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- **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**
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Al-Shifa Journal of Ophthalmology

A Journal of Al-Shifa Trust Eye Hospital, Rawalpindi

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Closing the Gap: Why Autonomous AI Needs Human Partners in Eye Care

Mehmona Asgher

Introduction:

Diabetic retinopathy (DR) is still the leading cause of preventable vision loss globally. A simple annual eye exam can save the sight of millions of people who suffer from diabetes. However, millions of people are not getting these necessary screenings annually, as there simply aren't enough eye doctors to examine them all. Medical technology has advanced in recent years and now, there are fully independent AI screening systems. These AI systems can automatically process fundus photographs in a local clinic and provide a diagnosis within seconds without any delay, whereas in the past, a specialist or physician would have to review the images a few days later. The question that arises in the era of contemporary medicine is whether it is necessary to have a human oversight in this technological shift or not.

Accessibility is the main reason for autonomous AI. Patients do not often see an ophthalmologist in rural areas or low resource health clinics. Autonomous algorithms enable non-specialist clinical staff to obtain a retinal image and instantly provide a proper diagnostic assessment of whether the patient requires an urgent referral to a specialist. Initial research has shown that deep learning algorithms can perform on par with human specialists in detecting the presence of diabetic eye disease. Further clinical studies showed that an autonomous AI system was capable of identifying disease that posed a risk to vision without the need for a doctor to review every image in primary care. Autonomous AI saves time by making sorting healthy eyes from at-risk eyes an automated process, saves money on

healthcare, and allows doctors to spend their limited time on patients who truly need care^{1,2}.

While fast, the elimination of human review poses real clinical and legal challenges:

- **Hidden Comorbidities:** An AI trained specifically for DR may not be able to capture other severe eye diseases that appear in the photo, like glaucoma or age-related macular degeneration.
- **Edge Cases and Rare Patterns:** When an algorithm is used to detect a disease, it is very good at recognising patterns that it has seen trained into its systems, but unusual eye anatomy or rare vascular conditions can cause it to miss a disease (false negative) or cause the software to trigger an unnecessary alarm (false positive).
- **Accountability:** There is also blurred accountability, when an autonomous machine makes a misjudgment, medical and legal liability are not clearly defined. Who is liable if a patient becomes blind because of an error in the AI, the primary care clinic, the software developer or the attending physician?³

The future for diabetic retinopathy screening is not "machines only" or "humans only" but "AI-assisted human oversight. Here, the autonomous AI takes care of the grunt work on the frontlines. It can rapidly detect normal, healthy eyes and alert you to eyes that need urgent attention. Human specialists intervene when images fall into a gray zone, and they are assigned to more complicated cases for final treatment decisions. Rather than view AI as

a threat to eye doctors, health systems can leverage it as an essential tool to maintain medical safety and provide access to millions of patients who could benefit the most.

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When The Healer Needs Healing: Assessing Burnout Among Ophthalmologists Using The Copenhagen Burnout Inventory

Amna Rizwan¹, Muhammad Ali Haider², Nida Khalid³

Abstract:

Objective: To evaluate the prevalence of burnout among ophthalmologists in Pakistan. Additionally, the study aimed to identify specific personal, professional, and demographic characteristics that may increase the likelihood of experiencing burnout.

Methods: This descriptive cross-sectional study was conducted at Al-Ehsan Welfare Eye Hospital, Lahore from February 2025 to July 2025. After obtaining approval from the hospital ethical committee, we included 126 ophthalmologists by non-probability convenient sampling. They filled out a questionnaire based on the Copenhagen Burnout Inventory (CBI) to classify burnout. Data analysis was performed using SPSS version 20 with frequency and percentage computed for qualitative data, and the mean and standard deviation computed for quantitative data. Independent samples t-test was performed to check whether differences in means were statistically significant with p-value <0.05.

Results: Mild burnout was seen in 58.7% of ophthalmologists, moderate burnout was seen in 35.7%, and high burn out was seen in 5.6% of ophthalmologists. The mean CBI burn out score is significantly higher in ophthalmologists with age below 45 years ($p=0.000$), general ophthalmologists ($p=0.001$), and in consultant ophthalmologists and senior registrars ($p=0.000$). It is higher for those working less than eight hours per day ($p=0.002$).

Conclusion: This study demonstrated that burnout is a significant concern among ophthalmologists in Pakistan, with more than half experiencing mild burnout and over one-third moderate burnout. Although only a small proportion exhibited high burnout, the presence of this severe form among specific subgroups highlights the need for targeted interventions. *Al-Shifa Journal of Ophthalmology 2026; 22(3): 114-122.*

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Introduction:

Healthcare professionals usually rank higher in stress levels as compared to others, due to long working hours and emotional exhaustion¹. This stress can lead to burn out, a state of physical, mental and emotional exhaustion, typically leading to fatigue, which eventually affects the quality of care the patient receives. For instance, long shifts and lack of sleep cause healthcare professionals to feel detached and unmotivated². In recent years, burnout among healthcare workers has escalated as reported by Nigam et al., 2023 who have looked at indicators of burnout worsening between 2018 to 2022³. The problem is further intensified during public health emergencies, such as epidemics and pandemics, which place additional strain on already overburdened professionals⁴. It is

imperative that we seek to understand the causes of burnout and address them. This typically involves improving the work-life balance and improving conditions at the workplace.

The 11th revision of the International Classification of Diseases of the World Health Organization (WHO) recognizes burnout as a major health hazard⁵. Burnout can start with intermittent physical and mental exhaustion and can progress to a more permanent feeling of exhaustion that has adverse effects in both the workplace and for the personal life of the individual. The situation can worsen to a feeling of detachment from the workplace. At a personal level, burnout causes a loss in self-confidence, further reducing the capacity of the individual to lead a normal life at the workplace and beyond⁶. Burnout is frequently accompanied by conditions such as anxiety, depression, insomnia and physical weakness⁷.

Stress and burnout in health care workers (HCWs) is particularly troubling as it will invariably compromise the quality of patient care and can have disastrous implications. It is known that stress and burnout can lead to a higher incidence of hospital-acquired infections as well as increase the chance of medical errors⁸. It is, therefore, no surprise that patient satisfaction is negatively correlated with increased burnout⁹. HCWs need to interact with a full team in order to deliver treatment, whereas stress and burnout complicate interactions with co-workers thereby further jeopardizing patient-care¹⁰. Pakistani ophthalmologists, like most doctors in Pakistan, are typically exposed to exhausting work hours and high patient loads, essentially high-risk factors contributing to stress and burnout. The primary objective of this study was to investigate the incidence of burnout in Pakistani ophthalmologists and seek to understand what personal, professional or demographic characteristics lead to higher burnout.

Methodology:

This descriptive cross-sectional study was conducted between February 2025 and July 2025 after obtaining approval from the ethical review committee of AL-Ehsan Welfare Trust Eye Hospital, Lahore. We included 126 ophthalmologists based on an estimate of n=124 for the sample size based on a 90% confidence interval for this study¹¹. Non-probability convenient sampling technique was used to collect data via a generated form based on the Copenhagen Burnout Inventory with ophthalmologists over WhatsApp. This mechanism allowed us to conveniently invite our colleagues to fill in the form. Ophthalmologists registered with the Pakistan Medical and Dental Council were included in this study. Data about basic demographic features like age, gender, and marital status were noted, as well as precipitating factors like working hours per week, and workload. The questions assessing burnout in ophthalmologists were taken from the Copenhagen Burnout Inventory (CBI), which consists of 19 items. The CBI evaluates personal, work, and client related burnout by posing 6, 7 and 6 questions, respectively. Twelve items have responses of frequency along a five-point Likert scale ranging from always (100), often (75), sometimes (50), seldom (25) to never/rarely (0). The remaining seven items also use a five-point uniform Likert scale categorizing intensity being of a very low degree (0) to very high degree (100). The responses are then averaged to compute mean burnout scores for each ophthalmologist in the three categories (personal, work, and patient related) as well as an overall burnout score. A score of 0 to 49 on the CBI corresponds to mild burnout, a score between 50 and 74 corresponds to moderate burnout, a score between 75 to 99 is taken to be high burnout, whereas a score of 100 is taken as severe burnout. The data collected was analyzed using SPSS version 20 with qualitative statistics determined as frequency and percentages, and the mean and standard deviation computed for the

quantitative data. We contrasted the means of various groups to study the factors that may be associated with burnout in ophthalmologists by using the independent sample t-test with $p \leq 0.05$ as signifying a statistically significant difference in the means.

Results:

Out of 126 individuals, 65 (51.6%) were males while 61 (48.4%) were females.

