Effect of Contact Lens Wear on Tear Film Break up Time (TBUT) among Contact Lens Users

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Purpose: To determine the effect of contact lens wear on tear film break up time (TBUT) and to find out correlation between tear film break up time (TBUT) with type of contact lens wear, daily wearing time of contact lens, years of contact lens use and power of contact lens.

Study Design: Cross-sectional study and convenient sampling was used.

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 05-04-2016 to 05-08-2016.

Materials and Methods: TBUT determined by using slit lamp and fluorescein strips. SPSS version 23 was used for data analysis. Inferential statistics was reported for variables.

Results: A sample of 100 (67 females and 33 males) contact lens users recruited for the study. Mean age of sample was 30.10 ± 7.86 years. Mean daily wearing time of contact lens was 9.82 ± 2.19 hours/day and mean of years of contact lens use was 8.35 ± 5.81 years. 67% of 100 contact lens users had abnormal (less than 10 sec.) tear film break up time (TBUT). A significant negative correlation of TBUT was found with daily wearing time of contact lenses (r = -.251), years of contact lens use (r = -.542) and minus power of contact lens (r=-.330). No significant association of TBUT was found with type of contact lens and plus power of contact lens.

Conclusions: TBUT decreases with increase in daily wearing time, years of contact lens use and high minus power of contact lens, while type of contact lens and plus power of contact did not significantly affect the TBUT.

Key Words: contact lens, tear film break up time, TBUT, tear film stability.

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The ocular surface consists of various glandular tissues, which secrete the tear film that coats and protect the ocular surface[1]. The tears are distributed by normal, non-voluntary action of eyelid and each blink refreshes the pre-corneal tear film. When blinking is held, evaporation of aqueous layer of tear film started which causes thinning of the tear film in a localized area. Subsequently dry spots are formed in tear film when the tears evaporate[2]. Tear film stability is usually measured by its lack of stability, by a test called Tear film break-up time (TBUT)[1]. TBUT is the time taken in seconds for the tear film to break following a blink cessation[2]. Tear break up time TBUT of 15-45 sec is considered normal while less than 10 sec is abnormal[2] and less than 5 sec is suggestive of symptoms of dry eye disease[1].

The physical placement of a contact lens over the ocular surface divides the tear film into two parts, i.e. a pre-lens tear film and a post-lens tear film and it forms a new interface within the ocular atmosphere.

This division and new interface induce changes in biophysical properties of tear film[3]. When a contact lens is placed on the eye, it affects the stability of tear film, evaporation rate of tears, thickness of lipid layer and volume of tears. The contact lens use mainly alters the normal sequence of tear film function and cause distractions in quantity and quality of the tear film, which lead to contact lens intolerance[4].Both RGP and soft contact lenses interfere with the tear film stability and decreases the TBUT. RGP contact lenses reduce TBUT up to 4 to 6 sec whereas soft contact lenses decrease TBUT up to 4 to 10 sec[5].This study is conducted to determine the effect of contact lens wear on tear film break up time (TBUT) and to find out correlation between tear film break up time (TBUT) with type of contact lens wear, daily wearing time of contact lens, years of contact lens use and power of contact lens.

MATERIAL AND METHODS:

It was a cross-sectional study and convenient sampling technique was used to collect the sample of 100 contact lens users. The study was conducted in 4 months from 05-04-2016 to 05-08-2016. 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 used contact lenses for more than 1 year and without any complain / symptom related to contact lens use were included in the study. Subjects suffering from any disease of the cornea or conjunctiva and those used contact lenses for less than 1 year, excluded from 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 type, daily wearing time, power and years of contact lens use were recorded in specially designed self-structured Performa. A detailed slit lamp examination was performed in a consistent, orderly fashion from eyelid to cornea to determine any ocular pathology. To measure tear film break-up time (TBUT), 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 subject was asked to blink several times. After that subject was instructed to avoid blinking and the tear film was observed between blinks with a slit lamp under cobalt blue light and time noted between a complete blink and the appearance of the first black dry spot. 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 recruited in which female contact lens users were 67 (67%) and male contact lens users were 33 (33%). Age of contact lens users ranged from 16 to 55 years with mean age of 30.10 ± 7.86 years. The study subjects were wearing different types of contact lenses. 54% of subjects were soft contact lens users, 17% were soft cosmetic contact lens users, 14% were RGP contact lens 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 ranged 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. The proportion of hyperopic contact lens users was less (4 %) and plus power of contact lenses ranged from +2.00 to +5.00 D with a mean value of +4.00D ±1.35 D.

