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Original Article

CORNEAL DENSITOMETRY CHANGES IN CONTACT LENS WEARERS

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Abstract

Purpose: *Our study aims at evaluating corneal densitometry values among subjects who use soft contact lenses regularly.* ***Methods:*** *Prospective, observational study with a total of 32 eyes of 16 subjects regularly use soft contact lenses (group 1) and 32 obtained from 16 participants who do not wear contact lenses as a control group (group 2) were enrolled in the study to evaluate corneal densitometry by the Scheimpflug corneal topography (Pentacam; Oculus Inc., Wetzlar, Germany). We divide the corneal area, totaling 12 mm, for densitometry studying into 4 annular regions (from 0 to 2, from 2 to 6, from 6 to 10, and from 10 to 12 mm), as well as 3 posterior, central, and anterior regions.* ***Results:*** *The mean duration of wearing soft contact lenses amounted to 6 ± 2.5 years in group 1. Regarding the values of corneal densitometry, they were dramatically higher in the anterior 0- to 2- and 2- to 6- and 6-10 mm in group 1 when making comparisons with group 2 (20.7 ± 1.55 concerning group 1 and 17.38 ± 0.63 concerning group 2 [*P *<0.001]; 20.08 ± 1.51 for group 1 and 16.88 ± 0.53 <0.001 for group 2 [*P*<0.001], respectively). They were 8.82 ± 1.12 for group 1 and 16.47 ± 0.48 for group 2 p <0.001 in 6- to 10- mm. The difference between the 2 groups in the values of densitometry at 10- to 12 mm was insignificant (p > 0.05).* ***Conclusion:*** *Our results concluded that the densitometry of the cornea could be higher in the central 0- to 10-mm of the anterior region. Corneal densitometry in persons who regularly wear contact lenses, although the cornea may remain transparent.*

Keywords: *Corneal densitometry, Contact lens.*

1. Introduction

The clarity of the cornea represents a vital factor for good vision [1]. The usage of soft contact lenses could cause physiological corneal changes [2,3]. Relative corneal hypoxia is very important when we assess how the cornea is affected by the usage of contact lenses [4]. Usually, research evaluates the contact lens-related hypoxic stress in the cornea. They study evaluates the changes in macroscopic anterior ocular tissue, as corneal oedema. Corneal thickness changes occur after soft contact lens wear [5,6]. Corneal opacification may occur due to corneal hypoxia caused by neovascularization and limbal stem cell deficiency [7,8]. So, the use of the corneal thickness as an index for hypoxia in the cornea can be considered a generalization. Microscopic corneal alterations, assessed by corneal transparency,

are highly recommended to be utilized for the use of contact lenses as indicators of ophthalmic health [9]. Currently, objective evaluation of corneal transparency can be carried out by assessing the corneal densitometry from corneal Scheimpflug images using proprietary [10,11] or custom-made software [12] or a new software tool [13]. Using the Pentacam HR, we can obtain measures for CD over a total corneal area of 12 mm and at four zones (0-2, 2-6, 6-10, and 10-12 mm) [13]. Corneal densitometry can detect physiological alterations by monitoring their effects on corneal transparency [2].

2. Material and Methods

2.1. *Ethical considerations*

Prior to conducting the present study, the authors obtained the Ethics Committee's approval from the Research Institute of Ophthalmology, Sohag, Egypt. The study was carried out following the Declaration of Helsinki. Furthermore, the subjects gave written informed consent before conducting the study.

2.2. *Patients and methods*

This study is prospective and observational. It includes two groups: The first (cases) includes 32 eyes of 16 subjects regularly use soft contact lenses, and the second (controls) includes 32 eyes of 16 subjects who not wear contact lenses to evaluate corneal densitometry using Scheimpflug corneal topography (Pentacam; Oculus Inc., Wetzlar, Germany). We divide the corneal area, totaling 12 mm, for densitometry studying into 4 annular regions (from 0 to 2, from 2 to 6, from 6 to 10, and from 10 to 12 mm), as well as 3 posterior, central, and anterior regions. The region of interest was the anterior region with its 4 annular zones in order to assess the influences of the regular uses of contact lenses even when the cornea is still clear as we exclude any cornea with significant corneal opacity discovered with slit-lamp biomicroscopy.

2.3. *Statistical analysis*

The statistical analyses of the research data were carried out by making use of SPSS V. 26 (IBM Inc., Chicago, IL, United States of America). Through the use of an unpaired Student's t-test, quantitative data were supplied in the form of mean and standard deviation, and a comparison was made between both groups. The statistical significance of a two-tailed P value less than 0.05 was regarded as acceptable. This prospective trial comprised 32 eyes of 16 subjects wear contact lenses regularly with a mean duration of wearing lenses 6 ± 2.5 years and attend laser refractive surgery centers and 32 eyes of 16 healthy controls (not wear contact lenses).

