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QUARTERLY PUBLISHED

- **Editorial: Closing the Gap: Why Autonomous AI Needs Human Partners in Eye Care**
- **Burnout Among Ophthalmologists**
- **Intralesional Bevacizumab for Pterygium**
- **Near Work and Convergence Insufficiency**
- **Tear Film Instability and Visual Discomfort in presbyopes**
- **Therapeutic Meibomian Gland Expression in Dry Eye**

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Editorial inquiries should be addressed to Prof. Dr. Tayyab Afghani, Department of Orbit and Oculoplastics, Al-Shifa Trust Eye Hospital, Jhelum Road Rawalpindi, Pakistan.
Tel: 0092 51 5487821-25, Fax: 0092 51 5487827; Email: drtayyabafghani@alshifaeye.org ;
Website: www.asjoalshifaeye.org

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Tear Film Instability as a Contributing Factor to Visual Discomfort in Presbyopic Patients Aged 40 Years and Above

Hamdia Fatima¹, Muhammad Jalil¹, Hadia Iqbal¹, Alishba Munir¹, Aminah Rafiq¹, Nazish Nazir¹

Abstract:

Purpose: To evaluate visual discomfort associated with tear film instability in presbyopic patients and investigate its prevalence according to age and gender.

Methods: A cross-sectional study conducted from February 2025 to June 2025 in hospitals of the twin cities of Pakistan. The non-random purposive sampling technique was considered in this study. Data was calculated using EPI software. A total of 384 presbyopic patients completed the Ocular Surface Disease Index (OSDI) questionnaire. Data analysis was performed with the use of SPSS version 25, and correlation was measured with crosstabs with chi-square tests. The p-value <0.05 was considered statistically significant.

Results: Majority of participants experienced strong visual discomfort. Severity of OSDI was statistically significant with regards to gender ($\chi^2 = 23.36$, $p = 0.005$) and not age ($\chi^2 = 3.62$, $p = 0.305$). Most frequently occurring symptoms included blurred vision (82.9%), screen pain (84.9%) and difficulty in reading (86.9%). Symptoms' severity was slightly higher for women of 45-50 years old.

Conclusion: In presbyopic patients, symptoms of unstable tear film were correlated with visual discomfort. According to data, gender influenced severity of symptoms while age did not. Eye examinations and proper management of presbyopia can be helpful in alleviation of visual discomfort. *Al-Shifa Journal of Ophthalmology* 2026; 22(3): 137-142.

1. Ibadat International University,
Islamabad.

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Correspondence to:

Hamdia Fatima

Ibadat International University, Islamabad.

hamdiafatima743@gmail.com

Introduction:

Shape flexibility is the medical term used to refer to the aforementioned reduction in close vision occurring usually after the age of 40^{1, 6}.

Tear film instability refers to inadequate tear secretion, unstable tear film, and increased evaporation of tears^{1, 15}. Poor quality of tears may cause irritation, discomfort, poor vision, photophobia, problems with accommodation, and difficulties with near-vision tasks like reading and looking at a computer screen⁸. Recently, researchers have discovered the link between presbyopia and tear film instability, where tear dysfunction aggravates the symptoms of presbyopia by causing additional visual stress and problems with accommodation^{1, 6}. However, those suffering from presbyopia tend to squint and squeeze their eyes in order to see well, thus aggravating ocular dryness⁴. Even using reading glasses to

address presbyopia can exacerbate symptoms of dry eyes.

Although tear film instability has been widely studied in adults, only a limited number of studies have specifically focused on presbyopic patients aged 40 years and above ^{2,7}. Furthermore, there is still lack of information regarding the prevalence of tear film instability in presbyopes on the basis of age and gender, especially in the Pakistani community. This research work fills these knowledge gaps and provides recommendations for improving diagnosis, treatment, and visual rehabilitation by evaluating the prevalence, severity, and contributing factors of tear film instability in presbyopic individuals ^{1,2}.

To enhance the living standards of this group, the study's objectives are to assess the prevalence of tear film instability in presbyopic patients, evaluate the kind and severity of related visual fatigue, and pinpoint relevant factors that could deteriorate tear film quality ^{2,8,7}.