TBUT value was ranging from 4 to 18 sec with a mean value of 9.14 ± 2.89 seconds in contact lens users. In males average TBUT was 8.88 ± 2.50 sec and in female it was 9.27 ± 3.08 sec. The results determined that 67% of contact lens users had abnormal TBUT and 33% had normal TBUT.

No significant (p = > 0.05) association was found between TBUT and types of contact lenses (Table 1).

A significant (p = .012) negative correlation was found between TBUT and daily wearing time of contact lenses (Table 2). Regression model shows that with 1 hour increase in daily wearing time, TBUT decreased by -.332 times (Figure 1).

A highly significant (p = .000) negative correlation was found between TBUT and years of contact lens use (Table 2). Regression model shows that with 1 year increase in contact lens use, TBUT decreased by - .270 times (Figure 2).

Table 1: Association between TBUT and types of contact lenses.

Type of Contact Lens	TBUT (Sec)		Total
	Abnormal (≤ 10)	**Normal (>10)**	
Soft	32	22	54
Hard	10	4	14
Soft Toric	8	4	12
Silicone Hydrogel	3	0	3
Soft Cosmetic	14	3	17
Total	67	33	100
Pearson Chi-Square	4.878	p-value	.300

Table 2: Significant Correlation of TBUT.

		Daily Wearing Time of CL (Hours/Day)	**Years of CL Use (Years)**	**Minus CL Power (D)**
TBUT (sec)	Pearson Correlation	-.251[*]	-.542[**]	-.330[**]
	Sig. (2-tailed)	.012	.000	.001
	N	100	100	96
*. Correlation is significant at the 0.05 level (2-tailed).				
**. Correlation is significant at the 0.01 level (2-tailed).				

A strong significant (p = .001) negative correlation was found between TBUT and minus power of contact lens (Table 2). Regression model shows that with -1 D increase in power of contact lens, TBUT decreased by -.263 times (Figure 3).

No significant (p > 0.05) association was found between corneal changes and plus power of contact lens.
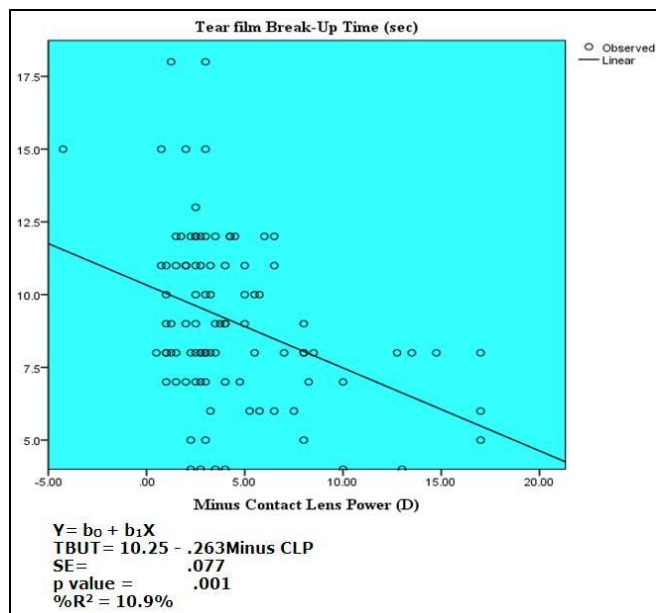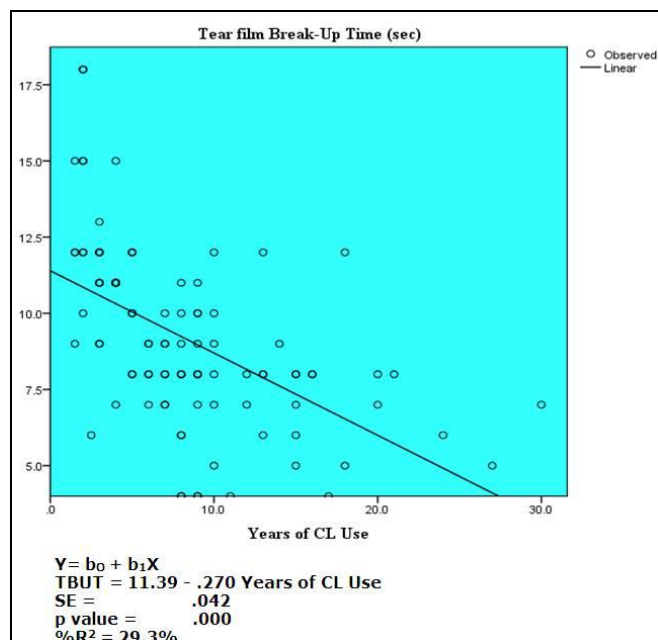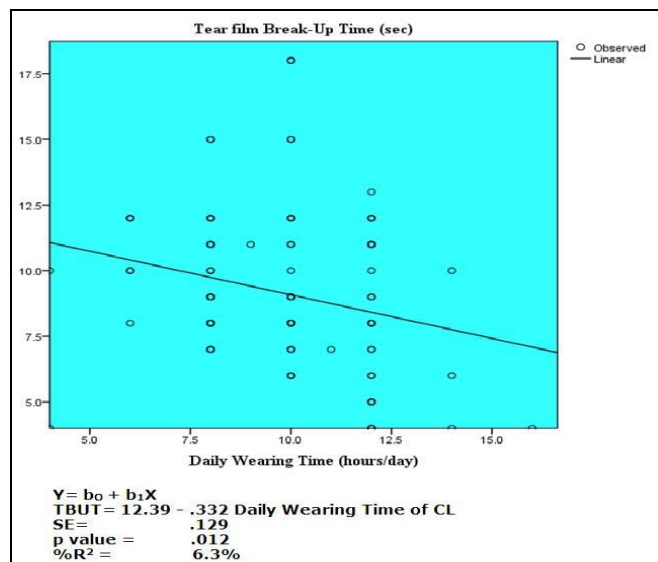
DISSCUSSION