3. Results

This prospective trial comprised 64 eyes divided into two groups. Group (1) includes 32 eyes of 16 subjects wear contact lenses regularly with a mean duration of wearing lenses 6 ± 2.5 years and attend laser refractive surgery centers and group (2) includes 32 eyes of 16 healthy controls (not wear contact lenses). We compare age of two groups as shown in tab. (1) and we find that age differences between both groups have not statistical significance. With range of ages in group 1 were (19-40) and in group 2 the range is 19-43 years old. We collect corneal densitometry values in both groups in anterior region in all concentric zones in a totalling 12 mm cornea to evaluate clarity in (0-2), (2-6), (6-10), (10-12) mm and we compare these CD values. There is a significance difference (P value ≤ 0.05) in anterior 0 to 2 corneal densitometry as values had a higher significance in the cases group

than the controls (P-value <0.001) as the mean ± SD in cases group is 20 ±1.55 and 17.38±0.63 in control group, fig. (1) Also, it is significance difference in anterior 2 to 6 corneal densitometry as values had a higher significance in the cases group than the controls (P value <0.001) as the mean ± SD in cases group is 20.08 ±1.51 and 16.88±0.53 in control group. also, there is a significance difference in anterior 6 to 10 corneal densitometry as values had a higher significance in the cases group than the controls (P value <0.001) as the mean ± SD in cases group is 18.82 ± 1.12 and 16.47 ± 0.48 in control group. But there was no significantly different (P value >0.05) in anterior 10 to 12 corneal densitometry as values was insignificantly different in the cases group and control group (P value 0.1) as the mean ± SD in cases group is 16.8 ±0.9 and 16.08 ± 0.48 in control group as shown in tab. (2). Age of 2 studied groups were compared as bar graph and show statistically non-significant results and CD values were compared also as bar graph to show the statistically significance values in anterior region in (0-2), (2-6), (6-10) mm zones but non-significant in zone (10-12), fig. (2).

Table 1: Age of the studied groups

		Cases group (n=32)	Control group (n=32)	P value
Age (years)	***Mean ± SD***	28.75 ± 6.56	30.13 ± 7.34	0.433
	Range	19 - 40	19 - 43	

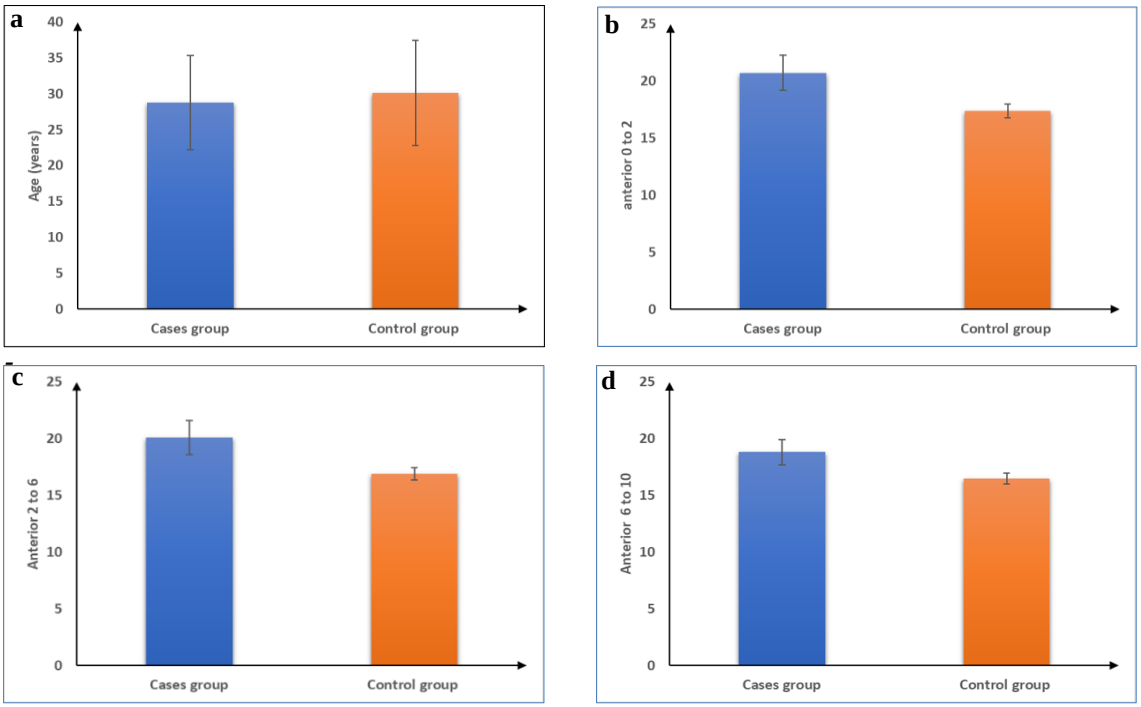

Figure 1: **a.** age of the studied groups, **b.** anterior 0 to 2 of the studied groups, **c.** anterior 2 to 6 corneal densitometry value of the studied groups, **d.** anterior 6 to 10 corneal densitometry value of the studied groups

Table 2: Corneal densitometry values in both groups in anterior region at (0 – 2), (2-6), (6-10), (10-12) mm zones.