Sixty-three (50%) were from general ophthalmology (i.e. ophthalmologists without further training as super specialists), 27 (21.4%) vitreo-retina surgeons, 17 (13.5%) paediatric ophthalmologists, six (4.8%) glaucoma specialists, four (3.2%) cataract surgeons, four (3.2%) cornea specialists, four (3.2%) oculoplastic surgeons and one (0.8%) uveitis specialist as shown in Figure 01.

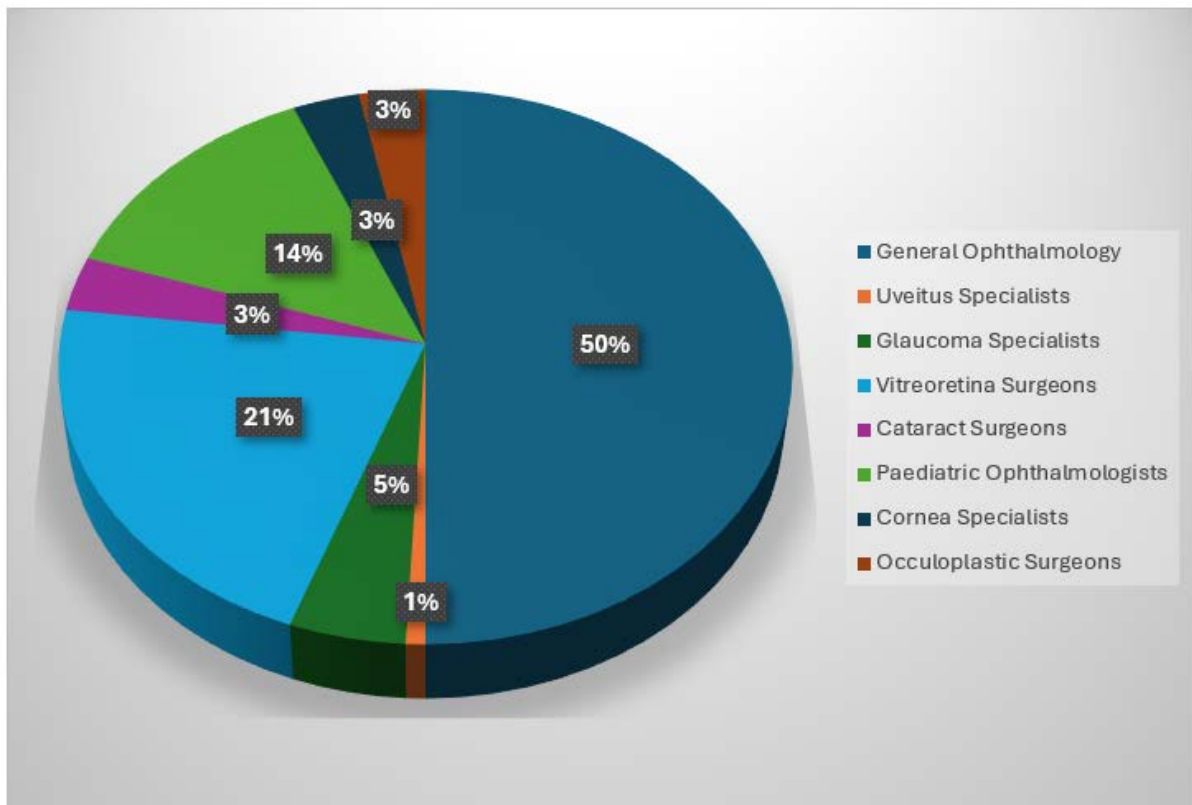


Fig 01: Distribution of sub-specialities among respondents.

Forty-seven (37.3%) were in age group 25-35 years, 61 (48.4%) in the 36-45 year group, 10 (7.9%) in the 46-55 year group, and eight (6.3%) in the 56-65 year group. Eighty-two (65.1%) were doing only one job, 25 (19.8%) were doing two jobs, 13 (10.3%) were doing three jobs and six (4.8%) were doing four jobs. Around 117 (92.9%) of the doctors were married, seven (5.6%) were single and two (1.6%) were divorced. Thirty (23.8%) were senior registrars (SRs), 26 (20.6%) were assistant professors, 11 (8.7%) were associate professors, five (4%) were professors, and

the remaining 54 (42.9%) were consultant ophthalmologists. A majority of the doctors (45.2%) worked 6-8 hours per day followed by 8-12 hours (40.5%), 4-6 hours (8.7%), and finally 5.6% worked more than 12 hours per day. Considering the time after postgraduate completion, 42.9% have worked for 0-5 years, followed by 6-10 years (19.8%), 11-15 years (24.6%), 16-20 years (4%), 21-25 years (4%) and 4.8% for more than 25 years.

It was reported that 9.5% ophthalmologists didn't do any surgeries on a weekly basis, 35.7% performed up to 10 surgeries per

week, 47.6% performed up to 20 surgeries per week, while only 7.1% performed more than 20 surgeries on a weekly basis. The total burnout scores as well as the personal, work, and patient related burnout scores are shown in Table 01 depicting the frequencies, percentages and cumulative percentages of ophthalmologists experiencing mild, moderate and high

burnout. In seven individuals who reported to have high burn out, all were males, four were consultant ophthalmologists and three were SRs. Six of these were general ophthalmologists and one was a uveitis specialist. Moreover, all of these high burnout cases were of married individuals aged 36-45 years.

Table 01: Frequency, percentage and cumulative percentage of total, personal, work and patient burnout among 126 ophthalmologists.

	Frequency	Percent (%)	Cumulative Percent
Total Burnout Grading			
Mild burnout	74	58.7	58.7
Moderate burnout	45	35.7	94.4
High burnout	7	5.6	100.0
Personal Burnout Grading			
Mild Burnout	49	38.9	38.9
Moderate Burnout	49	38.9	77.8
High Burnout	28	22.2	100.0
Work Burnout Grading			
Mild Burnout	74	58.7	58.7
Moderate Burnout	46	36.5	95.2
High Burnout	6	4.8	100.0
Patient Burnout Grading			
Mild Burnout	92	73.0	73.0
Moderate Burnout	30	23.8	96.8
High Burnout	4	3.2	100.0

Table 02: Comparison of mean burnout (total, personal, work, and patient related) between selected groups:

	Groups	N	Total Burnout			Personal Burnout			Work Burnout			Patient Burnout		
			Mea n	SD	p	Mea n	SD	p	Mea n	SD	p	Mea n	SD	P
Gender	Male	65	43.7	18.2	0.763	52.7	20.6	0.219	40.5	17.0	0.047	37.7	21.6	0.031
	Female	61	44.4	14		57.1	19.4		46.2	14.9		30.3	16.8	
Age	>=45 y	18	32.2	8.5	0.000	46.9	14.3	0.026	35.9	12.0	0.013	13.9	7.7	0.000
	<45 y	108	46.1	16.4		56.1	20.7		47.7	16.0		37.5	19.1	
Type	Speciali sts	63	39.5	14.5	0.001	50.5	18.3	0.016	38.6	14.2	0.001	29.2	17.8	0.005
	General Ophth	63	47.7	16.7		59.1	21.0		48.0	16.9		39.0	20.5	
Work Hours	>8hr/da y	58	39.3	15.2	0.002	48.7	19.2	0.001	39.0	14.5	0.032	30.1	17.8	0.005
	<=8hr/d ay	68	48.2	16.0		60.0	19.5		37.6	20.0		37.6	20.7	
Teachi ng Faculty	Junior (SR+AP)	56	46.9	15.6	0.000	58.1	18.4	0.000	46.0	14.5	0.035	36.6	21.1	0.001
	Senior (Assoc + Prof)	16	33.2	9.3		41.1	11.8		37.5	13.2		20.8	12.5	

Comparison of mean burnout between selected groups as well as the p values from the independent samples t-test. Also given are the standard deviation (SD) values. Ophth: Ophthalmologists, SR: Senior registrar, AP: Assistant professor, Assoc: Associate professor, Prof: Professor

Independent samples t-tests was performed on the collected data in Table 02. In order to be able to apply the independent sample t-test to our data, we divided the full data into various groups described in the second column of Table 2. The total burnout score difference is statistically significant in specialists versus general ophthalmologists, those working more versus those working less, and junior versus senior teaching faculty. And whereas there is no statistically significant difference between the genders in terms of total burnout score, there is a difference in the patient related and work related burnout scores. There was no statistically significant difference in mean burnout while comparing teaching faculty with consultant ophthalmologists. Likewise, we did not find any statistically significant difference in mean burnout considering number of years after post-graduation, the number of surgeries done per week, or marital status.

