

CORNEAL EPITHELIAL LAYER IMAGING USING ANTERIOR SEGMENT OPTICAL COHERENCE TOMOGRAPHY IN DIFFERENT STAGES OF KERATOCONUS.

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INTRODUCTION

Keratoconus is a progressive bilateral, asymmetric, non-inflammatory corneal degenerative disease that leads to the formation of a central or paracentral cone. Corneal epithelium is a non-vascular tissue composed of 5-7 layers of non-keratinized stratified squamous epithelium with average thickness of 50 um. It has a strong masking effect on a lot of changes that happen beneath in the stromal layer of the cornea. For this reason it is of great importance to study corneal epithelial changes in keratoconus disease. One of the most advanced methods of imaging of the corneal epithelium and different layers is the MS-39 (CSO, Italy) using anterior segment optical coherence tomography for accurate details about the corneal layers. It is noted that the corneal epithelium distribution is different in keratoconic eyes from normal eyes, and the most obvious change is that, it gets thicker superiorly and thinner inferiorly in keratoconic eyes.

AIM OF THE WORK

The aim of the study was to measure the corneal epithelial layerthickness with spectral domain OCT technology using MS-39 in healthy subjects and patients with different stages of keratoconus.

PATIENTS AND METHODS

This is a descriptive prospective non-randomized cross-sectional study comparing corneal epithelial changes in 120 keratoconus eyes, that were subdivided according to the ABCD system (table 1), so that each group of them included at least 10 eyes. Additionally, a group of 120 healthy corneas; both clinically and in imaging, were included as a control group. All patientshad undergone full ophthalmological examination including slit lamp biomicroscopy exam, Uncorrected Distance Visual Acuity (UDVA), Corrected Distance Visual Acuity (CDVA), subjective refraction and imaging using MS-39 machine (CSO, Italy). The OCT study using MS-39 (CSO, Italy) included the following: K1, K2, Kmax, central corneal thickness, thinnest location, anterior and posterior elevation maps, and corneal epithelial maps. The study assessed and described the central reading of epithelial thickness over an area of 3.0 mm and the nasal, temporal, superior, and inferior regions at 3.0-6.0 mm and 6.0-8.0 mm areas.

RESULTS

Table: Comparison between the different studied stages according to ratio corneal epithelial thickness in cases group

