Original Article

Effect of Contact Lens Wear on Cornea

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Purpose: To determine contact lens induced corneal changes among contact lens users.

Study Design: Cross-sectional study.

Place and Duration of Study: This study recruited the sample from Madinah Teaching Hospital Faisalabad, E Plomer Optics and Punjab Optics Lahore. The study was conducted in 4 months from 05 April to 5 August 2016.

Materials and Methods: Data of 100 contact lens users were collected. Corneal changes were observed by using slit lamp and fluorescein strips. SPSS version 23 was used for data analysis. Descriptive and inferential statistics were reported for variables.

Results: 58 (58%) of contact lens users found with corneal changes. Significant association of corneal changes were found with years of contact lens use (X^2 = 31.636; p = .000) and minus power of contact lens (X^2 =14.325; p = .000). No significant association (p > 0.05) of corneal changes were found with type of contact lens, daily wearing time of contact lenses and plus power of contact lenses. Neovascularization was found in 38% of contact lens users followed by corneal staining in 33%, corneal infiltrates in 17% and corneal abrasions in 12%.

Conclusion: It was concluded that long term, unmonitored use of contact lenses induced many corneal changes among contact lens users.

Key Words: contact lens, corneal changes, neovascularization, infiltrates, staining, abrasion.

The cornea is the principal refracting surface of the eye and accounts for two-thirds of the total eye's power. It is an avascular transparent tissue and has richest sensory nerve supplies in the body. Oxygen is a very important metabolite for cornea and 15-20.9% oxygen is necessary for its regular function. The cornea derives its oxygen supply mainly from the atmosphere via the tear film[1].

Due to corneal hypoxia aerobic glycolysis reduces, consequently glucose metabolizes into lactic acid and start to accumulate in the cornea. Corneal osmotic pressure raises due to increased concentration of lactic acid in corneal stroma and results in osmotically driven swelling in the stroma (stromal oedema) which leads to functional and structural changes in the cornea[1].

Contact lens wear causes reduction in the supply of oxygen to the cornea which leads to significant effects on the corneal structural integrity and function. Functional alterations in the cornea due contact lens wear includes reduction in epithelial mitosis, decrease in the density of the terminal nerve endings, reduction in corneal sensitivity and stromal environment becomes more acidic due to decrease in corneal pH[2]. Significant structural changes in corneal tissue due to contact lens wear includes corneal neovascularization[3], corneal infiltrates[4], corneal staining,[5] reduced corneal thickness, presence of vacuoles and microcysts, endothelial polymegathism and endothelial polymorphism[6].

The purpose of the study was to determine the contact lens induced corneal changes among contact lens users.

MATERIAL AND METHODS

It was a cross-sectional study and convenient sampling technique was used to collect the sample. The study was conducted in 4 months from 05 April to 5 August 2016. Data were collected from 3 different settings; Madinah Teaching Hospital Faisalabad, E Plomer Optics and Punjab Optics, Lahore. For ethical concerns, approval of study obtained from the ethical review board of The University of Faisalabad in accordance with the principles of Declaration of Helsinki. Subjects aged 15 to 55 years, those who used contact lenses for more than 1 year and without any complaint / symptom related to contact lens use were included in the study. An informed consent form delivered to gain consent from participants for their voluntary participation by briefly describing the study topic, its purpose, duration and assuring for confidentiality of respondents personal information. Subject's demographic details, history related to the contact lens type, daily wearing time, power and years of contact lens use were recorded in specially designed self-structured Performa. Due to unavailability of many different instruments required to determine all corneal changes, this study focused on only 4 corneal changes, i.e. corneal neovascularization, corneal infiltrates, corneal abrasions and corneal staining. Firstly a gross slit lamp examination was performed in a consistent, orderly fashion from eyelid to cornea by using diffuse illumination slit lamp technique. To observe corneal neovascularization and corneal infiltrates slit lamp direct observation (optic section) technique was used. To observe corneal abrasions slit lamp direct observation (parallelepiped) technique was used. To determine corneal staining, the subject was asked to look upward and sodium fluorescein was applied to the sclera at lower fornix by using fluorescein strip moistened by normal saline and then observed with a slit lamp under cobalt blue light. SPSS version 23 was used for data analysis. Descriptive and inferential statistics were generated and reported for variables.

