

Effect of Different Soft Contact Lenses on Tear Film Stability in Myopes



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ABSTRACT

Purpose: To assess the influence of soft contact lens wear on tear film stability in myopes.

Study Design: Quasi experimental study.

Place and Duration of Study: Social Security Hospital, Multan Road, Lahore, from February 2025 to May 2025.

Methods: Myopic participants with no prior experience of wearing contact lenses were chosen and were divided into two equal groups based on the type of lens: soft hydrogel; and silicone hydrogel. Patients with dry eyes, refractive errors other than myopia, or using systemic medications were excluded from the study. Tear film stability was evaluated with Tear Break-Up Time (TBUT), conducted before and after one month of lens wear. Data analysis was performed using SPSS, Version 27. A p-value < 0.05 was considered statistically significant.

Results: The study enrolled 90 myopic patients. For TBUT, soft hydrogel lenses showed a minor but significant reduction from 11.99s to 11.88s (Mean difference = -0.11s, p < 0.050), while silicone hydrogel lenses exhibited a significant improvement from 11.71s to 13.28s (Mean difference = +1.57s, p < 0.001). Independent t-test revealed that silicone hydrogel lenses had significantly greater positive changes in TBUT compared to soft hydrogels, indicating improved tear film stability after one month of lens wear.

Conclusion: This study shows that wearing soft contact lenses impacts tear film stability in myopic patients, however a positive or negative response depends on type of lens material worn.

Keywords: Myopia, Soft Contact Lenses, Soft Silicone Hydrogel Contact Lenses, Soft Hydrogel Contact Lenses, Tear Film Stability, Tear Break-Up Time Test, Dry Eye.

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INTRODUCTION

According to the WHO, uncorrected refractive errors is one of the leading causes of preventable visual impairment.¹ The global prevalence of myopia is 28.3%.² The pathophysiology of myopia involves structural changes in the eye, that include elongation of the eyeball (Axial Myopia), increase in corneal or lenticular curvature (Curvature Myopia), and refractive index (Index Myopia), which results in the

increase in overall power of the eye, leading to more convergence. Due to this increased refraction the parallel rays of light focus anterior to the retina.³ Myopic patients may experience eye strain, fatigue and headaches especially during screen use, reading a book and other near work.⁴ One of the most common treatments of myopia is soft contact lenses.⁵

Soft lenses are flexible plastic materials manufactured from hydrophilic polymer gels that keep the lens surface moist and permit oxygen to penetrate to the cornea.^{6,7} There are two basic types of soft contact lenses: Hydrogel and Silicone Hydrogel contact lenses.⁸ The choice between these two types depends upon comfort, needs and eye health.⁹ Although soft contact lenses have many benefits compared to prescription glasses, improper and long-term use of contact lenses can cause serious ocular

problems, including tear film instability or eye infection.¹⁰

Here is a refined version:

The present study investigates changes in tear-film parameters among myopic patients before and after contact lens wear. The findings will support eye-care professionals in making more informed prescribing decisions for myopes, including optimized wearing guidance and targeted interventions such as the use of lubricating eye drops.

METHODS

This Quasi-Experimental study was conducted at Optometrists Clinic, The University of Lahore and Social Security Hospital, Multan Road, Lahore from February 2025 to May 2025. This study was approved by the Institute Research Ethics Board (IREB) of The University of Lahore (**Reference number UOL/IREB/25/08/0004**). An informed written consent was obtained from all the participants prior to their inclusion in the study. A total of 90 patients were selected through purposive sampling. Participants aged 18 to 31 years, both male and female, clinically diagnosed with myopia, and with no history of severe ocular surface disease or prior contact lens wear were included. Individuals with dry eyes, history of refractive surgery, use of medications which could affect tear film, systemic diseases, mental retardation, pregnancy, or those unwilling to participate were excluded. Tear film stability was assessed using Slit Lamp and Fluorescein strips. Tear Break-Up Time (TBUT) was noted before and after one month of contact lens use. The OSDI (Ocular Surface Disease Index) which is a 12-item questionnaire was used to assess the severity of dry eye symptoms and their impact on daily life. The paired t-tests analyzed changes within each group, while independent t-tests compared differences between two lens types. The

criteria of significance (p-value) were kept 0.05 for this study.

RESULTS

There were 180 myopic eyes of 90 patients including 39 males (43.3 %) and 51 (56.7%) females. After 1 month of daily wear (approximately 8 hours/day) a significant reduction in TBUT was observed in soft hydrogel group, while silicone hydrogel lenses exhibited a significant improvement. Silicone hydrogel lenses provided significant improvement in tear film stability compared to soft hydrogels lenses. Maximum number of participants were in the 24-26 years age group and mean age was 24.98 ± 3.19 . (Table 1). Soft hydrogel lenses showed slight but marked decrease in TBUT, whereas Silicone hydrogel lenses showed a notable improvement in tear film stability after one month of wear (Table 2).

Table 1: Frequency Distribution of Age Range.

Range	Frequency	Percentage (%)
18 – 20	7	7.8
21 – 23	24	26.7
24 – 26	31	34.4
27 – 31	28	31.1
Total	90	100

Among soft-hydrogel lens wearers (n=45), TBUT decreased slightly (mean difference = $-0.11s$, $p<0.001$), whereas silicone-hydrogel wearers (n=45) showed a significant increase in TBUT (mean difference = $+1.57s$, $p<0.001$).