Discussion:

Mild burnout was seen in 58.7% of ophthalmologists, moderate burnout was seen in 35.7%, and high burnout was seen in 5.6% of ophthalmologists. High burn out was seen in males, 36-45 years of age, married, general ophthalmologists, and in consultant ophthalmologists and senior registrars.

Physicians within the 36–45year age cohort, typically categorized as Millennial generation, demonstrate a disproportionately high prevalence of burnout, with nearly 50% reporting associated symptoms¹². This population is particularly vulnerable due to the concurrent demands of professional advancement, family responsibilities, and financial obligations, which collectively contribute to heightened stress levels and increased risk of burnout. Our results are consistent with other studies in which younger age groups reported to have high burn out^{13,14,15}.

In our study, high burn out was seen in males only which is not consistent with the findings of Hussain et al., 2022, Azam et al., 2017 and Abbott et al., 2025^{13,14,16}. They suggested that female physicians exhibit higher levels of burnout, largely attributable to the simultaneous demands of professional duties and family roles, which often lead to greater physical and emotional exhaustion. These studies had included all categories of doctors, but including only ophthalmologists our findings are unique in the literature as only males reported high burn out. Furthermore, we have not seen any statistically significant difference when comparing total burn out and personal burn out between males and females. But having said this, we do see statistically significantly more burn out in females related to work burn out and in males related to patient burn out.

The high burnout cases (total of 7) in our study are attributed to married individuals. However, this is likely a case of correlation rather than causation as there was no statistically significant difference in any of the burnout scores between married and unmarried respondents. It is amusing to note that of the seven cases of high burn out, six were general ophthalmologists. This finding is consistent with general ophthalmologists being more prone to high burn out as compared to specialists in our results. The lone uveitis specialist reporting high burn out is consistent with a study conducted in Cairo which included 264 ophthalmologists and showed that uveitis specialists had high burn out¹⁷. Another study by Sedhom et al., 2022 conducted in the USA has shown similar results¹⁸.

We have compared the burn out in teaching faculty by dividing it into the two groups of junior faculty (SRs and Assistant professors) and senior faculty (Associate Professors and Professors). We have seen positive correlation as shown in Table 02 between junior faculty and higher burn out. These results are consistent with other studies^{19,20}. The reasons might be higher

clinical burden, and the complexity of the lives of young physicians, juggling new relationships and young children. We also found out that consultants have higher burn out scores as compared to senior teaching faculty.

Our study extends the existing literature on physician burnout and career satisfaction by investigating their connection with academic affiliation and exploring differences across faculty ranks. We find that involvement in teaching role is positively correlated with reducing job related burnout and, presumably, enhancing job satisfaction. Our study indicates the importance of a wide variety of factors that may contribute to burnout: academic affiliation, faculty position, stage of professional development, gender. Interventions need to be tailored to take these factors into account. Zhuang *et al.*, 2022 suggested that Department chairs and institutional administrators can play a pivotal role in mitigating physician burnout and enhancing career satisfaction by safeguarding dedicated time for academic pursuits, such as teaching and mentorship²¹. Our results also indicate that there is a correlation between time spent in mentorship and burnout as we have seen lower burnout in senior teaching faculty (Associate Professors and Professors).

We have found that less burn out was seen in doctors working more than 8 hours a day. These findings are contrary to other studies that have shown positive correlation between long working hours and high burn out^{22,23,24}. Burnout may arise from both excessively long and unusually short working hours, though through distinct pathways. Prolonged hours often cause physical and psychological fatigue, driven by stress, inadequate rest, and disruption of work–life balance. In contrast, reduced working hours, if not properly structured, can foster anxiety, a diminished sense of accomplishment, and feelings of purposelessness. Our results might be because more duty hours mean more financial stability that can potentially lead

to less stress and burnout. Limitations of our study are that these data are self-reported and subject to biases associated with recall and social desirability that could affect participant response. Another limitation is that we did not include the effect of monthly income. There presumably may be more factors that may affect the incidence of moderate to severe burnout which we have failed to consider in this limited study. We believe a larger follow-up study should investigate urban/rural setting, the range of available career opportunities, and the level of institutional and social support.

Conclusion:

This study demonstrated that burnout is a significant concern among ophthalmologists in Pakistan, with more than half experiencing mild burnout and over one-third reporting moderate burnout. The incidence of high burnout indicates an immediate need for targeted interventions particularly amongst males, physicians from 36-45 years of age, married individuals, general ophthalmologists, consultants, or senior registrars. We found that academic affiliation and professional subspecialties tend to reduce the risk of burnout. General ophthalmologists and junior faculty appeared more prone to higher burnout levels. Presumably, academic affiliation and senior faculty ranks provide protective effects, potentially through enhanced career satisfaction and opportunities for teaching and research.

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Effectiveness of Intralesional Bevacizumab in Grade I/II Pterygium as Primary Treatment

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Abstract:

Objective: To determine the effect of Intralesional Bevacizumab in pterygium (grade I/II) as primary treatment in terms of mean change in size.

Methods: The quasi-experimental study was conducted in the Ophthalmology Department, Benazir Bhutto Hospital, Rawalpindi, over a period of 6 months, from July 2019 to January 2020. Thirty eyes of patients aged 25–70 years with primary grade I or II pterygium were enrolled using consecutive sampling technique. We measured a reduction in the pterygium size by comparing the baseline measurements with those obtained 1 week, 1 month and 3 months after intralesional injection of 0.1 mL of 2.5mg bevacizumab. We analysed the data using SPSS version 22. Paired sample t-test was applied to compare pre and post injection change in size of pterygium. p-value <0.05 was considered statistically significant.

Results: The mean age of total study population was calculated to be 49.07±12.06 SD years. 66.7% (n=20) patients were males and 33.3% (n=10) were females. The mean pterygium length at baseline was found to be 2.26±1.05mm. We observed a statistically significant difference (p-value ≤0.05) in length of pterygium at 1 week, 1 month and three months after treatment when paired sample t-test was employed.

Conclusion: The size of pterygium following the use of intralesional injection of bevacizumab was found to be significantly less at 1 week, 1 month and 3 months, when compared with baseline values. *Al-Shifa Journal of Ophthalmology* 2026; 22(3): 123-129.

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Introduction:

Pterygium is a prevalent ocular surface disorder featuring a fibrovascular growth of conjunctival tissue onto the cornea¹. The prevalence of pterygium varies markedly across different geographic regions, ranging from 1 to 30%. Its global prevalence has been estimated at approximately 10.2%, with higher rates reported in populations exposed to ultraviolet radiation, particularly those living in tropical and subtropical climates². This geographic fluctuation signifies the role of environmental factors in its development. Although pterygium is typically described as a degenerative condition of the conjunctiva, its exact pathogenesis remains unclear. Multiple risk factors are associated in the development of pterygium, including excessive exposure to ultraviolet radiation, sunlight, wind, dust, chronic irritation, trauma, and inflammation³.

Increasing evidence suggests that inflammation, fibrovascular proliferation, and angiogenesis play vital roles in its development⁴. Pterygium cells produce matrix metalloproteinases (MMPs), which have been implicated in the pathogenesis of pterygium by facilitating invasion into Bowman's layer and the corneal stroma⁵. Pterygium is also composed of actively proliferating fibrovascular tissue, suggesting that neovascularization plays a pivotal role in its formation and progression.

Multiple immunohistochemical studies have demonstrated significantly increased production of vascular endothelial growth factor (VEGF) in pterygium tissue compared with normal conjunctiva and cornea. This overexpression supports the role of angiogenesis in pterygium pathogenesis and identifies VEGF as a potential therapeutic agent⁶.

The primary goal in the management of pterygium is prevention of progression and recurrence. At present, no effective medical therapy exists to reliably halt disease progression, and surgical excision remains the definitive treatment in most clinical settings. However, recurrence rates remain highly variable, ranging from 50% to 80% following simple excision and 5% to 15% with more advanced surgical techniques and adjunctive therapies. Although reduced recurrence has been documented with the use of antifibrotic agents, their use is associated with potentially serious complications, making pterygium management a subject of ongoing debate⁷. Given the established role of VEGF in pterygium pathogenesis, anti-VEGF therapy has emerged as a promising treatment modality. Bevacizumab is a recombinant humanized monoclonal antibody that works by preventing VEGF–receptor interaction and thus inhibits all isoforms of VEGF⁸. A recent local study demonstrated that intralesional bevacizumab injections can reduce pterygium vascularity and size in both primary and recurrent cases, without

significant local or systemic adverse effects⁹. However, that study primarily evaluated bevacizumab as an adjunct to surgical management rather than as primary treatment modality. Evidence regarding the effectiveness of bevacizumab as an independent treatment modality for primary pterygium remains insufficient in the Pakistani population. Therefore, the present study evaluated the effect of intralesional bevacizumab as a primary treatment option, with reduction in pterygium size as the primary outcome. This approach may offer a minimally invasive alternative to surgical treatment, particularly in patients with early pterygium.