RESULTS

A sample of 100 contact lens users was recruited in which female contact lens users were 67 (67%) and male contact lens users were 33 (33%). Age of contact lens users was ranged from 16 to 55 years with mean age of 30.10 ± 7.86 years. The study subjects were found wearing different types of contact lenses. There were 54% subjects using soft contact lenses, 17% were using soft cosmetic contact lens, 14% were RGP contact lenses users, 12% were soft toric contact lens users and 3% were silicone hydrogel contact lens users. The daily wearing time of contact lens determined in this study ranged from 4 to 16 hours/day and mean value was 9.82 ± 2.19 hours/day. The years of contact lens use found in this study was from 1.5 to 30 years with a mean value of 8.35 ± 5.81 years. In this study very high proportion of contact lens users was myopic (96 %) and used contact lenses of minus power. Minus power of contact lens ranged from -0.50 to -17.00 D with a mean value of -4.46 D ± 3.69 D. Proportion of hyperopic contact lens users was only 4 % and plus power of contact lenses ranged from +2.00 to +5.00 D with a mean value of +4.00 D ±1.35 D.

In this study various corneal changes were found among contact lens users. Results showed that 58 % (58 out of 100) of contact lens users presented with corneal changes while 42% (42 out of 100) of contact lens users had no corneal change. More than one corneal changes were present among some subject. Neovascularization was found in 38% of contact lens users followed by corneal staining in 33%, corneal infiltrates in 17% and corneal abrasions in 12%.

No significant ($p > 0.05$) association was found between corneal changes and types of contact lenses. It was observed that overall ratios between subjects with corneal changes and subjects without corneal changes did not differ largely for different types of contact lens (Table 1).

Table 1: Association between corneal changes and types of contact lenses.

Type of Contact Lens	No. of Subjects with Corneal Change		Total
	Yes	No	
Soft	29	25	54
Hard	9	5	14
Soft Toric	7	5	12
Silicone Hydrogel	1	2	3
Soft Cosmetic	12	5	17
Total	58	42	100
Pearson Chi-Square	2.492	p-value	.646

No significant ($p > 0.05$) association was found between corneal changes and daily wearing time of contact lenses. It was observed that overall ratios between subjects with corneal changes and subjects without corneal changes did not differ largely for different categories of daily wearing time of contact lens (Table 2).

Table 2: Association between corneal changes and daily wearing time of contact lenses.

Daily Wearing Time (hours/day)	No. of Subjects with Corneal Change		Total
	Yes	No	
4 – 8	17	18	35
9 – 12	38	22	60
13 – 16	3	2	5
Total	58	42	100
Pearson Chi-Square 1.986		p-value .370	

A significant ($X^2 = 31.636$; $p = .000$) association was found between corneal changes and years of contact lens use. Number of subjects with corneal changes increased with increase in number of years of contact lens use. It was determined that all of subjects those used contact lenses for 26 – 30 years and half of subjects those used contact lenses for 21 – 25 years presented with corneal changes (Table 3).

Table 3: Association between corneal changes and years of contact lens use.

Years of CL Use	No. of Subjects with Corneal Change		Total
	Yes	No	
1 – 5	10	29	39
6 – 10	31	6	37
11 – 15	8	4	12
16 – 20	6	1	7
21 – 25	1	2	3
26 – 30	2	0	2
Total	58	42	100
Pearson Chi-Square 31.636		p-value .000	

A significant ($X^2 = 14.325$; $p = .000$) association was found between corneal changes and minus power of contact lens. Number of subjects with corneal changes increased with increase in minus power of contact lens. It was determined that all subjects those used contact lens power ranged from -15.25 to -18.00 D and -12.25 to -15.00 D had corneal changes and half of the subject those used contact lens power ranged from -9.25 to -12.00 D had corneal changes (Table 4).

