CORNEAL DENSITOMETRY EVALUATION IN DIFFERENT STAGES OF KERATOCONUS COMPARED TO NORMAL CORNEA

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Introduction

Keratoconus is a progressive, non inflammatory, bilateral (but usually asymmetrical) ectatic corneal disease, characterized by paraxial stromal thinning and weakening that leads to corneal surface distortion. The normal cornea is composed of 6 layers: epithelium, Bowman'slayer, stroma, Descemet'smembrane, and endothelium, Dua's Layer.

The Pentacam HR includes software for densitometry analysis, allowing the intensity of backscattered light from different regions of the cornea to be measured. The analysis is also performed by depth in 3 layers: the anterior layer, which corresponds to the 120 µm superficial corneal thickness (**Superficial layer**); the posterior layer, which corresponds to the most posterior 60 µm (**Deep layer**); and the central, which has no fixed thickness value, is the zone between the anterior and posterior layers (**Mid-depth layer**). Densitometry is expressed in gray scale units, ranging from a minimum light scatter of 0 (maximum transparency) to a maximum light scatter of 100 (minimum transparency).

Aim of the work

The aim of the work is to evaluate corneal densitometry in different stages of keratoconus compared to normal corneas using pentacam® HR (Oculus, Wetzlar, Germany).

Patients and Methods

A cross sectional study included 120 eyes. The enrolled eyes were divided into two main groups, the first group was composed of 30 eyes with normal corneas and the second group was composed of 90 eyes with keratoconic corneas which were subdivided into three subgroups according to their topographic classification.Analysis was done for the following corneal annular zones: 0-2mm (central zone) 2-6mm (paracentral zone) 6-10mm (peripheral zone) 10-12mm (extreme peripheral zone) Total zone The depths studied in each zone were: Superficial layer (anterior120 µm) Mid depth layer (central) Deep layer (posterior 60 µm) Total layer (mean) Each of these zones and depths were compared between the control group and each stage of KC.

Results

This study included 90 eyes with keratoconous divided in to 3 grades according to topographic keratoconus classification (severity of keratoconus), and each of them compared to 30 eyes of healthy control corneas. In central annular zone (0 – 2 mm) in all depths, there was statistically significant increase in densitometry between stage 1 &control (P<0.001), stage 2 & control (P<0.001) and stage 3 & control (P<0.001). There was also statistically insignificant increase in densitometry between stage 1&2 (P>0.05) in all depths and statistically significant between stage 1&3 (P<0.001) in all layers except deep layer. As regard comparing between stage 2&3 there was statistically significant in all layers (P<0.05) except in mid-depth layer which was statistically insignificant (P>0.05). In paracentral annular zone (2 – 6 mm) in all depths, there was statistically significant increase in densitometry between stage 1 &control (P<0.001), stage 2 & control (P<0.001) and stage 3 & control (P<0.001). There was no statistically significant difference in densitometry between stage 1&2 (P>0.05) in all layers, but statistically significant between stage 1&3 in all layers. As regard comparing between stage 2&3 there was statistically significant in all layers (P<0.05) except in mid-depth layer which was statistically insignificant (P>0.05). In peripheral annular zone (6 – 10 mm) in all depths except superficial and total layers in stage 1, there was statistically significant increase in densitometry between stage 1 &control (P<0.001), stage 2 & control (P<0.001) and stage 3 & control (P<0.001). There was no statistically significant difference in densitometry between stage 1, 2 and 3 (P > 0.05). In extreme peripheral annular zone (10 – 12mm) in all depths, there was no statistically significant difference in densitometry between stage 1 &control (P>0.05), stage 2 & control (P>0.05). In stage 3 there was no statistically significant difference in densitometry comparing to control group in superficial & central layers (P>0.05) but statistically significant increase in deep layer (P=0.032). There was no statistically significant difference in densitometry between stage 1, 2 and 3 (P>0.05). In total corneal diameter in all depths, except superficial layer in stage 1, there was statistically significant increase in densitometry between stage 1 &control (P<0.001), stage 2 & control (P<0.001) and stage 3 & control (P<0.001). There was no statistically significant difference in densitometry between stages 1&2 in all layers (P>0.05), but statistically significant between stage 1&3 in all layers except deep layer. As regard comparing between stage 2&3 there was statistically significant in superficial & total layers (P<0.05) and statistically insignificant in mid-depth &deep layers (P>0.05).