Methods:

A quasi-experimental study was conducted in Ophthalmology Department, Benazir Bhutto Hospital, Rawalpindi, over a period of 6 months, from July 2019 to January 2020. The study included patients with primary pterygium (grade I/II). The sample size was calculated using the Open Epi sample size calculator based on a previous study. Assuming a 95% confidence level, 90% study power, and an effect size of 1.16, the required sample size was determined to be 30 eyes. Data was collected by consecutive sampling technique. Patients between 25 - 70 years of age with primary pterygium (grade I/II) causing symptoms like foreign body sensation, redness, itching and patients with cosmetic concerns were included in the study. Patients presenting with recurrent pterygium, having ocular surface disease like dry eye, ocular allergy, glaucoma, pregnant/lactating women and those allergic to bevacizumab were also excluded from study.

Prior to initiation of the study, approval was obtained from the Institutional Ethics Review Forum of Rawalpindi Medical University. Written informed consent was obtained from all participants. We performed a comprehensive clinical evaluation for each patient, including detailed history taking and documentation

of demographic characteristics such as age, sex, along with presenting ocular symptoms. A detailed ophthalmological examination was also performed for all the patients to exclude coexisting ocular conditions. The examination included assessment of best-corrected visual acuity (BCVA), slit-lamp biomicroscopic examination of the anterior segment, fundus evaluation, and intraocular pressure (IOP) measurement. We documented the site and size of the pterygium prior to intervention, with horizontal extension measured in millimeters using a standardized scale or Vernier caliper. Under strict aseptic conditions and following instillation of topical anesthesia, we injected 0.1 mL of bevacizumab (2.5 mg) into the body of the pterygium in the operating theater.

After the procedure, patients were discharged on topical medications consisting of a combined antibiotic–steroid eye drop administered four times daily, along with artificial tear substitutes four times daily for one week. Follow-up evaluations were performed at 1 week, 1 month, and 3 months post-injection. All clinical data was recorded on predesigned proformas. Pterygium size was used as the

primary outcome measure and reassessed at each follow-up visit for statistical analysis. The data was entered and analyzed using SPSS software version 22. The mean and standard deviations were calculated for Quantitative variables i.e. age, reduction in size of pterygium (baseline and 3 months) measured at baseline and post injection after 1 week, 1 month and 3 months. The 95% within-subject confidence intervals were calculated for pterygium size at baseline and at 1 week, 1 month, and 3 months after the injection. Paired sample t-test was applied to compare pre and post injection change in size of pterygium. P-value ≤ 0.05 was considered statistically significant. Effect modifiers like age, gender, grade were controlled by subgrouping. Paired sample t-test was applied to subgroups.

Results:

We included a total of 30 eyes ($n = 30$) with primary pterygium of grade I or II in the study. All patients presented with symptoms of foreign body sensation, redness, and itching. Demographic characteristics of the study population are shown in table I.

Table I: Demographics characteristics of the Study Participants

Variable	Frequency (%)	Age (mean $\pm$ SD)
Male	20 (66.7%)	49.85 $\pm$ 12.20
Female	10 (33.3%)	47.50 $\pm$ 12.28

The mean baseline pterygium size was 2.26 ± 1.05 mm. A progressive reduction in pterygium size following intralesional bevacizumab injection was observed. The mean pterygium size measured 1.64 ± 0.69 mm at 1 week, 1.38 ± 0.56 mm at 1 month, and 1.08 ± 0.52 mm at

3 months after treatment. The paired t-test demonstrated a statistically significant reduction in pterygium size at all follow-up visits compared with baseline ($p \leq 0.05$). Table II presents the detailed statistical analysis.

Table II: pterygium size at baseline and 1 week, 1 month and 3 months post treatment according to effect modifiers

Variables	N	Pterygium size Baseline (mm)	Pterygium size 1 week (mm) P value <0.001	Pterygium size 1 month (mm) P value <0.000	Pterygium size 3 months (mm) P value <0.000
Male	20	2.20±1.02	1.65±0.70 P value <0.001	1.37±0.51 P value <0.000	1.09±0.52 P value <0.000
Female	10	2.38±1.15	1.63±0.72 P value <0.004	1.41±0.66 P value <0.004	1.08±0.55 P value <0.002
< 50 years	15	2.27±1.03	1.63±0.68 P value <0.002	1.34±0.48 P value <0.000	1.06±0.52 P value <0.000
>50 years	15	2.25±1.11	1.65±0.73 P value <0.002	1.43±0.64 P value <0.001	1.11±0.54 P value <0.000
Grade 1 Pterygium	20	2.05±1.07	1.46±0.68 P value <0.000	1.26±0.59 P value <0.000	0.98±0.56 P value <0.000
Grade 2 Pterygium	10	2.68±0.92	2.00±0.61 P value <0.019	1.63±0.41 P value <0.003	1.28±0.39 P value <0.000

In four (13.3%) patients, subconjunctival hemorrhage at the injection site was observed. The condition was self-limiting and resolved spontaneously without any intervention. Subgrouping was performed for potential effect modifiers including age, gender, and pterygium grade. Paired sample t-test analysis applied to subgroups demonstrated a statistically significant reduction in mean pterygium size at 1 week, 1 month, and 3 months following treatment ($p \leq 0.05$).

Discussion:

Pterygium is an ocular surface degeneration in which fibrovascular proliferation and chronic inflammation play a significant role in its pathogenesis. Multiple immunological and genetic factors are implicated in disease progression, and growing evidence suggests that an imbalance between angiogenic and anti-angiogenic factors is central to its development^{10, 11, 12}. Immunohistochemical studies have demonstrated increased expression of vascular endothelial growth factor (VEGF) in pterygium tissue compared to normal conjunctiva. Consequently, abundant VEGF expression provides a rationale for anti-VEGF therapy

aimed at regression of neovascularization and reduction in pterygium size¹³.

In recent years, several studies have evaluated the effect of local bevacizumab therapy in both primary and recurrent pterygium^{12,14}. Our study assessed the effect of intralesional bevacizumab as a primary treatment modality in Grade I and II pterygium, with the aim of introducing a minimally invasive and cost-effective treatment option for the local population. Our results demonstrated a statistically significant reduction in pterygium size following treatment compared to baseline. Additionally, significant associations were observed with effect modifiers such as age, grade, and gender. No serious ocular or systemic adverse effects were observed.

A systematic review and network meta-analysis by Zeng et al., 2017 reported that subconjunctival bevacizumab has been administered in doses ranging from 1.25 mg to 7.5 mg as an adjunctive treatment for pterygium. The 2.5 mg dose used in our study falls within this reported therapeutic range. This meta-analysis reported that intralesional injection of bevacizumab was associated with a 62% reduction in the odds of pterygium recurrence compared with placebo¹⁰.

Our findings are consistent with the updated meta-analysis of randomized controlled trials by Zhang et al., 2021 which included 1124 patients and reported that subconjunctival bevacizumab at 2.5mg dose, effectively reduces pterygium size by suppressing fibrovascular proliferation. The meta-analysis also demonstrated that bevacizumab reduces the risk of pterygium recurrence and improves overall clinical outcomes, supporting its role as an effective therapeutic option in the management of pterygium¹⁵.

Similarly, Aziz et al., 2021 demonstrated that intralesional bevacizumab significantly reduced pterygium size and vascularity. Their study included 30 patients with primary pterygium, similar to the present study, and their findings were consistent with our results¹⁶.

In the present study we observed a reduction in pterygium size (measured in millimeters) along with decreased congestion on gross examination. Ghooz et al., 2019 reported that intralesional injection of 0.2ml of bevacizumab (5mg/ml) combined with 5-fluorouracil significantly reduced the pterygium vascularity and size ($P < 0.005$). However, despite these favorable clinical outcomes, the treatment did not result in a significant reduction in pterygium-induced astigmatism¹⁷.

In contrast to our findings, Liu et al., 2017 in a systematic review and meta-analysis, reported that subconjunctival bevacizumab did not significantly reduce pterygium recurrence when used as an adjunct to surgery¹⁸. However, their analysis focused on postoperative recurrence, whereas our study evaluated changes in pterygium size, vascularity, and symptoms following subconjunctival bevacizumab injection. The observed difference may be explained by the different outcome measures and the higher bevacizumab dose used in our study (2.5 mg vs. 1.25 mg in most studies included in the meta-analysis).

