

OPTICAL POWER OF THE CORNEA: FEATURES AT DIFFERENT DEGREES OF MYOPIA¹Municipal scientific and research institution "Research Institute of Socio-Economic Development of the City" (Kyiv, Ukraine)²Oles Honchar Dnipro National University (Dnipro, Ukraine)³Private Higher Education Institute Kyiv International University (Kyiv, Ukraine)

drozdova@ua.fm

Myopia today occupies one of the leading places in eye pathology; its prevalence and severity are significantly increasing worldwide. The aim is to assess the optical power of the cornea as a factor affecting visual acuity in people with myopia of various degrees. 200 patients with myopia were examined, who were divided into groups: 1 (without myopia); 2 (with mild myopia), 3 (with moderate myopia); 4 (with high myopia). Statistical analysis of the study results was carried out using mathematical statistics methods, in particular primary statistical and correlation analyses. Compared with emmetropes, in individuals with low myopia, the most significant changes in corneal optical power were observed in the Central zone; in patients with moderate myopia – in the Peripheral Superior Nasal and Peripheral Inferior Temporal zones; in subjects with high myopia – in the Central, Peripheral Inferior Nasal and Temporal zones. Common factors influencing the corneal optical power in all zones were means keratometric radius (mm) and keratometric power (D) under normal conditions and cycloplegia. Determining the characteristics of the cornea at different degrees of myopia, the relationships between the indicators of the optical power of the cornea and the data of vision and refractometry are the basis for deepening knowledge about the etiopathogenesis of myopia, the ability to predict complications and develop strategies for its prevention and correction.

Key words: optical power, corneal epithelial thickness, myopia, axial length, spherical equivalent, correlation analysis.

Connection of the publication with planned research work.

The results of the study were obtained by the authors during the research work of the Department of Psychology and Pedagogy of the Kyiv International University "The problem of formation and transformation of the self-concept and meaningful life orientations of modern youth in conditions of martial law and post-war recovery" (state registration number 0125U003729).

Introduction.

Myopia is one of the most common causes of vision loss. It is predicted that by 2050, about 9.8% of the world's population will have a high degree of myopia [1]. High degree of myopia is associated with changes in the sclera, choroid and retina, due to changes in the axial length of the eye and remodeling of scleral tissues, which in turn increases the risk of developing glaucoma, retinal detachment, myopic retinopathy, and as a result, vision loss [2, 3].

The corneal epithelium, as the outer layer of the cornea, is relatively stable, constantly renewing, plastic and with significant compensatory properties [4]. It has 5–7 cell layers and an optimal central thickness of 50–52 μm. Corneal epithelial thickness (CET) has the ability to adapt its profile to compensate for curvature and irregularities of the stromal layer, restoring a smooth ocular surface [5]. CET varies in different parts of the cornea and depends on a number of factors, such as gender, age, and ocular health [6, 7]. A number of imaging techniques are used to measure CET, including confocal microscopy [8], very high-frequency digital ultrasound [9], and anterior segment optical coherence tomography [4, 10, 11].

To date, there are differences in views regarding changes in corneal biomechanical parameters during myopia progression [12, 13]. Lee R. et al., 2016 showed significant differences during myopia progression in

such indicators as peak distance, external applanation velocity, and deformation amplitude [14]. They showed the relationship of intraocular pressure, central corneal thickness, and refractive error with peak distance and external applanation velocity, but did not take into account the axial length of the eye [2].

The aim of the study.

To assess the features of corneal optical power at different degrees of myopia and to identify factors influencing it.

Object and research methods.

Clinical studies of people with myopia were conducted in accordance with the Declaration of Helsinki of the World Medical Association, orders of the Ministry of Health of Ukraine (No. 281 dated 01.11.2000, No. 355 dated 09.25.2002) as amended by orders of the Ministry of Health of Ukraine No. 574 dated 05.08.2009, No. 1118 dated 12.21.2012.

200 patients were examined in ophthalmological centers in Kyiv. After signing informed consent, this study included patients with varying degrees of myopia combined with mild myopic astigmatism, with no history of corneal disease, keratoconus or keratoglobus, corneal dystrophy, congenital cataract, corneal or vitreous opacities, glaucoma, and optic nerve disease of any etiology.

All subjects were divided into 4 groups: group 1 – 11 people without myopia; group 2 – 77 people with mild myopia, group 3 – 74 people with moderate myopia; group 4 – 38 people with high myopia. In people of groups 1, 2, 3 and 4, the uncorrected distance visual acuity was 0.93 ± 0.039 IU; 0.14 ± 0.012 IU; 0.05 ± 0.005 IU; 0.03 ± 0.001 IU. Spherical refraction in all four groups was -0.05 ± 0.045 Dptr.; -2.00 ± 0.072 Dptr.; -4.41 ± 0.114 Dptr.; -7.56 ± 0.147 Dptr. and cylindrical – -0.16 ± 0.187 Dptr.; -0.59 ± 0.056 Dptr.; -0.63 ± 0.065 Dptr.; -0.57 ± 0.080 Dptr, respectively. In both healthy individuals and those

with mild, moderate and high myopia, the length of the anterior-posterior axis of the eye was 23.31 ± 0.109 mm; 24.47 ± 0.073 mm; 25.29 ± 0.074 mm; 26.31 ± 0.099 mm, and the corneal thickness at the central point was 559.41 ± 4.849 μ m; 551.56 ± 2.495 μ m; 547.07 ± 2.685 μ m; 550.79 ± 3.381 μ m [15].

The following ophthalmological examinations were performed on the patients: visometry, refractokeratometry, intraocular pressure measurement, biomicroscopy and ophthalmoscopy, computer keratometry and keratopography, biometry, optical coherence tomography.

Optical density and epithelial thickness were measured in pre-defined concentric ring-shaped zones located in the center of the cornea. Specific regions included the central zone (0–3 mm), paracentral zone (3–6 mm), and peripheral zone (6–8 mm). Measurements were made for the superior, inferior, nasal, and temporal regions within these zones [11].

The study results were processed using methods of mathematical statistics. Data analysis was performed in the JupyterLab environment using Python and the pandas, SciPy, scikit-learn, and statsmodels libraries.

The median and interquartile range (Me [Q25%; Q75%]) were used to describe the quantitative variables, as the distribution of most variables according to the Shapiro–Wilk test deviated from normality [16]. Pairwise comparisons between groups with different degrees of myopia were performed using the Mann–Whitney U test [16]. Only statistically significant differences ($p < 0.05$, $p < 0.01$, and $p < 0.001$) were indicated in the **table**.

Spearman's rank correlation coefficient [16] was used to identify relationships between variables. Only correlations with statistical significance ($p < 0.001$) were reported in the results.

The authors used ChatGPT (OpenAI, San Francisco, California, USA) to edit the English text. The authors reviewed and checked all AI-generated content to ensure accuracy and integrity.

Research results and their discussion.

When comparing corneal optical power between emmetropic individuals and patients with myopia, it was found that in emmetropes and individuals with low myopia the highest values were observed in the Central Inferior Temporal, Paracentral Superior Nasal¹ and Paracentral Inferior Temporal zones, whereas the lowest values were recorded in the Peripheral Superior Nasal³, Peripheral Superior Nasal⁴ and Peripheral Inferior Nasal¹ zones (**table**).

Compared with emmetropes, patients with low myopia demonstrated an increase in corneal optical power at the Central point by 0.7% ($p < 0.001$). In patients with moderate myopia, an increase was observed in the Central zone by 1.4% ($p < 0.001$), Central Superior Nasal by 1.9% ($p < 0.05$), Central Inferior Nasal by 1.4% ($p < 0.05$), Central Inferior Temporal by 1.2% ($p < 0.05$), Central Superior Temporal by 1.4% ($p < 0.05$), Paracentral Superior Nasal¹ by 0.9% ($p < 0.05$), Paracentral Inferior Nasal¹ by 1.4% ($p < 0.05$), Paracentral Inferior Nasal² by 1.2% ($p < 0.05$), Paracentral Inferior Temporal¹ by 1.4% ($p < 0.05$), Paracentral Inferior Temporal² by 1.4% ($p < 0.05$), Peripheral Superior Nasal⁴ by 1.7% ($p < 0.05$), Peripheral Inferior Nasal¹ by 1.4% ($p < 0.05$), Peripheral Inferior Nasal² by 1.6% ($p < 0.05$), Peripheral Inferior Nasal³ by 1.9% ($p < 0.01$), Peripheral Inferior Temporal¹ by 2.1% ($p < 0.01$), Peripheral Inferior Temporal² by 2.1%

($p < 0.01$), Peripheral Inferior Temporal³ by 1.6% ($p < 0.01$), Peripheral Superior Temporal¹ by 1.2% ($p < 0.05$), and Peripheral Superior Temporal² by 0.7% ($p < 0.05$). Individuals with high myopia differed from emmetropes by an increase in corneal optical power at the Central point by 0.9% ($p < 0.001$), Paracentral Inferior Temporal¹ by 0.7% ($p < 0.05$), Paracentral Inferior Temporal² by 0.5% ($p < 0.05$), Peripheral Superior Nasal⁴ by 1.4% ($p < 0.05$), Peripheral Inferior Nasal¹ by 1.4% ($p < 0.05$), Peripheral Inferior Nasal³ by 1.4% ($p < 0.01$), Peripheral Inferior Temporal¹ by 1.4% ($p < 0.01$), Peripheral Inferior Temporal² by 1.6% ($p < 0.01$), Peripheral Inferior Temporal³ by 1.2% ($p < 0.01$), Peripheral Superior Temporal¹ by 1.2% ($p < 0.05$) and Peripheral Superior Temporal² by 0.5% ($p < 0.05$) (**table**).

