optic disc from 1.95 to 2.86 mm, area of the neuroretinal rim from 1.82 to 2.73 mm on average 2.26, and OS diameter from 0.43 to 0.46 mm, area of the optic disc from 1.94 to 2.88 mm, area of the neuroretinal rim from 1.85 to 2.68 on average 2.27.

Figure 17

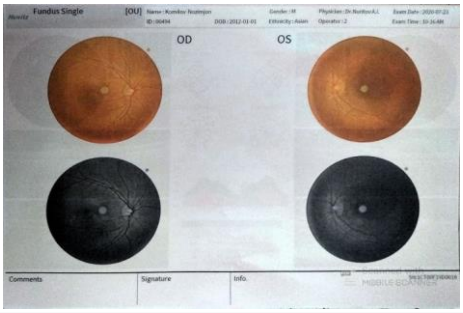
Morphometric parameters of the optic nerve head. Patient KN, 10 years old, diagnosed with type 1 diabetes mellitus, high myopia.



The state of the retinal vessels in boys of this group ranges from 139.64 μm to 159.43 μm in vein OD, 89.7 μm to 101.9 μm in arteries, on average 95.95 μm, vein OS from 139.43 μm to 160.54 μm , arteries from 88.2 microns to 103 microns, an average of 94.95 microns.

Figure 18

Morphometric parameters of retinal vessels. Patient K.N. 10 years old, diagnosed with type 1 diabetes mellitus, high myopia.



Conclusions: Thus, the determination of the morphometric parameters of the light-refracting parts of the eye and the elements of the fundus in children with diabetes mellitus with myopia is valid, regardless of the severity of myopia, as a result of diabetes, reactive-dystrophic pathological changes in these parameters of the eye were revealed. These identified morphological changes help to identify and diagnose pathological changes in the light-refracting parts of the eye and the elements of the fundus.

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