Parveen et al., 2023 found that 0.1ml injection of bevacizumab (2.5mg/ml)

offered a favorable safety profile, with no cases of punctate epithelial keratitis, unlike 5-fluorouracil, despite the latter showing greater efficacy in reducing pterygium progression¹⁹.

The literature regarding bevacizumab use in recurrent pterygium remains controversial. Ghiasian et al., 2022 reported that topical and subconjunctival bevacizumab provide only limited benefit in recurrent pterygium, and current evidence does not support their routine use²⁰. Conversely, Mansour et al., 2009 described effective control of inflammation in residual pterygium tissue following subconjunctival anti-VEGF therapy. Similarly, Teng et al., 2009²² reported transient regression of inflammation and hyperemia following subconjunctival bevacizumab injection in a patient with inflamed primary pterygium²¹. In the present study, our patients experienced symptomatic relief within one week of injection, accompanied by a significant reduction in pterygium size.

Bevacizumab has been used as an adjunct to pterygium surgery. In a prospective randomized controlled trial, Sayadi et al., 2022 reported that preoperative intralesional bevacizumab administered one month before surgery significantly reduced the risk of pterygium recurrence compared with surgery alone¹³. The study also demonstrated significantly improved pterygium color intensity, with 53.3% of patients demonstrating mild color intensity after treatment ($P = 0.001$). Mohamed et al., 2024 reported that preoperative subconjunctival bevacizumab administered before pterygium excision with conjunctival autografting significantly reduced the postoperative recurrence rate, supporting its role as an effective adjunct to surgical management⁴.

In conclusion, intralesional/subconjunctival bevacizumab significantly reduced the size, vascularity, and symptoms of Grade I and II primary pterygium, demonstrating its potential as a safe and effective minimally invasive

treatment, particularly in early-stage disease. The treatment was well tolerated, with no serious adverse effects observed. Although bevacizumab may not replace surgical excision in advanced or progressive cases, it may serve as a useful therapeutic option for selected patients who are poor surgical candidates or prefer a nonsurgical approach. The main limitations of this study were the relatively small sample size, short follow-up period, and the lack of detailed assessment of post-treatment visual acuity and corneal astigmatism. Future multicenter, adequately powered randomized controlled trials with standardized outcome measures and extended follow-up are warranted to determine the optimal dosing strategy, treatment schedule, long-term efficacy, safety, and cost-effectiveness of intralesional/subconjunctival bevacizumab in the management of primary pterygium.

Conclusion:

The study concluded that the size of pterygium following the use of intralesional/subconjunctival injection of bevacizumab was found to be significantly less at 1 week, 1 month and 3 months, when compared with baseline values.

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The Effect of Near Work on The Onset and Severity of Convergence Insufficiency in Individuals Aged Between 8 Years to 35 Years

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Abstract:

Purpose: To evaluate the effect of near work on the onset and severity of convergence insufficiency in individuals aged between 8 years to 35 years

Methodology: A prospective cross-sectional study was conducted on 150 participants aged between 8-35 years undertaking ≥ 2 hours/day of near work were enrolled using a convenient, non-probability sampling technique from March 2025 to June 2025 from the Outpatient Department, Khairun-Nisa Eye Hospital, Karachi, Pakistan. Convergence insufficiency was evaluated using Near Point of Convergence (NPC) measurement and the Convergence Insufficiency Symptom Survey (CISS). Chi-Square test was applied to analyze the data in SPSS version 27, with p-value < 0.05 considered statistically significant.

Results: Out of the 150 respondents, the CI group recorded a lower mean age (23 years) than the non-CI group (25.6 years) ($p = 0.007$). Gender distribution was even (48.7% female and 51.3% male) and did not significantly correlate with CI ($p = 0.8$). In both groups, the median NPC had the same value (13 cm) with a P-value of 0.4. According to CISS requirements, 82.7% of the respondents were symptomatic for CI. CI group reported a median of 6 hours/day near work time and those in the non-CI group reported 4 hours/day ($p < 0.001$).

Conclusion: Symptomatic CI was highly prevalent (82.7%) in persons aged 8-35 years and closely related to long-term near work. While the NPC measurement of both groups was not significantly different. These findings underscore the need to conduct regular binocular vision screening in populations at risk. *Al-Shifa Journal of Ophthalmology* 2026; 22(3): 130-136.

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Introduction:

In this age of advancing technology excessive use of smart devices and gadgets in children and adults are raising many concerns and impacting their eye health, along with this, individuals who perform tasks that require constant near vision, such as reading books for extended periods, people engaged in office work, or watchmakers doing precise work, also face numerous challenges. Whether a person is using a laptop computer or a mobile smart device or doing constant near work the visual symptoms linked to them have been found to be identical^{1,2}. Concerns regarding students' visual health are raised by the growing use of e-learning in educational

systems. The burden of screen time is associated with increased risk of developing convergence insufficiency and digital eye strain in people³. Convergence and accommodation are especially important since electronic gadgets are used at close working distances³. The miosis is additionally impacted by the spectral distribution of light, which causes convergence issues when reading⁴. Convergence is a tendency to look at a close object by turning both eyes inward toward one another. The ability to move both eyes outward to gaze at a far-off object is known as divergence, which is the reverse of convergence⁵. The normal NPC is about 6-10 centimeters. If the NPC is more than 10 centimeters, this is a sign of poor convergence other clinical manifestations are exophoria (XOP) that is greater in near than the distance by 4 PD (Prism diopters) or more, reduced positive fusional vergence (PFV) (Base out reserves) and reduced negative relative accommodation (NRA)⁶. Convergence insufficiency reduces how your eyes converge when you look at objects close by⁷. The symptoms of convergence insufficiency are headache, eye strain, Blurry vision, Squinting, closing or rubbing an eye, dizziness diplopia, motion sickness, and loss of concentration during a task performance⁸. Causes of convergence insufficiency is prolong near work, stress, neuro degenerative conditions also family history. The prevalence range of convergence insufficiency varies from 1.7% to 33%, depending on the study^{9,10}. Users of visual display terminals and the professions where individuals are required to work at a constant near distance frequently experience a prevalence rate of visual diseases and indications of ocular fatigue, and the function of an optometrist is farther in raising awareness of these elements¹¹. According to a systematic review by Mohamed and Alrasheed (2023),

roughly 7.98% of people suffer from convergence insufficiency. f the treatment studies, 80% preferred vision therapy, and 42% said that the most successful approach was office-based vergence/accommodative therapy combined with home reinforcement¹². Pillay and Munsamy (2021) conducted a thorough study and discovered that the prevalence of CI varied between 3.5% and 18% in clinical trials and between 5.46% and 13% in non-clinical settings. According to diagnostic criteria, the prevalence of CI in primary school students ranged from 6.80% to 31.40%, while in high school students, it might reach 32.60%. According to the review, there is no clear correlation between CI and the use of e-devices, even if screen time has been associated to myopia³. The frequency of CI among the elderly population was investigated in 2021. According to the study, 21.5% of subjects had three-sign CI and 29.6% had two-sign CI. It's interesting to note that there was no discernible trend in prevalence with age or a significant difference between men and women¹³. Among patients aged 15–35, Saeed et al. (2020) reported a 38.4% prevalence of accommodative insufficiency and a 29.4% prevalence of CI. Blurred vision, headaches, and eye strain were common symptoms¹⁴. The prevalence and effects of accommodative insufficiency (AI) and convergence insufficiency (CI) was evaluated in a 2019 study. According to the study, 2% of children had definite CI; when clinically important instances are taken into account, the frequency rises to 6.8%. 10% of the children had AI, and 3% had both CI and AI at the same time¹⁰. According to a 2017 study, 12.4% of participants had CI, and 55% said they were visually uncomfortable. These results imply that university professors are likely to have both CI and visual discomfort¹⁵. With increasing digital screen time and academic demands,

prolonged near work places significant strain on binocular vision. Investigating this relationship is essential to establish effect of prolonged near work on the onset and severity of Convergence Insufficiency.