Although most participants in both groups did not report symptoms of dry eye, a small number of silicone hydrogel users experienced mild discomfort, suggesting individual variability in lens tolerance despite favorable objective outcomes (Table 3).

Table 2: Descriptive and Comparative Distribution of Tear Break-Up Time (TBUT).

Lens Type	Pre-Test Mean (secs)	Post-Test Mean (secs)	Mean Difference	p-value
Soft Hydrogel	11.99	11.88	-0.11	0.024
Silicone Hydrogel	11.71	13.28	+1.57	0.000

Table 3: Dry Eye Interpretation Based on OSDI Scores in Soft Hydrogel and Silicone Hydrogel Contact Lens Users.

Contact Lens Type	0-12 OSDI score: Normal	13-22 OSDI score: Mild Dry Eye
Soft Hydrogel	45 (participants)	0 (participants)
Silicone Hydrogel	43 (participants)	2 (participants)
Total	88	2

DISCUSSION

The goal of this study was to check the consequences of soft contact lens wear on tear film stability in myopic individuals and compare the impact of two commonly used materials: soft hydrogel and silicone hydrogel on tear film. Our results demonstrated that the hydrogel lenses caused a reduction of TBUT, whereas silicone hydrogel lenses improved tear film stability after one month of wear. These findings suggest that lens material play a significant role in influencing ocular surface physiology. Clinically, these results support the preferential use of silicone hydrogel lenses for individuals requiring prolonged wear or those prone to dry eye.

Tear film, is about 2-5.5 micrometer thick layer, that has an essential role in protection, nourishment and sustenance of ocular surface.¹¹ Cornea, being an avascular structure, gets oxygen from this transparent film which keeps the cornea healthy.¹² Tear film lubricates the eye surface by reducing friction during the blink and protects the eye from foreign bodies and other environmental factors. In addition to this, tear film offers a consistent refractive medium for the refraction of light that results in sharp and clear vision.¹³ Therefore, tear film is crucial for maintaining overall health of the eye. Its three layers: outer lipid layer, middle aqueous layer and the inner mucin layer function to make a stable tear film.¹⁴

For pre-corneal tear film stability, a balanced tear film production and evaporation is important. However, this stability can be altered if any of these two factors are disturbed.¹⁵ Therefore, for the evaluation of adequate production and proper evaporation, Schirmer's 1 Test and Tear Break-Up Time Test (TBUT) are performed, respectively.¹⁶

When soft contact lens rests on the cornea, it alters overall structure as well as the function of tear film. This pre-corneal tear film splits into pre-tear layer and post-lens tear film.¹⁷ This pre-lens tear film comprises of lipid layer and a small concentration of aqueous layer, whereas the post-contact lens film contains aqueous and the mucin portion.¹⁸ As the post-tear film becomes thinner because of the division of tear film, the evaporation of tears becomes faster. This can cause dryness, irritation and discomfort in contact lens users. This prolonged use of soft contact lenses can cause increased evaporation, decreased comfort and can affect the tear film stability by influencing TBUT.¹⁹

The results of our study are supported by a

prospective clinical trial done by N. Misu et al, in 2024, which involved 42 first time silicone hydrogel lens wearers.²⁰ The researchers evaluated tear film stability and comfort over a 4-week period. Participants with myopia underwent Non-Invasive Tear Break-Up Time (NITBUT) test for the 1st time before the lens wear, after 1 week and after 4 weeks of lens wear. The NITBUT progressively increased from 5.9 ± 1.9 s before wearing lenses to 10.8 ± 2.2 s at one week and further to 11.4 ± 1.9 s at week four. Both readings increased significantly ($p < 0.01$). No adverse signs were found, and all wearers reported a high level of satisfaction at week four.²⁰ These results provide strong evidence to the present study, as both show significant gain in tear film stability with silicone hydrogels after a period of consistent wear.

However, not all evidence supports these favorable outcomes. Diec Jennie et al, conducted a randomized crossover trial involving 36 participants who alternated between silicone hydrogel and hydrogel lenses for two weeks each.²¹ Using non-invasive imaging techniques, the investigators found that hydrogel lenses maintained tear meniscus height and tear-film stability as effectively as, and in some instances slightly better than, silicone hydrogel lenses. Patient-reported outcomes also favored hydrogel lenses, with participants noting greater comfort and reduced dryness during the hydrogel phase.

The study emphasized that while silicone hydrogel materials provide higher oxygen transmissibility, this alone does not guarantee better tear film interaction, especially in patients with borderline or unstable tear films.

The present study has some limitations. The follow-up period was relatively short, i.e., one month, and external factors such as humidity and screen exposure were not controlled, which may have influenced tear film stability outcomes. Future studies with longer follow-up periods and controlled environments are recommended.

CONCLUSION

The impact of soft contact lenses on tear film stability varies depending on the lens material. This study observed that silicone hydrogel lenses improved tear film stability, while hydrogel lenses reduced stability after one month of wear. These results emphasize the advantage of silicone hydrogel materials in maintaining ocular comfort and minimizing tear film

disruption.

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Patient's Consent: Researchers followed the guidelines set forth in the Declaration of Helsinki.

Conflict of Interest: Authors declared no conflict of interest.

Ethical Approval: The study was approved by the Institutional review board/Ethical review board (UOL/IREB/25/08/0004).

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