	Cases group (n=32)	Control group (n=32)	P value
Anterior 0 to 2 (mm)	20.7 ± 1.55	17.38 ± 0.63	**<0.001***
Anterior 2 to 6 (mm)	20.08 ± 1.51	16.88 ± 0.53	**<0.001***
Anterior 6 to 10 (mm)	18.82 ± 1.12	16.47 ± 0.48	**<0.001***
Anterior 10 to 12 (mm)	16.8 ± 0.9	16.08 ± 0.48	**0.1**

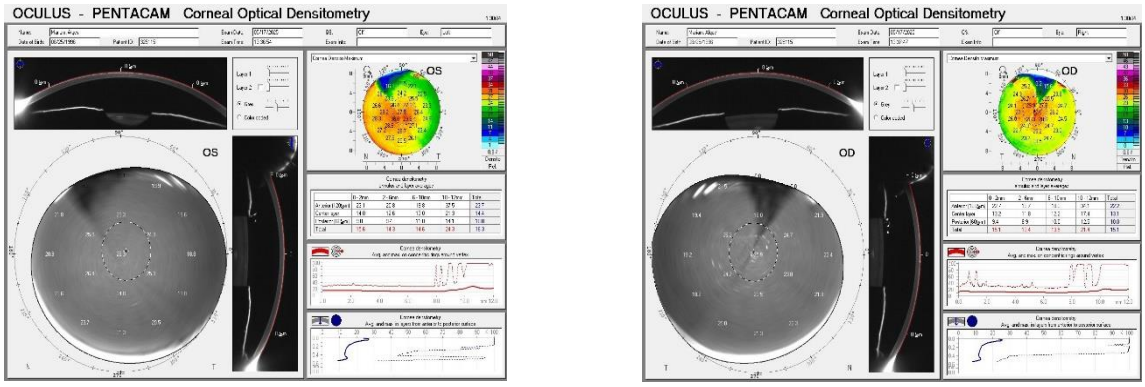

Figure 2: corneal densitometry using pentacam software in female patient with regular use of contact lenses.

4. Discussion

Corneal clarity is necessary for good vision. Many physiological changes in the cornea may occur because of the use of soft contact lenses. Nowadays, corneal transparency is assessed objectively by estimating corneal densitometry, which is novel software, which is used in the assessment of such physiological alterations by defining their influences on the transparency of the cornea. In the present study, we evaluate corneal densitometry between 2 groups (group 1, who use soft contact lenses regularly, with the mean duration of wearing contact lenses of 6 ± 2.5 years) and group 2, who do not use soft contact lens. We found that there were significant differences in the values of corneal densitometry between the 2 groups in the anterior 0 to 2 and 2 to 6 and 6 to 10 mm zones ($p < 0.001$), but an insignificant difference between the 2 groups in the 10 to 12 mm zone. Our results are similar to results founded by Dilay Ozek, et al., as they reported that the densitometry values of the cornea's anterior 0- to 2- and 2- to 6-mm recorded higher significance in the experimental group (who regularly wear soft contact lenses) when making comparisons with the controls (23.2 ± 4.7 concerning group 1 and 17.3 ± 5.6 concerning group 2 [P = .03]; 22.4 ± 6.4 concerning group 1 and 17.8 ± 1.4 concerning group 2 [P = .03], respectively) [2]. But our study is different from Dialy Ozek, et al., who found that both groups were not statistically significantly different in terms of the values of corneal densitometry between 6 and 12 mm. (P > .05) [2]. Also, our study supports what Doughty, et al study found as they found that Scheimpflug-based systems provide information that corneal transparency will be affected with long term soft contact lenses use [14]. Also, Cagri Ilhan found that there was significant statistically difference before and after-CCL values of corneal densitometry in zone (0-2 mm) but not significant statistically in other zones (2-6, 6-10, and 10-12) mm [15].

5. Conclusion

Regular soft contact lens affects corneal densitometry and so will affect corneal clarity specially in anterior 0-10 mm zone even if the cornea still clear clinically. More studies are needed to assess if soft contact lenses affect cornea or not and to assess to which extent is the effect.

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