Table 4: Association between corneal changes and minus power of contact lenses

Minus Contact Lens Power (D)	No. of Subjects with Corneal Change		Total
	Yes	No	
-0.50 to -3.00	19	27	46
-3.25 to -6.00	19	7	26
-6.25 to -9.00	11	4	15
-9.25 to -12.00	1	1	2
-12.25 to -15.00	4	0	4
-15.25 to -18.00	3	0	3
Total	57	39	96
Pearson Chi-Square 14.325		p-value .014	

No significant ($p > 0.05$) association was found between corneal changes and plus power of contact lens. In both categories of plus contact lens power similar ratio was found between subject with corneal changes and subjects without corneal changes (Table 5).

Table 5: Association between corneal changes and plus power of contact lenses.

Plus Contact Lens Power (D)	Corneal Changes		Total
	Yes	No	
+0.50 To +3.00	0	1	1
+3.25 To +6.00	1	2	3
Total	1	3	4
Pearson Chi-Square .444		P-Value .505	

Table 6: Association of Corneal changes with different contact lens parameters.

Contact Lens Parameters	Pearson Chi Square	p value
Type of Contact Lens	2.492	.646
Daily Wearing Time	1.986	.370
Years of Contact Lens Use	31.636	.000
Minus Power of Contact Lens	14.325	.014
Plus Power of Contact Lens	.444	.505

DISCUSSION

Various corneal changes among contact lens users were observed in this study. The reason might be that the long term contact lens wear induces hypoxia and dryness in the eye which lead to corneal changes. These results are in line with those reported by Liesegang[7], Efron et al.[8] and Beljan et al.[9] studies. This study observed corneal neovascularization, corneal infiltrates, corneal staining and corneal abrasions among contact lens users. These results are in agreement with those reported by Nichols and Sinnott,[5] Liesegang[7], Efron et al. [8], Beljan et al.[9], Æuruvija-Opaèiæ[10], Kymionis and Kontadakis[11], Lee et al.[12] and Wong et al.[13], Du Toit et al. [14], Nichols et al.[15], Riley et al. [16], Santodomingo-Rubido et al. [17], Ishak et al.[18], Kastelan et al.[19] and Pili et al.[20] and Muntz et al.[21] studies.

This study found no significant association between corneal changes and types of contact lenses. The reason might be that most of the subjects included in the study used soft contact lens and fewer subjects used other types of contact lenses. These results were similar to the Efron et al. [8], Nichols et al.[15] and Ishak et al.[18] studies. But contrary to those found in Nichols and Sinnott[5], Æuruvija-Opaèiæ[10] and Riley et al.[16] studies.

This study found no significant association between corneal changes and daily wearing time of contact lenses. These results were in line with those reported by Nichols et al.[15] study. Nevertheless, the results were found to be contrary to those reported by Nichols and Sinnott[5] and Beljan et al.[9] studies. This contrast might be due to regional and racial differences and use of different types of contact lens material and quality of contact lens could also change the results.

This study determined a significant association between corneal changes and years of contact lens use. The reason might be that long term use of contact lens caused prolonged hypoxia that lead to corneal changes. The results of this study were in favor with the results of Beljan et al.[9] study.

This study found a significant association between corneal changes and minus power of contact lens. This might be due to reason that high power contact lens were thicker and reduced the oxygen permeability through the contact lens and hence caused more damaging effects in cornea. Nichols et al.[5] and Lee et al.[12] studies were in favor with these results.

No significant association was found between corneal changes and plus power of contact lens. These results might be because of very less number of hyperopic contact lens users included in the study. No other study was found to sufficiently discuss these findings.

CONCLUSION

It was concluded that long term use of contact lenses induced many corneal changes (neovascularization, staining, infiltrates, abrasions) among contact lens users. As the number of years of contact lens use and minus power of contact lens increased, more corneal changes were found.

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Concept, Design of study, Sample collection, data collection, data analysis, manuscript drafting, Revision data analysis, Critical review, Drafting and revision of manuscript

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