In patients with moderate myopia, the lowest corneal optical power values were observed in the Peripheral Superior Nasal⁴, Peripheral Inferior Nasal¹, Peripheral Superior Temporal¹, and Peripheral Superior Temporal² zones, whereas the highest values were found in the Central Inferior Temporal, Central Superior Temporal, and Paracentral Superior Nasal¹. In patients with high myopia, the lowest values were recorded in the Paracentral Inferior Nasal¹, Paracentral Superior Temporal¹, Peripheral Superior Nasal³, Peripheral Superior Nasal⁴, Peripheral Inferior Nasal¹ and Peripheral Superior Temporal² zones, while the highest values were observed in the Paracentral Superior Nasal¹ and Paracentral Inferior Temporal¹ zones (**table**).

The optical power of the cornea in the Central zone was statistically significantly correlated with biometric parameters under normal conditions and under cycloplegia: flat keratometric radius (mm) ($r = -0.945$ and $r = -0.947$), steep keratometric radius (mm) ($r = -0.937$ and $r = -0.941$), flat keratometric power (D) ($r = 0.93$ and $r = 0.943$), steep keratometric power (D) ($r = 0.932$ and $r = 0.939$), mean keratometric radius (mm) ($r = -0.965$ and $r = -0.966$), and mean keratometric power (D) ($r = 0.961$ and $r = 0.966$); corneal curvature parameters: Cornea Front flattest radius of curvature (mm) ($r = -0.931$), flattest radius of curvature (mm) ($r = 0.939$); corneal optical power at specific zones: Central Superior Nasal ($r = 0.957$), Central Inferior Nasal ($r = 0.953$), Central Inferior Temporal ($r = 0.939$), Central Superior Temporal ($r = 0.927$), Paracentral Superior Nasal¹ ($r = 0.894$), Paracentral Superior Nasal² ($r = 0.926$), Paracentral Inferior Nasal¹ ($r = 0.925$), Paracentral Inferior Nasal² ($r = 0.933$) and a number of other indicator (**fig. 1A**).

In the Central Inferior Nasal zone, corneal optical power was significantly associated with biometric parameters under normal conditions and under cycloplegia: flat keratometric radius (mm) ($r = -0.935$ and $r = -0.939$), steep keratometric radius (mm) ($r = 0.929$ and $r = -0.932$), flat keratometric power (D) ($r = 0.919$ and $r = 0.934$), steep keratometric power (D) ($r = 0.923$ and $r = 0.931$), mean keratometric radius (mm) ($r = -0.952$ and $r = -0.956$) and mean keratometric power (D) ($r = 0.953$ and $r = 0.955$); corneal curvature parameters: Cornea Front flattest radius of curvature (mm) ($r = -0.919$), refractive power of the flat meridian (D) ($r = 0.928$), steepest radius of curvature (mm) ($r = -0.928$), refractive power of the steep meridian (D) ($r = 0.928$), mean radius of curvature (mm) ($r = -0.95$), mean keratometric power (D) ($r = 0.95$); corneal optical power at specific zones: Central ($r = 0.953$), Paracentral Inferior Nasal¹ ($r = 0.928$), Paracen-

Table – Corneal optical power in people with different degrees of myopia

Corneal optical power parameters	Patients			
	no myopia	myopia		
		low degree	moderate degree	high degree
Central	43.2 [42.5; 43.8]	43.5*** [42.3; 44.2]	43.8**** [43.0; 44.8]	43.6*** [43.1; 44.0]
Central Superior Nasal	42.9 [42.1; 43.8]	43.4 [42.2; 44.2]	43.7** [42.9; 44.6]	43.6 [43; 44.1]
Central Inferior Nasal	43.2 [42.6; 43.7]	43.5 [42.4; 44.4]	43.8** [43; 44.7]	43.5 [43.0; 44]
Central Inferior Temporal	43.4 [42.9; 43.9]	43.7 [42.5; 44.4]	43.9** [42.9; 44.8]	43.6 [43.2; 44.3]
Central Superior Temporal	43.3 [42.3; 43.8]	43.5 [42.5; 44.4]	43.9** [42.9; 44.7]	43.6 [43.1; 44.1]
Paracentral Superior Nasal ¹	43.7 [42.8; 44.3]	43.8 [42.9; 44.7]	44.1* [43.2; 45.0]	44.0 [43.3; 44.7]
Paracentral Superior Nasal ²	43.0 [42.2; 43.8]	43.4 [42.1; 44.3]	43.5* [42.7; 44.5]	43.5 [42.8; 44]
Paracentral Inferior Nasal ¹	42.5 [41.9; 43.3]	43 [41.6; 43.9]	43.1* [42.2; 44.0]	43.0 [42.5; 43.5]
Paracentral Inferior Nasal ²	43.2 [42.5; 43.6]	43.5 [42.3; 44.4]	43.7* [42.9; 44.5]	43.5 [43; 44.1]
Paracentral Inferior Temporal ¹	43.6 [43.0; 44.0]	43.7 [42.6; 44.6]	44.2* [43.3; 45.0]	43.9* [43.4; 44.7]
Paracentral Inferior Temporal ²	43.3 [42.4; 43.9]	43.6 [42.2; 44.4]	43.9*** [42.9; 44.5]	43.5* [43.1; 44.4]
Paracentral Superior Temporal ¹	43 [42.3; 43.5]	43.2 [41.8; 44.2]	43.1** [42.4; 44.2]	43.1 [42.6; 43.8]
Paracentral Superior Temporal ²	43.4 [42.8; 43.9]	43.5 [42.2; 44.3]	43.7 [42.6; 44.5]	43.7 [42.9; 44.1]
Peripheral Superior Nasal ¹	43.2 [42.1; 43.9]	43.3 [42.2; 44.2]	43.4 [42.6; 44.4]	43.5 [42.7; 44]
Peripheral Superior Nasal ²	42.8 [42.1; 43.7]	43.2 [41.9; 44]	43.4 [42.4; 44.2]	43.4 [42.7; 44]
Peripheral Superior Nasal ³	42.3 [41.8; 43.3]	42.9 [41.6; 43.8]	43.2 [42.1; 44.0]	43.1 [42.3; 43.7]
Peripheral Superior Nasal ⁴	42.2 [41.6; 42.9]	42.8 [41.5; 43.7]	42.9* [42.0; 43.6]	42.8* [42.2; 43.4]
Peripheral Inferior Nasal ¹	42.3 [41.7; 42.9]	42.8 [41.5; 43.7]	42.9* [42.1; 43.8]	42.9* [42.2; 43.4]
Peripheral Inferior Nasal ²	42.6 [42.1; 43.1]	43.1 [41.8; 43.9]	43.3* [42.5; 44.1]	43.2 [42.6; 43.9]
Peripheral Inferior Nasal ³	42.9 [42.3; 43.3]	43.3 [42; 44.1]	43.7** [42.7; 44.5]	43.5** [42.9; 44.2]
Peripheral Inferior Temporal ¹	43 [42.5; 43.5]	43.5 [42; 44.2]	43.9**** [42.8; 44.8]	43.6** [42.9; 44.5]
Peripheral Inferior Temporal ²	42.8 [42.5; 43.5]	43.2 [41.9; 44.1]	43.7**** [42.6; 44.5]	43.5** [42.9; 44.2]
Peripheral Inferior Temporal ³	42.6 [41.7; 43.4]	43 [41.8; 43.9]	43.3**** [42.3; 44]	43.1** [42.6; 43.8]
Peripheral Superior Temporal ¹	42.3 [41.5; 43]	42.7 [41.3; 43.7]	42.8** [41.9; 43.7]	42.8* [42.3; 43.3]
Peripheral Superior Temporal ²	42.5 [41.3; 42.7]	42.8 [41.4; 43.6]	42.8* [41.8; 43.6]	42.7* [42.1; 43.2]
Peripheral Superior Temporal ³	42.6 [41.5; 43.4]	42.9 [41.6; 43.8]	43.1 [42.1; 43.8]	43 [42.4; 43.6]
Peripheral Superior Temporal ⁴	43 [41.8; 43.6]	43.2 [41.9; 44]	43.4 [42.3; 44.2]	43.4 [42.6; 43.9]

Notes: p-values represent differences between groups: *, **, *** – p<0.05, p<0.01, p<0.001 for myopic vs. non-myopic patients; ^, ^^ – p<0.05, p<0.01 for low vs. moderate myopia; # – p<0.05 for low vs. high myopia.