Methodology:

A prospective cross-sectional design was conducted at Khairu-Nisa Eye Hospital in Karachi, Pakistan, from March 2025 to June 2025. Data was collected through a convenient, non-probability sampling technique after the approval, KNNEH/ERC/APR/10-25. The NCSS PASS was used to determine the sample size which was found out to be 150 with an 80% power and a 5% margin of error. Patients who were willing to participate and met the inclusion criteria were chosen from among those who attended the hospital's outpatient department. People of age between 8 and 35 years who study, read, or use digital devices like computers or smartphones for at least two hours per day were eligible to take part in this study and gave their informed consent for participation and publishing. To avoid any confounding effects on visual function assessments, participants with a diagnosis of neurological or ocular conditions with the exception of convergence insufficiency (CI) were not allowed to participate in this study. A thorough history-taking procedure was the first step in the evaluation, which focused on symptoms like headaches, eye strain, blurred or double vision, and trouble focusing when performing close activities. Convergence insufficiency was measured by two factors. Poor convergence and maybe convergence insufficiency was indicated by an NPC break point larger than 10 cm. The Convergence Insufficiency Symptom Survey (CISS), a validated 15-item questionnaire, was used to measure the

severity of symptoms. When used to evaluate CI symptoms in a range of age groups, the CISS has shown strong construct validity and reliability. IBM SPSS Statistics software, version 27, was used to analyze the data. The prevalence of convergence insufficiency (CI) symptoms and participant data, such as age, gender, and length of daily near labor, was compiled using descriptive statistics. Chi-square tests was used to evaluate relationship between categorical variables like near work length categories and presence of CI symptom.

Results:

This study involved 150 participants, the mean age of the participants in their group of convergence insufficiency (CI) was 23 years (18 years to 27 years) compared to the mean age of the comparison (non-CI) group that was 25.59 years (23 years to 29 years) with a significant difference. The outcome shows that the age distribution in the two groups differed in a significant way ($p = 0.007$) whereby the younger participants were likely to have more CI. The distribution of the sample in terms of gender allocation indicates insignificant results between the CI and non-CI groups ($p = 0.8$). The Near Point of Convergence (NPC), had to be evaluated during the diagnosis of CI in both groups. CI and non-CI groups had a median NPC of 13 cm. The interquartile ranges of the CI group were 12 to 13.5 cm and non-CI was 12.5 and 14 cm. Variation in NPC was not so important ($p = 0.4$). Although NPC values exceeded the normal cut-off point of 10 cm, the two groups had similar means of convergence ranges which could mean NPC sufferers cannot be efficient enough to indicate severity or preponderance of the symptoms.

Table 1: Demographic and Clinical Profile of Study Participants

Age (Years)	23.00 (18.00 – 27.00)
Age Categories, n (%)	
Children (7–12 years)	18 (12.0%)
Adolescents (13–18 years)	17 (11.3%)
Early Young Adults (19–24 years)	41 (27.3%)
Late Young Adults (25–30 years)	52 (34.7%)
Mature Adults (31–36 years)	22 (14.7%)
Gender Distribution, n (%)	
Female	73 (48.7%)
Male	77 (51.3%)
CISS Symptom Status, n (%)	
CI Symptomatic (CI Group)	124 (82.7%)
Asymptomatic / Non-CI Group	26 (17.3%)

This was the most striking result as there was a big disparity in the amount of near work per day between the two groups. The group of CI subjects had a median of 6 (IQR 5-7) hours per day of near work and the non-CI membership had 4 (IQR 3-5) per day. This variation was of statistical significance ($p < 0.001$). It is interesting to

note that these findings show that there is a close relationship between protracted near work activity and the presence of convergence insufficiency, supporting the theory that the use of digital devices and associated extended near optical work add to a personal development or increment in convergence insufficiency.

Table 2: Comparison Between CI and Non-CI Groups

Parameters	CI Group (n = 124)	Non-CI Group (n = 26)	p-value
Age (Years), Mean (Range)	23.00 (18 – 27)	25.59 (23 – 29)	0.007
Gender Distribution, n (%)			
Female (n = 73)	60 (48.4%)	13 (50%)	0.800
Male (n = 77)	64 (51.6%)	13 (50%)	
Near Point of Convergence (NPC) (cm)	13.0 (12.0 – 13.5)	13.0 (12.5 – 14.0)	0.400
Daily Near Work Duration (Hours/Day)	6.0 (5.0 – 7.0)	4.0 (3.0 – 5.0)	< 0.001

Discussion:

The study tested the hypothesis of association between prolonged near work and convergence insufficiency (CI) in patients between the age of 8 and 35 years. The research has identified CI symptoms using the Convergence Insufficiency Symptom Survey (CISS) incidence of 82.7%, which significantly contrasts the entire division of the non-clinical population of Spanish children aged 6 to 14 years (5.30%) studied by Sánchez-Cano et al., 2022¹⁷. There was a large age variation

among the groups: average age of CI group was 23 years, and convergence sufficient group was 25.6 years old ($p = 0.007$). This corresponds with the study conducted by Usgaonkar et al., 2021 on post-pandemic data according to which the prevalence of symptomatic CI was above among the younger demographics performing intensive screen-based near work¹⁸.

The duration of near-work per day was also much longer in CI group (median 6 hours) than in the sufficiency group (4 hours, $p < 0.001$), which also leads to the significance

of excessive use of digital devices in developing CI. Similar effects on higher mean CISS scores, and more significant binocular vision anomalies were also seen in prior study of children conducted by Cai et al., 2024 with screen-time 4 hours/day or more, compared to less than 4 hours/day in children with no significant difference in age and mean distance diopter prescriptions in that study group¹⁹.

The Near Point of Convergence (NPC) was not significantly different among the groups ($p = 0.4$) though both groups had a median value of ~13 cm. This observation reminds us that clinical measurements, in some cases as studied by Borsting et al., 2003, do not correlate well with symptom burden and that when testing CI, it is possible to under-diagnose the condition in the absence of validated symptom questionnaires such as the CISS²⁰.

The total CI prevalence was not different by gender ($p = 0.8$) as per available previous epidemiological study by Barrett et al., 2009 with reported prevalence ranging between 4 and 6% in children of both genders²¹. There possibly are small gender variations in the reporting of the symptoms that do not appear to manifest actual clinical difference.

The high prevalence of this study might also indicate the overall epidemiology of the non-strabismic binocular vision disorders (NSBVD), in which the CI is most frequent, with the prevalence of approximately 18-30% in the population with a high near demand in the study by Lara et al., 2001²².

A systematic review and meta-analysis conducted by Mohamed et.al 2023, estimated CI prevalence in the pool of ~7.98 % worldwide, supporting the previous results and emphasizing a significant heterogeneity due to differences in diagnostic criteria, demographic groups, and the methodology²³.

The cross-sectional study design of this study inhibits any chance of determining a cause-effect relationship between long-time near work activities and convergence

insufficiency (CI). Sampling of one hospital is a convenience design that makes it less generalizable. The largest group of participants was between 18 and 27 which under-represented lower age groups. There can be bias in symptom severity self-reporting through CISS. Such main clinical parameters

as fusional vergence and phoria were not evaluated. Extra-physical (screen distance, lighting, mental fatigue) were uncontrolled. Besides, the kind of digital device to be applied was not mentioned, which could alter the variation of symptoms. The limitations prove how important it would be to conduct a more general study that would be able to recap the character of the research.

Conclusion:

The findings showed a very high prevalence rate of symptomatic CI (82.7%), which is much higher than estimated in the general population prior to this study. This underscores the developing issue of younger people and digital device use and enhanced visual needs, especially in the post-pandemic world offering greater quantities of screen-based tasks than ever before. This proves the fact that high exposure to near activities, e.g., reading, or screen time, is a major contributor to the onset of CI.

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

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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.

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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.

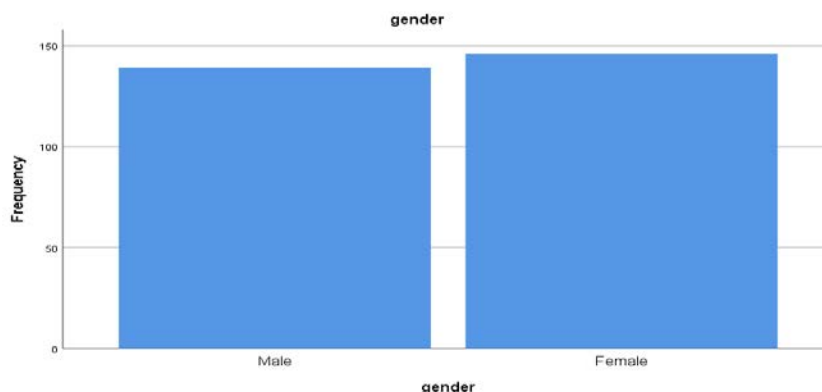


Figure: 1 Distribution of OSDI Severity According

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.