In this study a decreased value of TBUT was found in majority of contact lens users. The results determined that 67% of contact lens users had abnormal TBUT. The reason might be that the contact lens induced hypoxia interfered with tear film stability and resulted in shortened TBUT. These results were similar to the studies of Sweeney et al.[1], Craig et al.[3], Eghosasere et al.[4], Du Toit et al.[6], Thai et al.[7], Glasson et al.[8], Nichols and Sinnot[9], Riley et al.[10], Stapleton et al.[11], Janine et al.[12], Guillon and Maissa[13], Jansen et al.[14], Shrestha et al.[15], Young et al.[16], Kastelan et al.[17], Gupta et al.[18] and Pili et al.[19]. However these findings were contrary to the results reported by Santodomingo-Rubido et al.[20] study. This could be due to the regional, racial or environmental differences.

In this study no significant association was found between TBUT and type of contact lens. The study results were similar to Craig et al.[3] and Thai et al.[7] studies. But contrary to Sweeney et al.[1], Eghosasere et al.[4], Riley et al.[10], Kastelan et al.[17] studies which found association between TBUT and type of contact lenses. The reason might be that more than half of total subjects used soft contact lenses and proportions

of other types of contact lens users were less, therefore, could not find any significant association.

Fig. 1: Regression model of TBUT and daily wearing time of contact lenses (showed that as the daily wearing time of contact lens increased, the TBUT value decreased).

Fig. 2: Regression model of TBUT and Years of Contact Lens Use (showed that as the number of years of contact lens use increased, the TBUT value decreased).

Fig. 3: Regression model of TBUT and minus power of contact lenses (showed that as the minus power of contact lens increased, the TBUT value decreased)

In this study a significant negative correlation was found between TBUT and daily wearing time of contact lenses. The reason could be that increased daily wearing time of contact lens caused more hypoxia which adversely affected the tear film stability. These results were in line with those reported by Kastelan et al.[17] study.

In this study a highly significant negative correlation was found between TBUT and years of contact lens use. This might be due to the reason that prolonged use of contact lenses resulted in chronic hypoxia which unfavorably affected the tear film stability. No other study could be found to sufficiently discuss the results.

In this study a strong significant negative correlation was found between TBUT and minus power of contact lens. The reason could be that high power contact lenses were thicker which reduced oxygen permeability and caused hypoxia which lead to reduce TBUT. No other study was found to sufficiently discuss the results.

In this study no significant association was found between corneal changes and plus power of contact lens. These insignificant results could be due to very less number of hyperopic contact lens users in the study. No other study was found to sufficiently discuss the results.

CONCLUSION

It is concluded that long term use of contact lenses decreased the stability of tear film and thus TBUT. TBUT was more affected with increase in daily wearing time, years of contact lens use and high minus power of contact lens.

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Concept, Design of study, Sample selection. Data collection, Data entry, Data analysis, Critical review, Drafting and revision of manuscript.

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