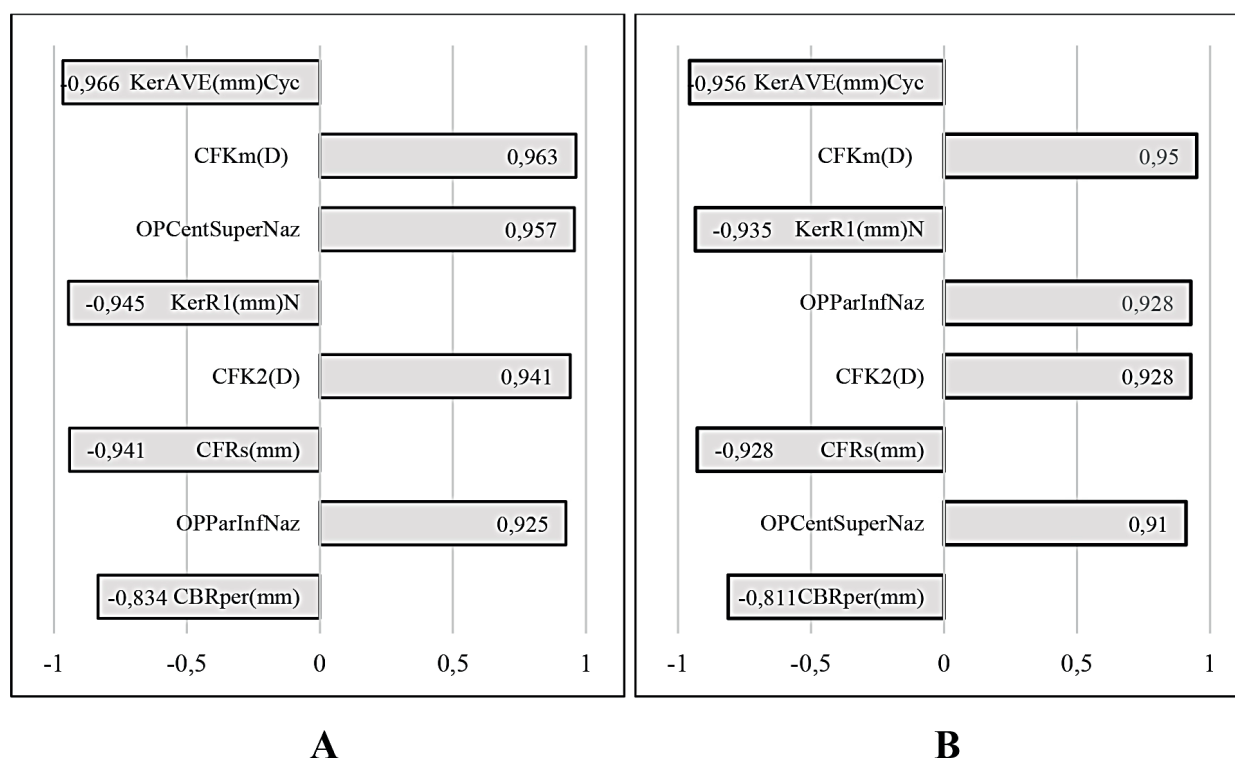
tral Inferior Nasal² (r=0.968) and a number of other indicator (**fig. 1B**).

The optical power of the cornea in the Central Inferior Temporal point was statistically significantly associated with biometric parameters under normal conditions and under cycloplegia: flat keratometric radius (mm) (r=-0.921 and r=-0.92), steep keratometric radius (mm) (r=-0.909 and r=-0.918), flat keratometric power (D) (r=0.911 and r=0.921), steep keratometric power (D) (r=0.901 and r=0.91), mean keratometric radius (mm) (r=-0.939 and r=-0.941), and mean keratometric power (D) (r=0.933 and r=0.94); corneal curvature parameters: Cornea Front flattest radius of curvature (mm) (r=-0.908), refractive power of the flat meridian (D) (r=0.915), steepest radius of curvature (mm) (r=-0.917), refractive power of the steep meridian (D) (r=0.917), mean radius of curvature (mm) (r=-0.939), and mean keratometric power (D) (r=0.936); corneal optical power at specific zones: Central (r=0.939), Central Superior Nasal (r=0.939), Central Inferior Nasal (r=0.906), Paracentral Superior Nasal² (r=0.908), Paracentral Inferior Nasal¹ (r=0.908), Paracentral Inferior Temporal² (r=0.944), Peripheral Inferior Temporal³ (r=0.921), Peripheral Superior Temporal¹ (r=0.897) and a number of other indicator (**fig. 2A**).

In the Central Superior Temporal zone, corneal optical power was significantly associated with biometric parameters under normal conditions and under cycloplegia: flat keratometric radius (mm) (r=-0.92 and r=-0.921), steep keratometric radius (mm) (r=-0.921 and r=-

0.92), flat keratometric power (D) (r=0.901 and r=0.911), steep keratometric power (D) (r=0.914 and r=0.925), mean keratometric radius (mm) (r=-0.943 and r=-0.942), and mean keratometric power (D) (r=0.94 and r=0.941); corneal curvature parameters: Cornea Front refractive power of the flat meridian (D) (r=0.905), steepest radius of curvature (mm) (r=-0.913), refractive power of the steep meridian (D) (r=0.913), mean radius of curvature (mm) (r=-0.93), mean keratometric power (D) (r=0.93), and minimum radius of curvature (mm) (r=-0.906); corneal optical power at specific zones: Central (r=0.927), Central Inferior Nasal (r=0.911), Paracentral Superior Nasal¹ (r=0.913), Paracentral Inferior Nasal² (r=0.901), Peripheral Superior Temporal² (r=0.922), Peripheral Superior Temporal³ (r=0.943), and Peripheral Superior Temporal⁴ (r=0.913) and a number of other indicator (**fig. 2B**).

Corneal optical power in the Paracentral Inferior Nasal² zone was significantly correlated with biometric parameters: uncorrected distance visual acuity (r=-0.106), under normal conditions and under cycloplegia – flat keratometric radius (mm) (r=-0.941 and r=-0.941), steep keratometric radius (mm) (r=-0.928 and r=-0.931), flat keratometric power (D) (r=0.928 and r=0.938), steep keratometric power (D) (r=0.92 and r=0.93), mean keratometric radius (mm) (r=-0.954 and r=-0.958), and mean keratometric power (D) (r=0.956 and r=0.956); corneal curvature parameters: Cornea Front flattest radius of curvature (mm) (r=-0.922), refractive power of the



Notes: Here and in the following pictures KerR1(mm)N – flat keratometric radius (mm) under normal conditions; KerAVE(mm)Cyc – mean keratometric radius (mm) under cycloplegia; CFRs(mm) – Cornea Front steepest radius of curvature (mm); CFK2(D) – Cornea Front refractive power of the steep meridian (D); CFKm(D) – Cornea Front mean keratometric power (D); CBRper(mm) – Cornea Back peripheral corneal radius (mm); OPCentSuperNaz – optical power in the Central Superior Nasal; OPParInfNaz¹ – optical power at the Paracentral Inferior Nasal¹ point.

flat meridian (D) ($r=0.93$), steepest radius of curvature (mm) ($r=-0.925$), refractive power of the steep meridian (D) ($r=0.925$), mean radius of curvature (mm) ($r=-0.95$), mean keratometric power (D) ($r=0.95$), and minimum radius of curvature (mm) ($r=-0.92$); corneal optical power at specific zones: Central ($r=0.933$), Central Superior

Nasal ($r=0.9$), Central Inferior Nasal ($r=0.968$), Peripheral Superior Nasal⁴ ($r=0.913$), Peripheral Inferior Nasal¹ ($r=0.941$), Peripheral Inferior Nasal² ($r=0.967$), Peripheral Inferior Nasal³ ($r=0.954$), Peripheral Inferior Temporal¹ ($r=0.928$), Peripheral Inferior Temporal² ($r=0.926$),

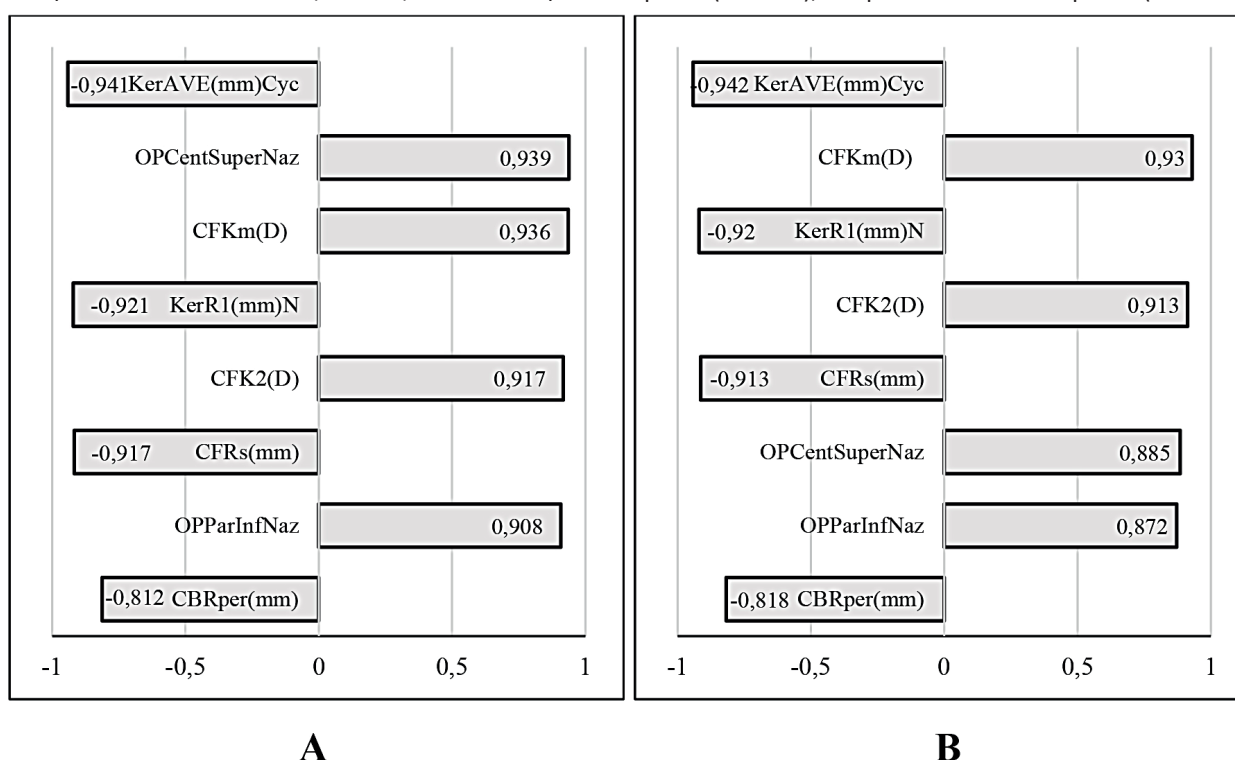


Figure 2 – Correlations of corneal optical power: A – in the Central Inferior Temporal zone; B – in the Central Superior Temporal zone.