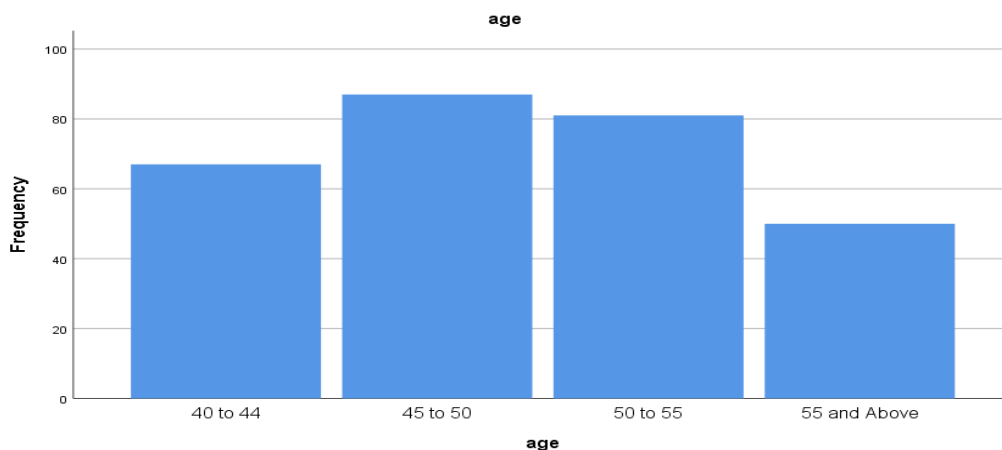


Figure: 2 Distribution of OSDI Severity According to Age

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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Efficacy of Therapeutic Meibomian Gland Expression in Evaporative Dry Eye

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Abstract:

Objective:

To analyze the impact of therapeutic meibomian gland expression in evaporative dry eye patients.

Methods: The quasi-experimental research was done at Institute of Ophthalmology, Mayo Hospital, Lahore, between March, 2025 and August, 2025. Total sample size consisted of 78 participants recruited through non probability convenience sampling. Patients aged 18-35 were assessed for evaporative dry eye through OSDI score, meibography, non-invasive first and average tear film analysis, to detect meibomian gland dysfunction. Patients having MGD underwent Therapeutic Meibomian Gland Expression as treatment for MGD. The assessments were repeated after two weeks in order to assess any changes in the symptoms and the functioning of the glands. All the data were documented with caution and analyzed with SPSS version 26. Statistical comparison was done by applying paired t test and a p-value <0.05 was regarded as significant.

Results: Non-Invasive First Tear Break Up Time improved in both the eyes (OD; $p = 0.026$, OS; $p < 0.001$), and NI Average TBUT improved in both eyes (OD; $p = 0.013$, OS; $p < 0.001$). Meiboscore significantly improved ($p < 0.001$) in both upper and lower lids of both eyes. OSDI scores had shown significant symptomatic improvement where normal (OSDI < 12) and mild-to-severe (OSDI > 12) categories had reduced significantly ($p < 0.001$).

Conclusion: It is concluded from the findings of this study that Therapeutic Meibomian Gland Expression (MGE) is safe and effective for evaporative dry eye due to MGD. *Al-Shifa Journal of Ophthalmology* 2026; 22(3): 143-149.

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Introduction:

Dry eye disease (DED) ranks among the most common disorders affecting the eye surface, which is met on a daily basis in clinical practice¹. Dry eye is a problem estimated to impact 5 to 50 percent of the world population with higher rates of prevalence as age advances. However, in recent epidemiological evidence, it shows an increasing prevalence in younger adults². DED is of two types. Aqueous-deficient dry eye (ADDE) and evaporative dry eye (EDE)³. Meibomian Gland Dysfunction (MGD) is a chronic and widespread disorder of the meibomian glands which is commonly manifested by obstructed ducts and glandular secretion alteration⁴. MGD patients exhibit a state of ocular dryness, irritation, redness, burning,

sensation of a foreign body and intermittent blurred vision⁵.

Dry eye can be assessed through various ways. The OSDI questionnaire is a reliable and popular instrument of measuring the subjective severity of dry eye symptoms⁶. Non-invasive Tear Break-Up Time (NITBUT) is a method of evaluating tear film stability without instilling fluorescein in the eye⁷. Meibography is a non-invasive imaging method that utilizes infrared light to directly observe the structure and morphology of the meibomian glands⁸. Common approaches to MGD treatment include warm compresses and lid hygiene⁹. Though it is effective but dependent on patient compliance. Heat is not maintained at required temperature. It may also be uncomfortable¹⁰. Artificial tears help improve the comfort of the eyes by adding to the aqueous layer of the tear film but do not treat the underlying gland obstruction¹¹. Meibomian gland dysfunction can be treated with topical corticosteroids to treat ocular surface inflammation. These methods can bring some relief but they do not always help in moderate and severe situation¹². Therapeutic Meibomian Gland Expression (MGE) is an inexpensive procedure whereby regulated mechanical pressure is used to express gland contents that are obstructed¹³. But even with its increasing popularity, there is very little local data available on the effectiveness of MGE especially when assessed with standardized outcome measures like OSDI, NITBUT, and meibography. This research tends to fill this gap by undertaking the systematic assessment of effects of therapeutic MGE on symptoms, tear film stability, and gland morphology.

Methodology:

The quasi-experimental research was done at Institute of Ophthalmology, Mayo Hospital, Lahore, between March, 2025 and August, 2025. The research was conducted under the guidelines provided by Declaration of Helsinki (1964, and its further amendments). Informed consent

was obtained from the subjects after explanation of the nature and possible consequences of the study. Sample size of 78 was estimated by the formula $n = \frac{z_{1-\alpha/2}^2 P(1-P)}{d^2}$ with $1 - \alpha =$ Confidence level = 90%, $P =$ Anticipated population proportion = 0.0779 and Absolute precision required = 0.05¹⁴. Patients visiting eye out patient and diagnosed with evaporative dry eye disease were included by convenient sampling technique. Subjects who were already taking treatment of dry eye in any form were excluded. Evaporative dry eye was detected with the help of the Ocular Surface Disease Index (OSDI) questionnaire, non-invasive first and average tear film breakup time (NITBUT), and meibography. After informed consent, Meibomian Gland Expression (MGE) was then done as a therapeutic intervention. Topical anesthetic eyedrops were instilled before MGE and expression was done by applying gentle pressure to upper and lower eyelid with the help of sterile meibomian gland expressor forceps and the same evaluations (OSDI, NITBUT, and Meibography) were carried out again after two weeks to ascertain the effectiveness of the treatment. OSDI scoring was done by using a validated proforma. Tear breakup time and meibography was done on SIRIUS topographer, which is a non-invasive imaging device. It uses infrared imaging to visualize meibomian glands and Placido Disk technology for non-invasive first and average tear film analysis. First NITBUT is time from last blink to first tear break up observed anywhere on corneal surface and average NITBUT is mean time of all local break ups across entire cornea. Both first and average NITBUT above 10 seconds are considered normal.

Meibomian gland expression of all subjects was done by single consultant. Data was entered on pre designed proforma and later on in SPSS version 26 for analysis. Statistical significance was checked by applying paired t test and P value of less than 0.05 was taken as significant.

Results:

In this study, there were 78 participants; in which 44 of the participants were female

and 34 of the participants were male. Majority of the participants were female.

Table 1: Non-Invasive (NI) First and Average Tear Breakup Time (TBUT)

<u>Right Eye</u>	Pre	Post	P-Value (Paired t test)
NI First TBUT (seconds)	10.34 ± 5.33	11.48 ± 4.84	0.026
NI Avg TBUT (seconds)	11.61 ± 4.37	12.63 ± 4.01	0.013
P-Value	0.001	0.001	
<u>Left Eye</u>	Pre	Post	P-Value (Paired t test)
NI First TBUT (seconds)	9.28 ± 5.23	12.09 ± 4.50	0.001
NI Avg TBUT (seconds)	10.54 ± 4.40	13.30 ± 3.71	0.001
P Value	0.001	0.001	

This table shows mean ± standard deviation non-invasive first and average tear film analysis before and after MGE in Right eye. The analysis of left eye revealed significant results with regards to change in first and average tear break up time.

Table 2: SIRIUS Topographer Meibography Gland Loss

Meibography Loss <u>Right Eye</u>	Pre	Post	P-Value (Paired t test)
Upper Lid (percentage)	17.19 ± 9.79	14.64 ± 8.28	0.001
Lower Lid (percentage)	14.77 ± 11.25	10.24 ± 7.63	0.001
P-Value	0.074	0.001	
Meibography Loss <u>Left Eye</u>	Pre	Post	P value (Paired t test)
Upper Lid (Percentage)	18.22 ± 12.84	13.74 ± 9.88	0.001
Lower Lid (Percentage)	13.25 ± 9.78	8.66 ± 6.83	0.001
P Value	0.004	0.001	

This table shows mean ± standard deviation meibography gland loss in upper and lower lid in right eye before and after MGE. Contrary to table 1, differences in meibography based Meibomian gland loss showed statistically significant values in both eyes.