A comprehensive study in Shanghai reported an overall prevalence of tear film instability of 41.43% in adults aged 20 years and older. Tear film break-up time (TBUT) and Schirmer tests have shown that the prevalence was higher in contact lens wearers (54.1%) than in non-wearers (35.2%). These results suggest that tear film instability might be a factor causing ocular surface irregularities and postoperative refractive changes ⁶.

Negishi et al. studied presbyopia and tear film instability in 40- to 59-year-old adults and discovered that both these conditions cause visual fatigue, lower quality of sleep and decreased subjective well-being. Besides, gender differences were detected. Men get presbyopia at an earlier age than women, while women suffer from tear film instability more severely ^{1,2}.

Further evidence of this hypothesis was provided by Ayaki, Hunyadi, and Negishi. They examined 2,743 middle-aged patients grouped according to their age into three categories (36- to 45-, 46- to 55-, and 56- to 65-year-old patients). In this way,

researchers found that tear film instability increases with the patient's age, reaching the highest values in women aged 46- to 55-years old. Furthermore, they found tear film instability to be associated with visual fatigue, photophobia, and presbyopia development ^{2,3}.

From these papers, one can conclude about a connection between tear film instability and visual discomfort in presbyopia ^{5,15}.

Nevertheless, the majority of research studies have been carried out outside of Pakistan and prevalence of tear film instability is yet to be explored in terms of age and gender among Pakistani presbyopes ^{2,3}. This highlights the importance of having local evidence to facilitate appropriate diagnosis and prevention ^{2,7}.

Methodology:

This descriptive cross-sectional study uses the Ocular Surface Disease Index (OSDI) questionnaire to determine subjective symptoms and tear film instability. Non-probability or purposive sampling method was employed to conduct a study on 384 patients. The sample size for the study was determined using a minimum number of 384 individuals using single proportion with 95% confidence level ($Z = 1.96$), 5% margin of error, and an expected proportion of 50%. Data collection was done between February to June 2024 from Pakistani eye clinics located in Rawalpindi.

The study subjects will comprise presbyopic people who are aged 40 years or more. Patients with a history of having ocular surface diseases including blepharitis, ocular surgeries within six months prior to this study, wearing of contact lenses within a month prior to the study, systemic diseases that interfere with tear production, and drugs that cause instability of tear film (antihistamines and antidepressants among others) were excluded from the study. The inclusion criterion for the study involved patients diagnosed with presbyopia. The Ocular Surface Disease Index (OSDI)

questionnaire that comprises 12 items was given to qualified subjects. Each question was rated on a 0 to 4 scale, whereby 0 corresponded to “none of the time” and 4 “all of the time.” Scores of total points denoting “none of the time” and 4 corresponding to “all of the time.” Total scores were generated as a measure of the severity of tear film instability as well as related visual discomfort. Consent was acquired from all subjects before recruitment, and the study adhered to ethical guidelines as per the Declaration of Helsinki.

Results:

The results were analyzed using SPSS version XX (IBM Corp., Armonk, NY, USA). The descriptive statistics are used to summarize participant characteristics including age, gender, and OSDI severity. Categorical variables (gender, OSDI categories) were reported as frequencies and percentages while continuous variables

(age) were expressed as mean $\pm$ standard deviation.

Distribution of OSDI severity across gender and age group were presented using Cross tabulations. The association between OSDI severity and categorical variables (gender and age) were assessed using Pearson chi-square test. A p-value <0.05 was considered statistically significant. For all crosstabs, row and column percentages were calculated to illustrate the distribution of OSDI categories within each subgroup. In cases where expected cell counts were less than ⁵, caution was applied in interpreting the results.

1: OSDI Severity by Gender

Male and Females had slightly difference in distribution of OSDI. 11.5% of the males had normal, 2.9% mild, 0.7% moderate, and 84.9% severe symptoms. Among females, 11.0% had normal, 0.7% mild, 2.8% moderate, and 85.5% severe symptoms. The Chi-square test showed a significant association between gender and OSDI severity ($\chi^2 = 23.36$, $p = 0.005$).