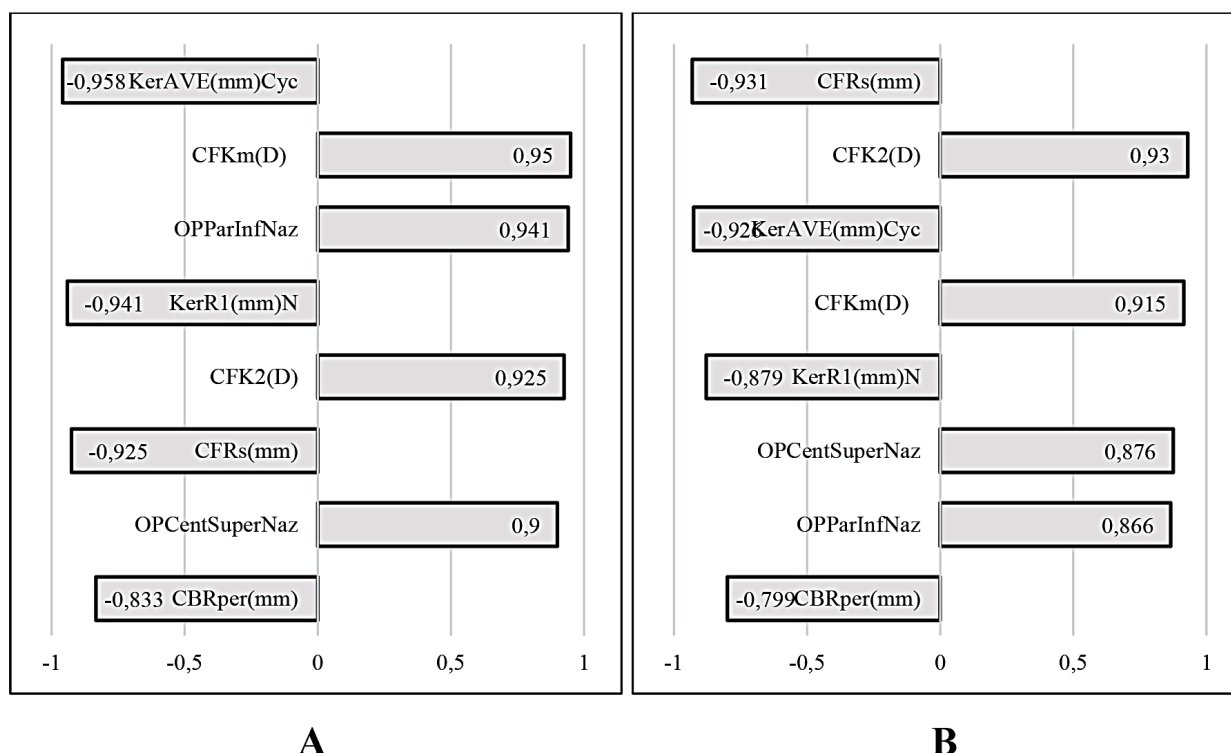


Figure 3 – Correlations of corneal optical power: A – in the Paracentral Inferior Nasal² zone; B – in the Paracentral Inferior Temporal¹ zone. Peripheral Inferior Temporal³ ($r=0.916$) and a number of other indicator (fig. 3A).

In the Paracentral Inferior Temporal¹ zone, corneal optical power was statistically significantly associated with biometric parameters: uncorrected distance visual acuity ($r=-0.143$), under normal conditions and under cycloplegia – steep keratometric radius (mm) ($r=-0.934$ and $r=-0.934$), steep keratometric power (D) ($r=0.923$ and $r=0.926$), mean keratometric radius (mm) ($r=-0.926$ and $r=-0.926$), and mean keratometric power (D) ($r=0.924$ and $r=0.925$); corneal curvature parameters: Cornea Front minimum radius of curvature (mm) ($r=-0.928$); corneal optical power at specific zones: Paracentral Inferior Nasal² ($r=0.95$), Paracentral Inferior Temporal² ($r=0.927$), Peripheral Inferior Nasal² ($r=0.914$), Peripheral Inferior Nasal³ ($r=0.948$), Peripheral Inferior Temporal¹ ($r=0.959$), Peripheral Inferior Temporal² ($r=0.956$), Peripheral Inferior Temporal³ ($r=0.91$) and a number of other indicator (fig. 3B).

Corneal optical power in the Peripheral Inferior Nasal² zone was significantly associated with biometric parameters: uncorrected distance visual acuity ($r=-0.118$), under normal conditions and under cycloplegia – flat keratometric radius (mm) ($r=-0.937$ and $r=-0.935$), steep keratometric radius (mm) ($r=-0.903$ and $r=-0.908$), flat keratometric power (D) ($r=0.927$ and $r=0.934$), mean keratometric radius (mm) ($r=-0.944$ and $r=-0.942$), and mean keratometric power (D) ($r=0.941$ and $r=0.943$); corneal curvature parameters: Cornea Front flattest radius of curvature (mm) ($r=-0.918$), refractive power of the flat meridian (D) ($r=0.926$), mean radius of curvature (mm) ($r=-0.934$), mean keratometric power (D) ($r=0.936$), peripheral corneal radius (mm) ($r=-0.926$); corneal optical power at specific zones: Central ($r=0.909$), Central Inferior Nasal ($r=0.943$), Paracentral Inferior Nasal¹ ($r=0.945$), Paracentral Inferior Nasal² ($r=0.967$), Peripheral Inferior

Nasal¹ ($r=0.97$), Peripheral Inferior Nasal³ ($r=0.964$) and a number of other indicator (fig. 4A).

In the Peripheral Inferior Nasal³ zone, the corneal optical power was statistically significantly correlated with biometric parameters: uncorrected distance visual acuity ($r=-0.158$), under normal conditions and under cycloplegia – flat keratometric radius (mm) ($r=-0.893$ and $r=-0.891$), steep keratometric radius (mm) ($r=-0.913$ and $r=-0.915$), mean keratometric radius (mm) ($r=-0.923$ and $r=-0.923$), and mean keratometric power (D) ($r=0.921$ and $r=0.923$); corneal curvature parameters: Cornea Front steepest radius of curvature (mm) ($r=-0.907$), refractive power of the steep meridian (D) ($r=0.906$), mean radius of curvature (mm) ($r=-0.91$), mean keratometric power (D) ($r=0.912$), peripheral corneal radius (mm) ($r=-0.913$), and minimum radius of curvature (mm) ($r=-0.905$); corneal optical power at specific zones: Central Inferior Nasal ($r=0.922$), Paracentral Inferior Nasal² ($r=0.954$), Paracentral Inferior Temporal¹ ($r=0.948$), Paracentral Inferior Temporal² ($r=0.906$), Peripheral Inferior Nasal¹ ($r=0.908$), Peripheral Inferior Nasal² ($r=0.964$), Peripheral Inferior Temporal¹ ($r=0.982$), Peripheral Inferior Temporal² ($r=0.957$), Peripheral Inferior Temporal³ ($r=0.912$) and a number of other indicator (fig. 4B).