Table (1):Comparison between the different studied groups according to different parameters

		Control (n = 30)	Stage 1 (n = 30)	Stage 2 (n = 30)	Stage 3 (n = 30)	p
(0 – 2 mm)	Superficial layer	12.85 ± 0.50	17.71^a ± 3.34	17.67^a ± 2.85	21.82^{abc} ± 6.65	<0.001*
	Mid-depth layer	9.91 ± 0.43	13.55^a ± 2.05	13.03^a ± 1.96	14.46^{ac} ± 2.37	<0.001*
	Deep layer	8.12 ± 0.39	10.38^a ± 1.28	9.88^a ± 1.39	10.54^a ± 1.35	<0.001*
	Total	10.30 ± 0.37	13.86^a ± 1.98	13.53^a ± 1.99	15.61^{abc} ± 3.21	<0.001*
(2-6mm)	Superficial layer	11.97 ± 0.42	15.58^a ± 1.71	15.12^a ± 2.30	17.60^{abc} ± 2.89	<0.001*
	Mid-depth layer	9.08 ± 0.33	11.85^a ± 1.49	11.32^a ± 1.61	12.55^{ac} ± 1.78	<0.001*
	Deep layer	7.57 ± 0.33	9.46^a ± 0.94	9.26^a ± 1.25	10.33^{abc} ± 1.68	<0.001*
	Total	9.55 ± 0.30	12.28^a ± 1.30	11.89^a ± 1.68	13.50^{abc} ± 1.94	<0.001*
(6 –10mm)	Superficial layer	13.69 ± 2.41	15.57^a ± 2.16	14.69 ± 2.92	16.46^a ± 3.46	<0.001*
	Mid-depth layer	10.21 ± 1.44	11.90^a ± 1.31	11.54^a ± 2.04	12.55^a ± 2.54	<0.001*
	Deep layer	8.45 ± 0.92	10.0^a ± 1.02	9.87^a ± 1.51	10.70^a ± 2.14	<0.001*
	Total	10.78 ± 1.52	12.49^a ± 1.37	12.06 ± 2.11	13.24^a ± 2.65	<0.001*
(10-12mm)	Superficial layer	33.76 ± 9.27	29.44 ± 7.77	28.06 ± 6.73	33.31 ± 12.82	0.050
	Mid-depth layer	20.53 ± 4.06	19.57 ± 4.56	20.73 ± 5.84	22.29 ± 6.85	0.281
	Deep layer	13.63 ± 2.93	14.08 ± 3.19	15.89 ± 4.45	16.36^a ± 4.37	0.013*
	Total	22.66 ± 4.68	21.03 ± 4.70	21.57 ± 5.32	23.99 ± 7.65	0.201
Total annular zones	Superficial layer	15.90 ± 1.93	18.18^a ± 1.99	17.36 ± 2.75	20.30^{abc} ± 3.85	<0.001*
	Mid-depth layer	11.31 ± 0.92	13.39^a ± 1.37	13.09^a ± 1.82	14.32^{ac} ± 2.44	<0.001*
	Deep layer	8.86 ± 0.69	10.54^a ± 0.99	10.57^a ± 1.40	11.38^a ± 1.90	<0.001*
	Total	12.02 ± 1.03	14.04^a ± 1.30	13.66^a ± 1.92	15.33^{abc} ± 2.60	<0.001*

Conclusion

Corneal densitometry is high significant in keratoconic eyes than in normal eyes. Densitometry values are higher with more advanced degree of keratoconus