Table 1. Distribution of OSDI Severity According to Gender

	Male	Female	Total
Normal	16 (11%)	16 (11%)	32 (8.3%)
Mild	4 (2.6%)	1 (0.7%)	5 (1.3%)
Moderate	1 (0.7%)	4 (2.6%)	5 (1.3%)
Severe	118 (76.8%)	124 (80.0%)	242 (63.0%)
Total	139	145	384

Chi-square: $\chi^2 = 23.36$, $df = 9$, $p = 0.005$

50% of cells had expected counts less than 5, minimum = 0.86. Interpretation should be cautious.

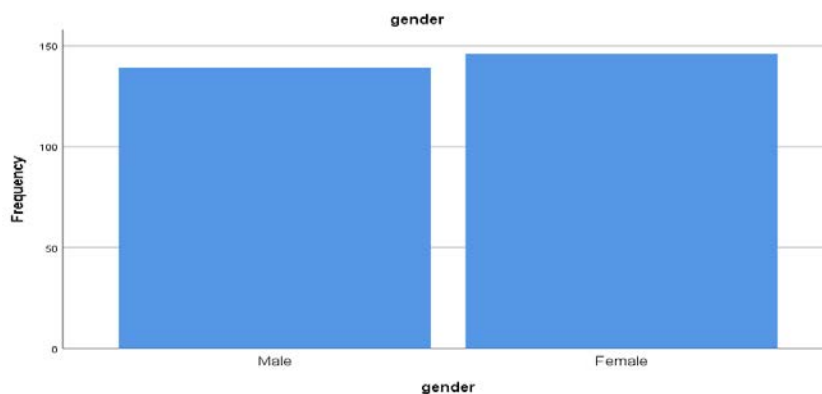


Figure: 1 Distribution of OSDI Severity According

2: OSDI Severity by Age Group

Severe ocular distress was common among all age categories. Among the age category of 40-44 years, 77.6% suffered from severe symptoms; 45-50 years, 90.8%; 50-55 years, 90.1%; and 55+ years, 77.6%. The

Normal, Mild, and Moderate categories were much lower among all age categories. The Chi-square test indicated no significant association between age and OSDI severity ($\chi^2 = 3.62$, $p = 0.305$).

Table 2. Distribution of OSDI Severity According to Age Group

OSDI Category	40–44	45–50	50–55	55+	Total
Normal	11 (16%)	7 (8%)	6 (7%)	8 (16%)	32 (8.3%)
Mild	0 (0%)	0 (0%)	2 (2.5%)	3 (6.1%)	5 (1.3%)
Moderate	4 (6%)	1 (1.1%)	0 (0%)	0 (0%)	5 (1.3%)
Severe	52 (77.6%)	79 (90.8%)	73 (90.1%)	38 (77.6%)	242 (63.0%)
Total	67 (17.4%)	87 (22.6%)	81 (21.1%)	49 (12.8%)	384

Chi-square: $\chi^2 = 3.62$, $df = 3$, $p = 0.305$

Four cells (50%) had expected counts less than 5, minimum = 2.45. No significant association was observed between OSDI severity and age group.

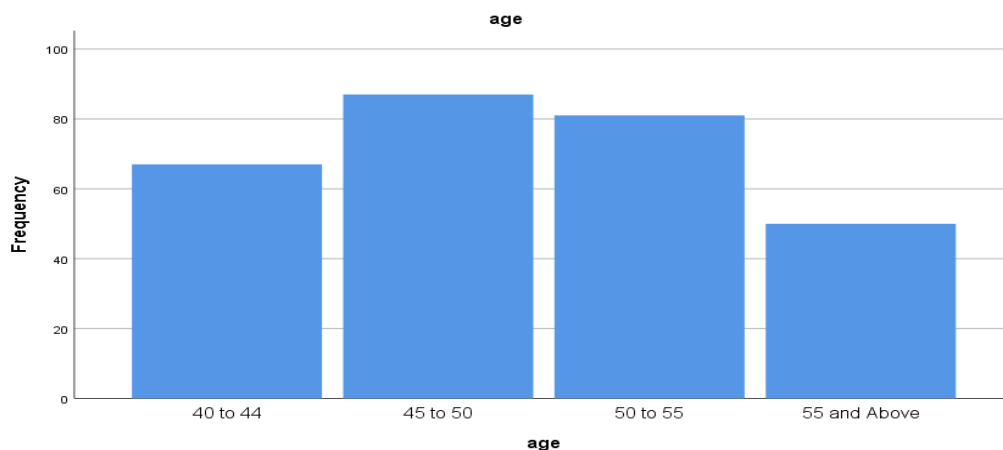


Figure: 2 Distribution of OSDI Severity According to Age

Discussion:

Through the use of Ocular Surface Disease Index (OSDI), this study aimed at evaluating the discomfort sensation of presbyopic subjects aged 40 years and above. From the results, it is clear that a large number of subjects had symptoms of severe visual pain. Indeed, the results are similar to the previous studies where it has been shown that middle-aged and older individuals suffer from ocular surface

symptoms, which may affect their daily life and vision, particularly near vision tasks. Statistically significant correlation was established between gender and OSDI severity. Both men and women had severe symptoms but female subjects had more severe symptoms compared to men. Indeed, there are similar findings in previous studies where it has been noted that women had increased symptom burden of dry eyes possibly due to differences in hormones and age related changes in tear film physiology.

Gender is therefore an important variable for evaluation of ocular surface symptoms in presbyopes although the present study did not intend to look into the molecular basis of such differences.

On the contrary, OSDI values did not show any connection with age groups. Continuous presence of symptoms in all age groups in this study may explain the absence of any connection, although in other studies, there is an increase in tear film abnormalities with aging. It was difficult to see age-specific differences since all the participants were presbyopic patients older than 40 years. Individual characteristics, such as digital device usage, work conditions, environmental factors, systemic diseases, as well as seeking medical help for the problems, could influence the severity of symptoms.

Blurry vision, difficulties in reading, and discomfort while working on the screen were the most widespread symptoms. They may affect the efficiency of vision and create a negative effect on the activities such as reading, work at the office, and using digital devices. Ocular surface instability affects the optical quality, which causes visual fatigue and sometimes blurriness. At the same time, tear film instability cannot be proven objectively, as the OSDI questionnaire was the only method used in this study. Thus, it is more correct to say that these results indicate patient self-perceived ocular surface discomfort rather than tear film failure.

The current study provides useful information concerning the prevalence of ocular surface symptoms among presbyopic patients in Pakistan, a country with limited evidence on the issue. Knowledge about the distribution of ocular surface symptoms is useful for ophthalmologists and optometrists because it can aid in recognizing patients who need to undergo additional ocular surface examinations in addition to refraction.

It should be noted that there are several limitations that need to be considered while interpreting these results. First, the

assessment of ocular surface symptoms was done using the OSDI questionnaire without applying objective procedures for examination of the ocular surface, such as ocular surface staining, Schirmer test or tear breakup time (TBUT). It means that there is no evidence of the clinical verification of tear film instability. Second, a cross-sectional study does not allow establishing causal relationships or temporal associations between presbyopia and ocular surface symptoms. Third, non-probability sampling was applied to recruit participants from hospitals in the twin cities, which may limit the generalization of results. Lastly, some confounders that may influence the severity of symptoms were not analyzed in the study (e.g., screen exposure, environment, medications, menopausal status, occupation, refraction correction).

In order to evaluate the state of the ocular surface in people suffering from presbyopia in a more comprehensive way, any future investigation into this area needs to include not only tear film functional testing but also self-reporting of their symptoms. A relationship between ocular symptoms and presbyopia would also have been even more strongly proven with a multicentered study involving different demographic profiles.

Conclusion:

According to the study, presbyopic persons 40 years of age and older frequently experience tear film instability symptoms, which are linked to increased visual discomfort. Women report slightly more severe symptoms. Patient comfort and visual performance may be enhanced by routinely assessing the ocular surface and tear film as part of presbyopia treatment. Future research should incorporate objective tear film tests, larger study populations, and examination of potential confounding factors to reinforce the findings because this study had methodological limitations and was based on subjective symptom assessment.

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Authors Contribution

Concept and Design: Muhammad Jalil, Hamdia Fatima
 Data Collection / Assembly: Hadia Iqbal, Aminah Rafiq, Hamdia Fatima
 Drafting: Alishba Munir, Hamdia Fatima, Nazish Nazir
 Statistical expertise: Hamdia Fatima
 Critical Revision Hamida Fatima