The corneal optical power in the Peripheral Inferior Temporal zone¹ was significantly correlated with biometric parameters: uncorrected distance visual acuity ($r=-0.162$), under normal conditions and under cycloplegia – flat keratometric radius (mm) ($r=-0.869$ and $r=-0.866$), steep keratometric radius (mm) ($r=-0.909$ and $r=-0.911$), mean keratometric radius (mm) ($r=-0.907$ and $r=-0.907$), and mean keratometric power (D) ($r=0.905$ and $r=0.906$); corneal curvature parameters: Cornea Front steepest radius of curvature (mm) ($r=-0.906$), refractive power of the steep meridian (D) ($r=0.905$), and minimum radius of curvature (mm) ($r=-0.901$); corneal optical power at specific zones: Paracentral Inferior Nasal² ($r=0.928$),

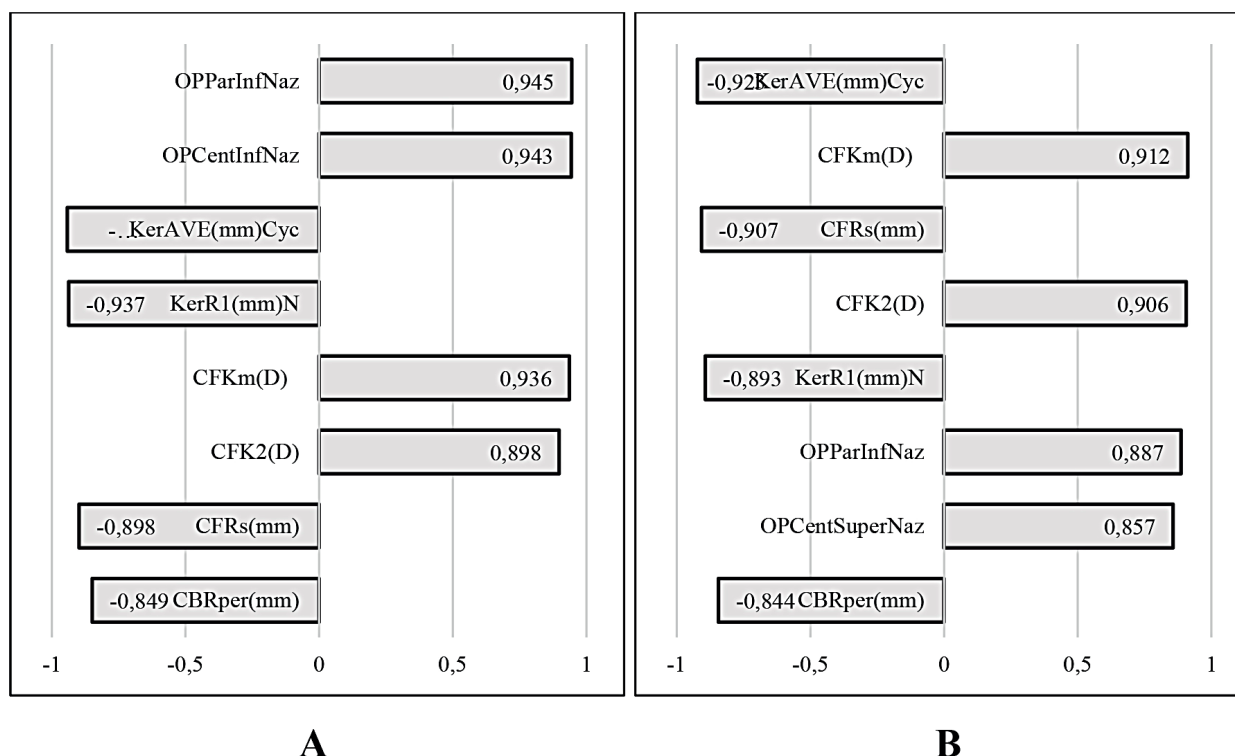


Figure 4 – Correlations of corneal optical power: A – in the Peripheral Inferior Nasal² zone; B – in the Peripheral Inferior Nasal³ zone.

Paracentral Inferior Temporal¹ ($r=0.959$), Paracentral Inferior Temporal² ($r=0.913$), Peripheral Inferior Nasal² ($r=0.926$), Peripheral Inferior Nasal³ ($r=0.982$), Peripheral Inferior Temporal² ($r=0.98$), Peripheral Inferior Temporal³ ($r=0.921$) and a number of other indicator, with whom the connection was somewhat weaker (fig. 5A).

In the Peripheral Inferior Temporal² zone, corneal optical power was statistically significantly associated with biometric parameters: uncorrected distance visual acuity ($r=-0.142$), intraocular pressure ($r=-0.134$), under normal conditions and under cycloplegia – steep keratometric radius (mm) ($r=-0.917$ and $r=-0.921$), steep keratometric power (D) ($r=0.901$ and $r=0.913$), mean keratometric radius (mm) ($r=-0.927$ and $r=-0.928$), and mean keratometric power (D) ($r=0.924$ and $r=0.926$); corneal curvature parameters: Cornea Front steepest radius of curvature (mm) ($r=-0.915$), refractive power of the steep meridian (D) ($r=0.915$), mean radius of curvature of the anterior corneal surface (mm) ($r=-0.917$), mean keratometric power of the anterior corneal surface (D) ($r=0.919$), peripheral corneal radius (mm) ($r=-0.908$), and minimum radius of curvature (mm) ($r=-0.908$); corneal optical power at specific zones: Paracentral Inferior Nasal² ($r=0.926$), Paracentral Inferior Temporal¹ ($r=0.956$), Paracentral Inferior Temporal² ($r=0.954$), Peripheral Inferior Nasal² ($r=0.92$), Peripheral Inferior Nasal³ ($r=0.957$), Peripheral Inferior Temporal¹ ($r=0.98$), Peripheral Inferior Temporal³ ($r=0.966$), and a number of other indicator (fig. 5B).

Corneal optical power in the Peripheral Inferior Temporal³ zone was significantly associated with biometric parameters: uncorrected distance visual acuity ($r=-0.109$), intraocular pressure ($r=0.133$), under normal conditions and under cycloplegia – flat keratometric radius (mm) ($r=-0.94$ and $r=-0.935$), steep keratometric radius (mm) ($r=-0.9$ and $r=-0.901$), flat keratometric power

(D) ($r=0.928$ and $r=0.935$), mean keratometric radius (mm) ($r=-0.941$ and $r=-0.942$), and mean keratometric power (D) ($r=0.94$ and $r=0.941$); corneal curvature parameters: Cornea Front flattest radius of curvature (mm) ($r=-0.918$), refractive power of the flat meridian (D) ($r=0.924$), mean radius of curvature of the anterior corneal surface (mm) ($r=-0.93$), mean keratometric power of the anterior corneal surface (D) ($r=0.932$), peripheral corneal radius (mm) ($r=-0.92$); corneal optical power at specific zones: Central ($r=0.904$), Central Superior Nasal ($r=0.902$), Central Inferior Temporal ($r=0.921$), Paracentral Inferior Nasal¹ ($r=0.923$), Paracentral Inferior Nasal² ($r=0.916$), Paracentral Inferior Temporal¹ ($r=0.91$), Paracentral Inferior Temporal² ($r=0.972$), Paracentral Superior Temporal¹ ($r=0.901$), Peripheral Superior Nasal⁴ ($r=0.909$), Peripheral Inferior Nasal¹ ($r=0.914$), Peripheral Inferior Nasal² ($r=0.912$), Peripheral Inferior Nasal³ ($r=0.921$), Peripheral Inferior Temporal² ($r=0.966$), Peripheral Superior Temporal¹ ($r=0.96$), Peripheral Superior Temporal² ($r=0.926$) and a number of other indicator, with whom the connection was somewhat weaker (fig. 6A).

In Peripheral Superior Temporal⁴ zone, the corneal optical power was statistically significantly related to biometric parameters under normal conditions and under cycloplegia: steep keratometric radius (mm) ($r=-0.902$ and $r=-0.906$), steep keratometric power (D) ($r=0.887$ and $r=0.91$), mean keratometric radius (mm) ($r=-0.899$ and $r=-0.901$); corneal optical power at specific zones: Paracentral Superior Temporal² ($r=0.929$), Peripheral Superior Nasal¹ ($r=0.96$), Peripheral Superior Nasal² ($r=0.918$) and Peripheral Superior Temporal³ ($r=0.962$) and a number of other indicator (fig. 6B).

Corneal optical power demonstrated a highly organized spatial structure. Strong correlation between neighboring central, paracentral and peripheral regions indicate that local optical properties of the cornea do

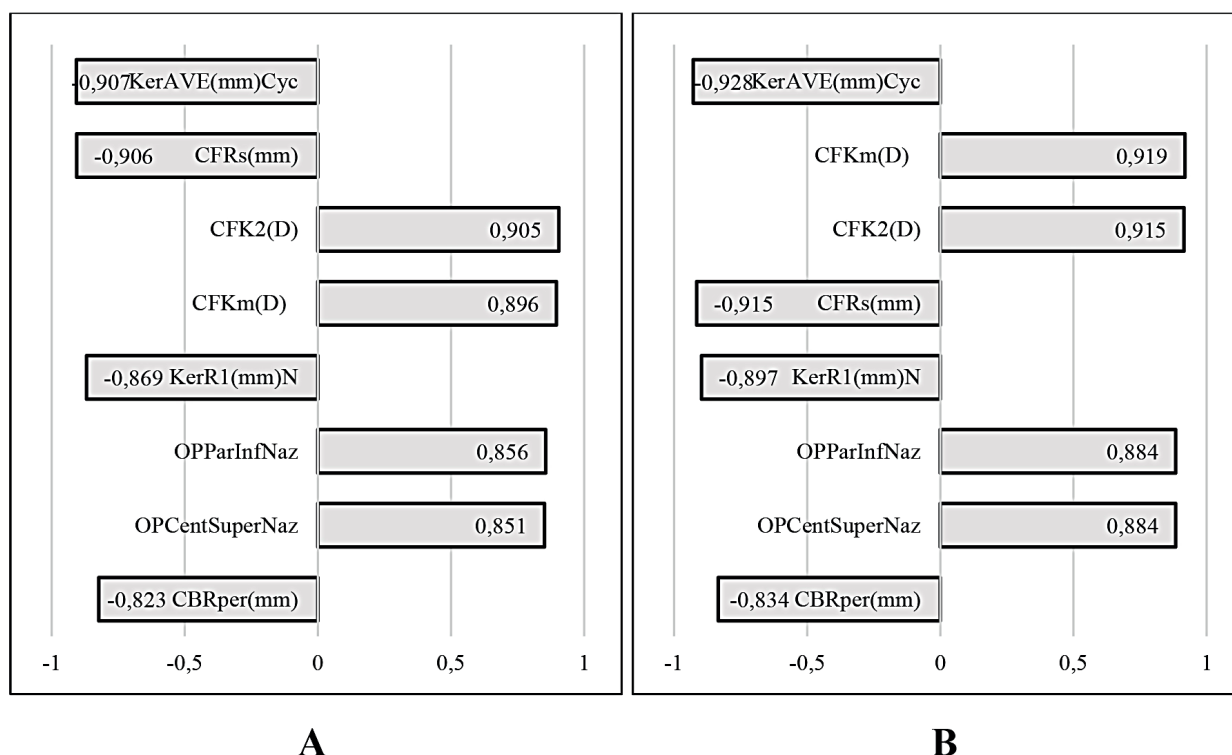


Figure 5 – Correlations of corneal optical power: A – in Peripheral Inferior Temporal¹ zone; B – in the the Peripheral Inferior Temporal² zone.