		Stage 0 (n = 10)	Stage 1 (n = 10)	Stage 2 (n = 31)	Stage 3 (n = 18)	Stage 4 (n = 51)	F	p
Temporal nasal ratio	3 – 6 mm zone							
	Min. – Max.	1.10–0.92	1.05–0.90	0.84 – 1.08	0.81 – 1.02	1.06–0.77	7.090*	<0.001*
	Mean ± SD.	0.05±0.98	0.05±0.98	0.95 ± 0.05	0.92 ± 0.05	0.07±0.91		
	Median (IQR)	0.97 0.99)–(0.96	0.98 1.01)–(0.96	0.95 0.97)–(0.94	0.92 0.94)–(0.89	0.90 0.97)–(0.85		
	P ₀		1.000	0.630	0.046*	0.003*		
	P ₁			0.643	0.048*	0.003*		
	Sig. bet. grps.		p ₂ =0.266,p ₃ =0.009*,p ₄ =0.971					
	6 – 8 mm zone							
	Min. – Max.	1.08–0.92	1.06–0.88	0.85 – 1.04	0.79 – 1.04	1.13–0.74	8.157*	<0.001*
	Mean ± SD.	0.05±0.98	0.05±0.99	0.95 ± 0.05	0.92 ± 0.06	0.08±0.89		
	Median (IQR)	0.96 1.0)–(0.94	0.99 1.0)–(0.96	0.96 0.98)–(0.92	0.92 0.95)–(0.88	0.90 0.94)–(0.84		
	P ₀		0.997	0.801	0.173	0.003*		
Superior inferior ratio	P ₁			0.536	0.070	0.001*		
	Sig. bet. grps.		p ₂ =0.490,p ₃ =0.002*,p ₄ =0.579					
	3 – 6 mm zone							
	Min. – Max.	1.03–0.90	1.07–0.92	0.91 – 1.28	0.83 – 1.37	1.53–0.74	4.326*	0.003*
	Mean ± SD.	0.03±0.98	0.05±0.99	1.09 ± 0.09	1.07 ± 0.12	0.13±1.10		
	Median (IQR)	0.99 1.0)–(0.97	0.98 1.03)–(0.97	1.08 1.14)–(1.03	1.05 1.12)–(0.99	1.08 1.17)–(1.04		
	P ₀		1.000	0.054	0.296	0.017*		
	P ₁			0.077	0.366	0.027*		
	Sig. bet. grps.		p ₂ =0.939,p ₃ =0.994,p ₄ =0.771					
	6 – 8 mm zone							
	Min. – Max.	1.02–0.90	1.06–0.88	0.83 – 1.37	0.77 – 1.32	1.55–0.73	4.637*	0.002*
	Mean ± SD.	0.04±0.97	0.07±0.97	1.05 ± 0.11	1.03 ± 0.12	0.15±1.10		
	Median (IQR)	0.97 1.0)–(0.94	0.96 1.04)–(0.91	1.02 1.10)–(0.98	1.02 1.09)–(0.94	1.10 1.18)–(1.0		
	P ₀		1.000	0.359	0.763	0.017*		
	P ₁			0.362	0.766	0.018*		
	Sig. bet. grps.		p ₂ =0.960,p ₃ =0.347,p ₄ =0.160					

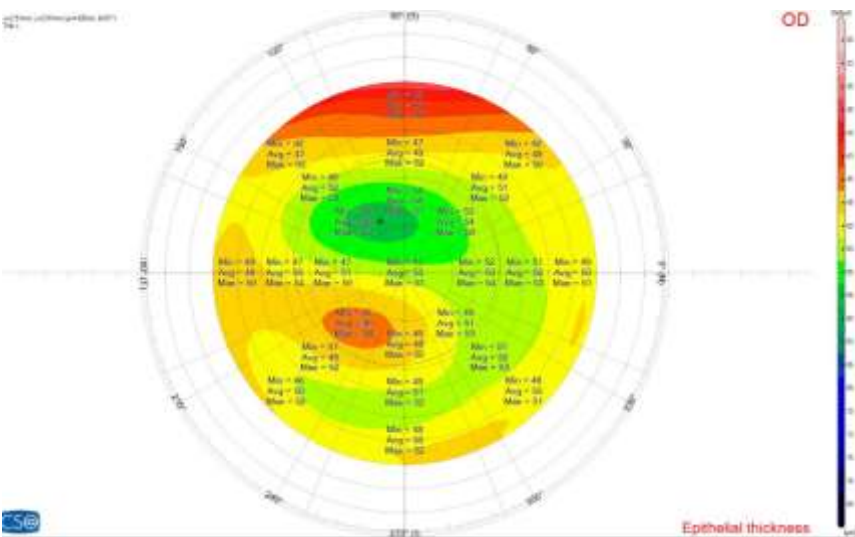


Figure: Showing corneal epithelial mapping of stage 0, showing doughnut pattern of epithelium thinning in the center with surrounding thickening

CONCLUSION

Early kc (stage 0 and 1) has differences in corneal epithelium with higher superior inferior ratio in both 3-6 and 6-8 mm zones compared to normal individuals group, while no significant difference in both the central 3 mm zone and temporal nasal ratio. There are significant differences in corneal epithelium map between early and advanced kc (stage 4), as the temporal nasal ratio was higher significantly in stage 0,1 and 2 compared to stage 4. However, the superior inferior ratio was lower significantly in stage 0 and 1 compared to stage 4.