Table 3: OSDI questionnaire Scores

OSDI Score	Pre	Post	P-Value
OSDI < 12	9.00 ± 3.20	5.13 ± 4.08	0.001
OSDI > 12	27.87 ± 8.39	17.86 ± 8.05	0.001
P-Value	0.001	0.001	

This table shows mean ± standard deviation OSDI scores before and after MGE in both normal (OSDI <12) and mild-to-severe (OSDI >12) groups.

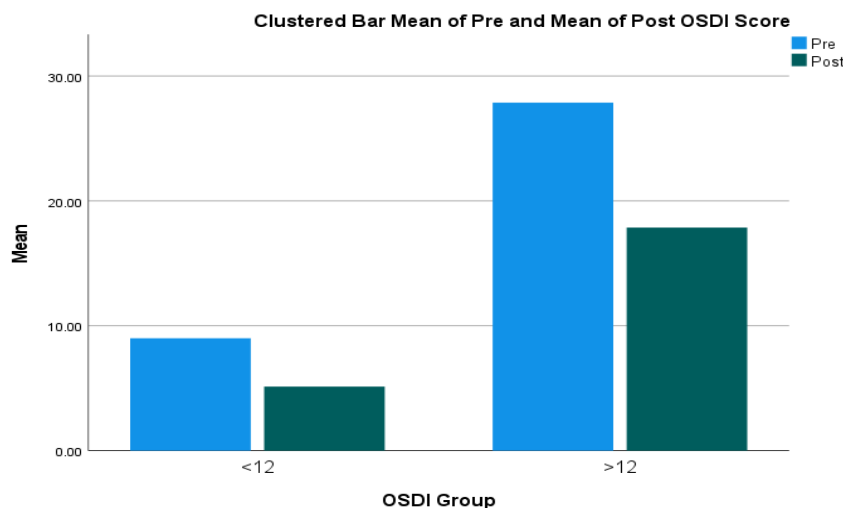


Figure 1: Clustered bar chart comparing mean pre- and post MGE Ocular Surface Disease Index (OSDI) scores. X-axis shows two OSDI groups, Normal OSDI Score group (<12) and Mild to Severe OSDI Score group (>12) and Y-axis shows Mean OSDI Score.

Discussion:

In the current study, 78 patients diagnosed with DED due to MGD underwent MGE as a treatment. OSDI, tear film parameters and meibography were recorded before and two weeks after the treatment and outcomes were compared to check the efficacy of MGE. In a study by Swiderska et al., 2024, 15 subjects underwent MGE. The least square mean difference (95% CI) from baseline for Michelson contrast was -0.006 (10.39%) and 0.758 (7.79% decrease) for gland length ratio¹⁴. In this study, a significant improvement was found in meiboscore ($p < 0.001$), OSDI ($p < 0.001$) showing structural recovery, and symptomatic relief. In randomized study (2021) by Kaiserman et al. 44 patients underwent either MGE or sham treatment. OSDI score in MGE group after 1 week ($p = 0.01$), 1 month ($p = 0.001$) and 2 months ($p = 0.0001$). Other group showed delayed improvement¹⁵. Current study strongly agrees and shows significant improvement in OSDI score ($p < 0.001$).

In randomized study by Antonio et al. in 2024, 99 participants treated either with MGE combined with home-based care or home-based care only. Only the MGE group showed improvement in OSDI score ($P = 0.02$) whereas TBUT, corneal staining, or gland function (MGE) showed

mild improvement¹⁶. This study partly agrees with current study. It significantly improved OSDI ($p < 0.001$) and tear film (right eye $p = 0.026$, left eye $p < 0.001$) with MGE only. In the randomized controlled trial by David Semp et al., 2025, 30 participants treated with either traditional debridement with heating and expression or multimodal MGrx device showed marked improvement in OSDI, SANDE and DEQ-5 questionnaires (all $p < 0.001$), upto 8 weeks with no significant difference between groups ($p > 0.05$). NIBUT decreased in the traditional group between 4 and 8 weeks ($p = 0.006$)¹⁷. This study agrees with current study. Both studies showed a marked improvement in symptoms such as OSDI ($p < 0.001$). It showed improvement in non-invasive tear break up time (right eye $p = 0.026$, left eye $p < 0.001$) after two weeks.

In a comparative study by Park et al., 2020, 30 eyes from 15 patients received either LipiFlow alone or LipiFlow with MGE. OSDI improved ($p = 0.001$ both groups). NIBUT ($p < 0.001$ both), and LLT (Lipiflow only: $p = 0.006$, Lipiflow with MGE: $p < 0.001$) improved at 3 months but only the lipiflow with MGE persisted at 6 months¹⁸. These findings are consistent with the current study, where a significant improvement was also seen in OSDI scores

($p < 0.001$), tear film stability (right eye $p = 0.026$, left eye $p < 0.001$) and meiboscore ($p < 0.001$) after two weeks of MGE.

In the prospective study by Guo et al., 2019, 48 patients with MGD, treated with 0.1% FML combined with MGE showed significant rise in tear meniscus height ($P = 0.023$). In patients with systemic immune disease there was a transient increase in TBUT, at week 2 ($P = 0.0418$), at month 1 ($P = 0.0005$) and at month 3 ($P = 0.0799$)¹⁹. This study agrees with the current study as both show improvement in OSDI ($p < 0.001$) and tear break up time (right eye $p = 0.026$, left eye $p < 0.001$) at 2 weeks. A prospective study (2023) was conducted by Antonio et al. in which 70 patients with MGD were allocated into two groups. One group received a combination of microblepharoexfoliation, IPL, and MGE and other received home-based care. OSDI ($p=0.001$), SANDE ($p=0.001$) and NIBUT ($p=0.033$) improved in combination group²⁰. Similarly in this study, OSDI score improved significantly ($p < 0.001$) along with TBUT (right eye $p = 0.026$, left eye $p < 0.001$) and meiboscore ($p < 0.001$).

A meta-analysis study of 6 RCTs and 326 patients by Liu et al. compared IPL and MGE versus MGE. A significant difference for MGYSS ($P = 0.005$), while no significant difference for meiboscore ($P = 0.90$), TBUT ($P = 0.46$), SPEED ($P = 0.99$), and CFS ($P = 0.64$)²¹. In this study OSDI scores ($p < 0.001$), TBUT (right eye $p = 0.026$, left eye $p < 0.001$) and meiboscore ($p < 0.001$) with MGE only. In Singapore study, both groups, the thermal pulsation and twice-daily warm compresses, decreased the symptoms of irritation ($p < 0.01$). TBUT also gained better at 1 month with thermal pulsation ($p = 0.048$) but no difference between groups at 3 months ($p = 0.88$)²².

This study which used MGE as treatment option showed significant improvement in OSDI score ($p < 0.01$) and TBUT (right eye $p = 0.026$, left eye $p < 0.001$) which shows significant symptoms improvement at 2 weeks.

In prospective study by Hae Min Park et al., 2022, MG length increased in MGD group but not significant ($p = 0.401$). Whereas it improved significantly ($p = 0.028$) in normal group²³. In this study meibography findings also showed significant reduction in gland loss after MGE. Meiboscore reduced ($p < 0.001$) in both lids. In comparative study by Dongkyun et al., 2021, 49 patients undergoing mechanical squeezing improved meiboscore, OSDI, TBUT($p < 0.001$ all)²⁴. Similarly, this study also showed improvement in meiboscore and OSDI score ($p < 0.001$ both) as well as at TBUT parameters (right eye $p = 0.026$, left eye $p < 0.001$). In prospective study by Hun Lee et al., 2017, 32 patients treated by MGE combined with other treatment improved TBUT, lid margin abnormality, meibum quality, OSDI and MGD stage ($p < 0.001$)²⁵. This study agrees with Hun Lee study as it improves OSDI score, meiboscore ($p < 0.001$ both) and TBUT is also improved significantly (right eye $p = 0.026$, left eye $p < 0.001$).

The researchers conducted only one follow-up at two weeks which was not enough to determine the stability of treatment outcomes at the long-term. Manual evaluation of meibography allowed a possible observer bias and unreliability in gland loss estimates. Besides, tear film measurements with Sirius topographer indicated that the repeatability was low and subtle changes might be detected in successive measurements of one eye. Automated or AI-based meibography analysis should be used to reduce the amount of human error and enhance consistency in grading. Additionally, the reliability of the results would be increased by using less reflex-tear-raising and more repeatable instruments on tear film assessment.

Conclusion:

Therapeutic Meibomian Gland Expression (MGE) is safe and effective for evaporative dry eye due to Meibomian Gland Dysfunction (MGD). It improves

evaporative dry eye symptoms, tear film parameters, gland structure and function.

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