not vary independently but form integrated topographic patterns. The strongest associations were observed in inferior peripheral regions, suggesting that these areas may be more sensitive to corneal remodeling associated with myopia progression.

A meta-analysis by Zhang Z., et al., 2023, covering PubMed, EMBASE, Cochrane Library, Web of Science, and Medline from 2012 to 2023 [17], showed that in patients with different degrees of myopia, compared with emmetropes, anterior chamber depth, axial length, corneal curvature, and axial length to corneal radius ratio were significantly increased, whereas central corneal thickness, perifoveal retinal thickness (RT), corneal curvature radius (CR), subfoveal choroid thickness (ChT), parafoveal ChT, foveal ChT, perifoveal (except nasal) ChT, and retinal nerve fiber layer (pRNFL) (except temporal) thickness were significantly decreased. In the low and moderate myopia groups, parafoveal and perifoveal RT (except nasal), CCT and pRNFL (except superior and temporal) were significantly reduced. Compared with emmetropes, in the high myopia group, CR increased significantly, while perifoveal ChT (except nasal), perifoveal RT and pRNFL (except temporal), and parafoveal RT and LT decreased significantly [17].

Alturki H. et al., 2025, reported that in older individuals, higher average corneal thickness values were observed in the central, paracentral, and peripheral zones, but not in the upper paracentral, temporal, and nasal peripheral quadrants. In men with myopia, thickening was found in the central, paracentral, and peripheral zones, except for the lower peripheral quadrant; corneal thickness values were significantly higher than in women, and thickness increased with age. On average, the corneal thickness in the center reached 52.1 μm , while in the paracentral region it was 50.8 μm in the nasal, 49.8 μm in the temporal, 49.6 μm in the superior, and 49.3 μm in the inferior quadrant. Some differences

between upper and lower sections were observed in the paracentral and peripheral zones [11].

In our study, in emmetropes and patients with low myopia, the highest corneal optical power values were found in the Central and Paracentral Inferior Temporal, Paracentral Superior Nasal¹, while the lowest values were observed in the Peripheral Superior Nasal³, Peripheral Superior Nasal⁴, Peripheral Inferior Nasal¹ zones, with no significant differences between the two groups. In patients with moderate myopia, the lowest Paracentral values were found in the Peripheral Superior Nasal⁴, Inferior Nasal¹, Superior Temporal¹, Superior Temporal² zones; the highest values were found in the Central Inferior and Superior Temporal and Paracentral Superior Nasal¹ zones. In patients with high myopia, the lowest Paracentral values were found in the Paracentral Inferior Nasal¹ and Superior Temporal¹, Peripheral Superior Nasal³ and Nasal⁴, Peripheral Inferior Nasal¹, Peripheral Superior Temporal² zones; the highest values were found in the Paracentral Superior Nasal¹ and Paracentral Inferior Temporal¹ zones.

Alturki H. et al., 2025, using a one-way ANOVA, demonstrated that individuals with complex myopia had higher mean corneal thickness values in the inferior paracentral region, while those with mixed astigmatism had higher mean corneal thickness in the nasal paracentral region, and patients with low to moderate myopia had higher mean corneal thickness in the thinnest epithelial region [11].

Reinstein D. et al., 2024, using VHFU technology, showed that the corneal thickness in the center reaches 53,4 μm , without a tendency to thinning in the periphery [18], whereas Loureiro T. et al., 2021 [10], Urs R. et al., 2016 [19], Latifi G. et al., 2020 [20], using SD-OCT, described that normal corneal thickness profiles thin towards the periphery. Several studies reported significantly thicker cornea in the lower part than the upper,

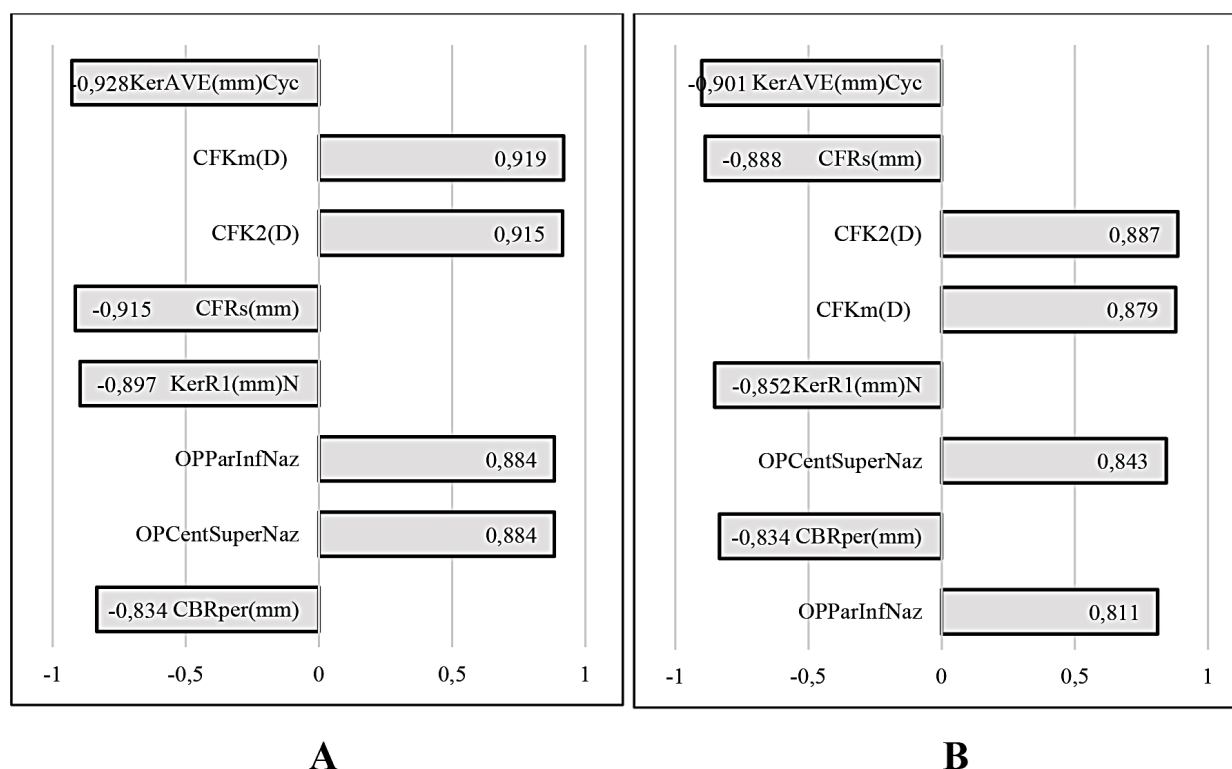


Figure 6 – Correlations of corneal optical power: A – in Peripheral Inferior Temporal³ zone; B – in the the Peripheral Inferior Temporal⁴ zone. which is characteristic of both healthy eyes and myopia [18, 21, 22].

Dutra B. et al., 2025, showed that epithelial thickness is not related to corneal structure and does not affect corneal optical power in emmetropes [23]. Wendelstein J et al., 2025, emphasized the need to consider epithelial thickness and corneal curvature when determining cornea or intraocular lens optical power for refractive surgery or keratoconus diagnosis [24].

Alturki HS et al., 2025, found significant correlation between the superior, inferior, temporal, and nasal quadrants in the paracentral and peripheral zones, while no significant correlation was found between the spherical equivalent and the corneal thickness map [11].

According to Iribarren R, et al., 2012, larger anterior chamber diameter is associated with a flatter cornea, and smaller diameter with a steeper cornea; corneal power correlates with anterior chamber diameter and axial length [25].

In our study, corneal optical power in the Central zone correlated under normal conditions and under cycloplegia with the mean keratometric radius (mm), mean keratometric power (D), Cornea Front and Cornea Back steepest radius of curvature (mm), refractive power of the steep meridian (D), mean radius of curvature (mm), mean keratometric power (D), and optical power in the Central Superior Nasal and Inferior Temporal zones; in the Central Inferior Temporal zone – under normal conditions and under cycloplegia with the mean keratometric radius (mm), mean keratometric power (D), Cornea Front and Cornea Back refractive power of the flat meridian (D), steepest radius of curvature (mm), refractive power of the steep meridian (D), and optical power in the Central and Superior Nasal and Paracentral Inferior Temporal zones²; in the Central Superior Temporal zone – under normal conditions and under cycloplegia with mean keratometric radius (mm), mean keratometric

power (D), Cornea Front and Cornea Back steepest radius of curvature (mm), mean radius of curvature (mm), mean keratometric power (D), and optical power in the Central, Peripheral Superior Temporal², Temporal³ and Temporal⁴ zones; in the Central Superior Nasal zone – under normal conditions and under cycloplegia with flat keratometric radius (mm), flat keratometric power (D), mean keratometric radius (mm), mean keratometric power (D), Cornea Front and Cornea Back mean radius of curvature (mm), mean keratometric power (D), and corneal optical power in the Central, Paracentral Superior Nasal¹ zones; in the Central Inferior Nasal zone – under normal conditions and under cycloplegia with mean keratometric radius (mm), mean keratometric power (D), Cornea Front and Cornea Back steepest radius of curvature (mm), refractive power of the steep meridian (D), mean keratometric power (D), and corneal optical power in Central, Paracentral Superior Nasal², Peripheral Superior Nasal³.

The corneal optical power in the Paracentral Inferior or Nasal² zone correlated under normal conditions and under cycloplegia with keratometry flat keratometric radius (mm), mean keratometric radius (mm), mean keratometric power (D), with Cornea Front and Cornea Back refractive power of the flat meridian (D), mean radius of curvature (mm), mean keratometric power (D), and corneal optical power in the Central Inferior Nasal and Temporal, Peripheral Inferior Nasal² and Nasal²; in the Paracentral Inferior Temporal¹ zone – under normal conditions and under cycloplegia with keratometry steep keratometric radius (mm), steep keratometric power (D), mean keratometric radius (mm), Cornea Front and Cornea Back steepest radius of curvature (mm), refractive power of the steep meridian (D), minimum radius of curvature (mm), and corneal optical power in the Peripheral Inferior Temporal¹ and Temporal² zones; in the Paracentral Superior Nasal² zone – under normal conditions and

under cycloplegia with steep keratometric radius (mm), steep keratometric power (D), mean keratometric radius (mm), mean keratometric power (D), Cornea Front and Cornea Back steepest radius of curvature (mm), refractive power of the steep meridian (D), mean radius of curvature (mm), mean keratometric power (D), and corneal optical power in Central and Superior Nasal zones; in the Paracentral Superior Temporal² zone – under normal conditions and under cycloplegia with flat keratometric radius (mm), steep keratometric power (D), mean keratometric radius (mm), mean keratometric power (D), Cornea Front and Cornea Back mean radius of curvature (mm), mean keratometric power (D), and corneal optical power in Central Superior Temporal, Peripheral Superior Temporal² and Temporal³ zones.

The corneal optical power in the Peripheral Inferior Nasal² zone was related under normal conditions and under cycloplegia to the keratometric measures flat keratometric radius (mm), mean keratometric radius (mm), mean keratometric power (D), Cornea Front and Cornea Back flattest radius of curvature (mm), steepest radius of curvature (mm), refractive power of the steep meridian (D), peripheral corneal radius (mm), and corneal optical power in Peripheral Superior Nasal⁴, Peripheral Inferior Nasal¹ and Nasal³ zones; in the Peripheral Inferior Temporal² zone – under normal conditions and under cycloplegia with mean keratometric radius (mm), mean keratometric power (D), Cornea Front and Cornea Back steepest radius of curvature (mm), refractive power of the steep meridian (D), mean keratometric power of the anterior corneal surface (D), and corneal optical power in Peripheral Inferior Nasal³, and Temporal¹ and Temporal³ zones; in the Peripheral Superior Nasal⁴ zone – under normal conditions and under cycloplegia with flat keratometric radius (mm), flat keratometric power (D), mean keratometric radius (mm), Cornea Front and Cornea Back flattest radius of curvature (mm), refractive power of the flat meridian (D), mean radius of curvature of the anterior corneal surface (mm), mean keratometric power (D), and corneal optical power in Paracentral Inferior Nasal¹, Peripheral Superior Nasal³, Peripheral Inferior Nasal³ zones; in the Peripheral Superior Temporal³ zone – under normal conditions and under cycloplegia with flat keratometric radius (mm), mean keratometric radius (mm), mean keratometric power (D), Cornea Front and Cornea Back mean radius of curvature (mm), mean keratometric power (D), peripheral corneal radius (mm), and corneal optical power in Paracentral and Peripheral Superior Temporal², Peripheral Superior Temporal⁴ zones.

Prospects for ocular surface research include the use of artificial intelligence. According to Shukla R. et al, 2025m ChatGPT 4.0 outperformed Google Gemini and Microsoft Bing in interpreting computed tomography for ocular surface diseases and may be applied in ophthalmology for early diseases diagnosis [26].

Conclusions.

1. In patients with low myopia, the highest corneal optical power was in the Central Inferior Temporal, Paracentral Superior Nasal¹ and Paracentral Inferior Temporal zones, while the lowest was in the Peripheral Superior Nasal³, Peripheral Superior Nasal⁴, and Peripheral Inferior Nasal¹ zones. Compared to emmetropes, these patients were distinguished by a significant increase in the corneal optical power at the Central point.

2. Among patients with moderate myopia, the highest corneal optical power was found in the Central, Paracentral Superior and Inferior Temporal, and Peripheral Inferior Temporal zones; the lowest was in the Peripheral Superior and Inferior Nasal, and Peripheral Superior Temporal. The corneal optical power increased most in the Peripheral Superior Nasal and Peripheral Inferior Temporal zones.

3. Patients with high myopia had the highest corneal optical power in the Paracentral Superior Nasal and Paracentral Inferior Temporal zones, and the lowest in the Peripheral Superior Nasal and Peripheral Superior Temporal zones. The most significant changes were observed in the Central, Peripheral Inferior Nasal and Temporal zones.

4. Corneal optical power in the Central zone correlated with the mean keratometric radius (mm) and mean keratometric power (D) under normal conditions and under cycloplegia, with the curvature of the central vertical radius (mm), refractive power of the central vertical radius of curvature (D), and refractive power of the average central radius in the 3 mm zone around the corneal apex (D) of the anterior and posterior corneal surface. In the Paracentral zone, it correlated with the steep keratometric radius (mm), mean keratometric radius (mm), mean keratometric power (D) under normal conditions and under cycloplegia, as well as with mean radius of curvature (mm), and mean keratometric power (D) of the anterior and posterior corneal surface. In the Peripheral zone, it correlated with the flat keratometric radius (mm), mean keratometric radius (mm), mean keratometric power (D) under normal conditions and under cycloplegia, as well as with the steepest radius of curvature (mm) and mean keratometric power (D) of the anterior and posterior corneal surface.

5. Corneal optical power in the Superior Temporal quadrant was associated with the mean keratometric radius (mm) and mean keratometric power (D) under normal conditions and under cycloplegia, as well as with the mean radius of curvature (mm) and mean keratometric power (D) of the anterior and posterior corneal surface. In the Inferior Temporal quadrant, it was associated with the mean keratometric radius (mm) and mean keratometric power (D) under normal conditions and under cycloplegia, as well as with the Cornea Front and Cornea Back steepest radius of curvature (mm) and refractive power of the central vertical radius of curvature of the anterior and posterior corneal surface. In the Superior Nasal quadrant, it was associated with the flat keratometric power (D), steep keratometric power (D), and mean keratometric power (D) under normal conditions and under cycloplegia, as well as with the mean radius of curvature (mm) and mean keratometric power (D) of the anterior and posterior corneal surface. In the Inferior Nasal quadrant it was associated with the mean keratometric radius (mm) and mean keratometric power (D) under normal conditions and under cycloplegia, as well as with the steepest radius of curvature (mm) and refractive power of the steep meridian (D) of the anterior and posterior corneal surface.

Prospects for further research.

In the future, the analysis of optical power and corneal thickness in people with myopia will be used to develop new approaches to determining the volume and area of laser correction, to develop practical recom-

mendations for preventing the progression of myopia in young people.

Study limitations.

The authors acknowledge that the limitations of this review are due to the previously defined scope of the review, time periods, and types of studies, as well as the availability of sources. The search strategy included PubMed, Clinical Key Elsevier, Cochrane Library, eBook Business Collection and Google Scholar. The included

studies varied in design and methodological quality; some studies were at high risk of bias, and inter-study variability remained substantial, reducing the internal validity of the pooled estimates and limiting the generalizability of the findings to other populations and clinical contexts. To reduce these impacts, independent double selection and data extraction, expanded combinations of keywords and logical operators were used.

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ОПТИЧНА СИЛА РОГІВКИ: ОСОБЛИВОСТІ ПРИ РІЗНИХ СТУПЕНЯХ МІОПІЇ

Дроздов В. О., Мацуґа О. М., Дроздова І. В., Мартиненко С. М.

Резюме. Міопія сьогодні посідає одне з провідних місць в патології ока; суттєво зростає її поширеність і виразність у всьому світі.

Мета – оцінити оптичну силу рогівки, як чинник, що впливає на гостроту зору у осіб з міопією різного ступеня.

Обстежено 200 пацієнтів з міопією, які були розподілені на групи: 1 – 11 осіб без міопії; 2 – 77 обстежених з короткозорістю слабкого ступеня, 3 – 74 осіб з міопією середнього ступеня; 4 – 38 обстежених з міопією високого ступеня. Статистичний аналіз результатів дослідження здійснювали із використанням методів математичної статистики, зокрема первинного статистичного та кореляційного аналізів.

В порівнянні з еметропами, у осіб з міопією низького ступеня спостерігались найсуттєвіші зміни оптичної сили рогівки в центральній зоні; у пацієнтів з міопією середнього ступеня – в зонах Peripheral Superior Nasal and Peripheral Inferior Temporal; у обстежених з високим ступенем міопії – в Central, Peripheral Inferior Nasal and Temporal зонах. Спільними факторами, що впливали на оптичну силу рогівки в усіх зонах, були середній кератометричний радіус (mm) і середня кератометрична потужність (D) в нормальних умовах і при циклоплегії; тоді як відмінними в центральній зоні – кривизна центрального вертикального радіуса (mm), сила заломлення центрального вертикального радіуса кривизни (D) і сила заломлення середнього центрального радіуса в зоні 3 мм навколо верхівки рогівки (D) передньої та задньої поверхні рогівки; у парацентральної зоні – крутий кератометричний радіус (mm) у нормі та при циклоплегії, середній радіус кривизни (mm) та кератометрична потужність (D) передньої та задньої поверхні рогівки; у периферичній зоні – плоский кератометричний радіус (mm) при нормальних умовах та циклоплегії, найбільш крутий радіус кривизни (mm) та середня кератометрична сила (D) передньої та задньої поверхні рогівки.

Визначення особливостей стану рогівки при різних ступенях міопії, взаємозв'язків між показниками оптичної сили рогівки та даними візю- та рефрактометрії є основою поглиблення знань щодо етіопатогенезу міопії, можливостей прогнозувати ускладнення та розробляти стратегії її профілактики й корекції.

Ключові слова: оптична сила рогівки, товщина епітелію рогівки, міопія, передньо-задня довжина ока, сферичний еквівалент, кореляційний аналіз

OPTICAL POWER OF THE CORNEA: FEATURES AT DIFFERENT DEGREES OF MYOPIA

Drozdov V. O., Matsuga O. M., Drozdova I. V., Martynenko S. M.

Abstract. Myopia today occupies one of the leading places in eye pathology; its prevalence and severity are significantly increasing worldwide.

The aim is to assess the optical power of the cornea as a factor affecting visual acuity in people with myopia of various degrees.

200 patients with myopia were examined, who were divided into groups: 1 – 11 people without myopia; 2 – 77 examined with mild myopia, 3 – 74 people with moderate myopia; 4 – 38 examined with high myopia. Statistical analysis of the study results was carried out using mathematical statistics methods, in particular primary statistical and correlation analyses.

The information technology “Typologies of nosogenies in myopia” was developed and included a model for diagnosing nosogenies in myopia, improved diagnostic methods, and software. Compared with emmetropes, in individuals with low myopia, the most significant changes in corneal optical power were observed in the Central zone; in patients with moderate myopia – in the Peripheral Superior Nasal and Peripheral Inferior Temporal zones; in subjects with high myopia – in the Central, Peripheral Inferior Nasal and Temporal zones. Common factors influencing the corneal optical power in all zones were means keratometric radius (mm) and keratometric power (D) under normal conditions and cycloplegia; while the different factors were in the Central zone – curvature of the central vertical radius (mm), refractive power of the central vertical radius of curvature (D), and refractive power of the average central radius in the 3 mm zone around the corneal apex (D) of the anterior and posterior corneal surface; in the Paracentral zone – steep keratometric radius (mm) under normal conditions and cycloplegia, mean radius of curvature (mm), mean keratometric power (D) of the anterior and posterior corneal surface; in the Peripheral zone – flat keratometric radius (mm) under normal conditions and cycloplegia, steepest radius of curvature (mm) and mean keratometric power (D) of the anterior and posterior corneal surface.

Determining the characteristics of the cornea at different degrees of myopia, the relationships between the indicators of the optical power of the cornea and the data of vision and refractometry are the basis for deepening knowledge about the etiopathogenesis of myopia, the ability to predict complications and develop strategies for its prevention and correction.

Key words: optical power, corneal epithelial thickness, myopia, axial length, spherical equivalent, correlation analysis.

ORCID and contributionship:

Drozdov V. O.: <https://orcid.org/0000-0001-6565-5858> ^{BCDE}
 Matsuga O. M.: <https://orcid.org/0000-0001-6444-8566> ^{AEF}
 Drozdova I. V.: <https://orcid.org/0000-0003-3252-6202> ^{AEF}
 Martynenko S. M.: <https://orcid.org/0000-0002-7822-5600> ^{BCDE}

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The authors declare no conflict of interest

Corresponding author

Drozdova Iryna Volodymyrivna
 Private Higher Education Institute Kyiv International University
 Ukraine, 03179, Kyiv, 49 Lvivska str.

Tel.: +380677571077
E-mail: drozdova@ua.fm

A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval of the article.

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Калашніков О. О.

ФАКТОРИ РИЗИКУ НЕСПРОМОЖНОСТІ ЛІНІЇ СТЕПЛЕРНОГО ШВА ПІСЛЯ РУКАВНОЇ РЕЗЕКЦІЇ ШЛУНКА

Державна наукова установа «Центр інноваційних медичних технологій НАН України»
(м. Київ, Україна)

kalashnikov.cimt@gmail.com

Неспроможність лінії степлерного шва належить до найбільш небезпечних ускладнень рукавної резекції шлунка. Незважаючи на відносно невисоку частоту її виникнення, клінічні наслідки можуть бути тяжкими та потребувати тривалого лікування, повторних оперативних або ендоскопічних втручань. Водночас питання прогнозування цього ускладнення залишається актуальним, оскільки значення окремих передопераційних та інтраопераційних факторів оцінюється неоднозначно, а ризики повторних баріатричних втручань потребують окремого вивчення. Метою роботи було проаналізувати потенційні фактори ризику неспроможності лінії степлерного шва після первинної та ревізійної рукавної резекції шлунка. Проведено ретроспективний аналіз результатів лікування 253 пацієнтів, серед яких 242 перенесли первинну, а 11 – ревізійну рукавну резекцію шлунка. Неспроможність степлерної лінії діагностовано у 7 випадках. Оцінювали демографічні, антропометричні та інтраопераційні показники. Серед проаналізованих факторів статистично значущий зв'язок із розвитком неспроможності встановлено для ревізійного характеру операції. За даними однофакторної логістичної регресії ревізійна рукавна резекція асоціювалася зі збільшенням шансів виникнення неспроможності у 10,53 раза порівняно з первинною операцією. Вік, стать, індекс маси тіла, тривалість втручання, обсяг крововтрати та візуальна кровоточивість степлерної лінії статистично значущого зв'язку з ускладненням не продемонстрували. Отримані дані вказують на доцільність урахування факту попереднього баріатричного втручання при передопераційній оцінці ризику та виборі тактики виконання ревізійної рукавної резекції шлунка.

Ключові слова: рукавна резекція шлунка, неспроможність степлерної лінії, ревізійна хірургія, фактори ризику, баріатрична хірургія.

Зв'язок публікації з плановими науково-дослідними роботами.

Робота є фрагментом науково-дослідної роботи «Застосування малоінвазивних методик в лікуванні пацієнтів з ожирінням та метаболічним синдромом» (номер державної реєстрації 0118U004272).

Вступ.

Рукавна резекція шлунка (РРШ) залишається найбільш поширеним первинним метаболічним та баріатричним оперативним втручанням у світі [1]. Незважаючи на стандартизацію техніки операції, накопичення хірургічного досвіду та вдосконалення періопераційного ведення, неспроможність лінії степлерного шва (НЛСШ) залишається одним із найбільш тяжких та складних для лікування післяопераційних ускладнень РРШ. Виникнення НЛСШ асоціюється зі значним збільшенням післяопераційної захворюваності, необхідністю повторних хірургічних та ендоскопічних втручань, тривалим лікуванням і збільшенням його вартості [2].

Розвиток НЛСШ має багатофакторний характер, а його виникнення пов'язують із сукупним впливом характеристик пацієнта, супутніх захворювань, нутритивного статусу та особливостей оперативного втручання. У сучасних дослідженнях аналізується широкий спектр потенційних факторів ризику, зокрема вік, стать, індекс маси тіла, куріння, цукровий діабет, артеріальна гіпертензія, синдром обструктивного апное сну, гіпоальбумінемія, застосування стероїдів, попередні оперативні втручання на верхніх відділах травного тракту, тривалість операції та технічні особливості формування степлерної лінії [2–4]. Водночас результати досліджень щодо значущості окремих чинників не є однозначними: фактори, які демонструють статистично значущу асоціацію з НЛСШ в одних дослідженнях, не завжди підтверджуються в інших, а ефективність окремих технічних заходів щодо зменшення ризику неспроможності також залишається предметом дискусії [1, 5].

Особливої уваги потребує оцінка ризику НЛСШ при ревізійних втручаннях із повторним формуван-