

ORIGINAL ARTICLE

Dry Eye Disease Practice in Lahore: Diagnostic Perspectives, Treatment Modalities, and Challenges

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ABSTRACT

OBJECTIVE: To investigate the diagnostic procedures, treatment modalities, and challenges encountered by eye care professionals managing dry eye disease (DED) in Lahore, Pakistan.

METHODOLOGY: This descriptive cross-sectional study was conducted across multiple healthcare facilities in Lahore from October 2025 to January 2026. Using purposive sampling, we recruited 171 licensed eye care professionals. We collected data using a structured questionnaire and analyzed them using descriptive statistics (frequencies and percentages) in SPSS version 25.

RESULTS: Most respondents (97.7%) routinely managed dry eye disease (DED), with evaporative dry eye being the predominant subtype (50.3%). Clinicians relied primarily on clinical history (97.7%), while advanced tests like meibography (2.9%) and tear osmolarity (8.2%) were rarely available. Major challenges included lack of effective medications (74.9%), inadequate diagnostic tools (62.0%), and patient affordability issues (58.5%).

CONCLUSION: DED management in Lahore relies mainly on clinical assessment because of limited access to advanced diagnostics and treatments. Targeted interventions to improve resource availability and standardize protocols are needed.

KEYWORDS: Dry Eye Disease, Meibomian Gland Dysfunction, Diagnostic Practices, Treatment Modalities, Evaporative Dry Eye, Eye Care Professionals

INTRODUCTION

Dry eye disease (DED) is a globally recognized, multifactorial ocular surface disorder characterized by loss of tear film homeostasis, ocular symptoms, and subclinical inflammation that severely affects visual function and daily quality of life^{1,2}. Historically, DED was treated as a minor, transient symptomatic inconvenience; however, modern ophthalmic research has established it as a chronic, complex disease with a South Asian prevalence ranging from 18.4% to 54.3%, and approximately 32% in Pakistan^{3,4}. Despite the landmark publication of the Tear Film & Ocular Surface Society (TFOS) DEWS II global guidelines, substantial clinical variation persists in resource-constrained environments^{6,7}. In metropolitan Lahore, a mega-city of over 13 million people, eye care professionals face unique challenges, including severe seasonal smog, high air pollution, and widespread digital device use, which dramatically accelerate evaporative dry eye and meibomian gland dysfunction^{5,8}. While prior Pakistani literature has focused heavily on disease prevalence, there remains a critical lack of empirical data on diagnostic accessibility, prescribing patterns, and treatment behaviors among local practitioners remain limited⁹.

This study is motivated by the urgent need to bridge this "diagnostic gap" and understand how global clinical standards translate into a healthcare system constrained by out-of-pocket costs and medication supply chain issues. The primary objective of this study is to systematically investigate the diagnostic procedures, treatment modalities, and structural challenges encountered by eye care professionals managing DED in Lahore, Pakistan, and to establish an empirical baseline to guide localized, resource-adapted clinical protocols.

METHODOLOGY

The research was a cross-sectional study (descriptive) that was undertaken in several healthcare centers in Lahore from October 2025 to January 2026. The study sites included University of Lahore Teaching Hospital, Sir Ganga Ram Hospital, Jinnah Hospital, Mughal Eye Trust Hospital, Mayo Hospital, and various private practices. This varied sampling represented DED management practices at various levels of resources.

The calculation of sample size involved a formula of finite population proportions. Based on an estimated number of 171 practicing eye care professionals in Lahore, a 50 per cent prevalence of routine DED management, a 95 percent confidence level, and a 5 percent margin of error, the required sample size was 183. The target was 201 participants, calculated to account for a 10% non-response rate, with 171 completed responses (response rate: 85.1%).

Purposive sampling was used to ensure representation across practice settings (government, trust, private) and professional types (optometrists, ophthalmologists). Inclusion criteria were practitioners currently practicing in Lahore with at least one year of experience, regular experience in managing ocular surface disorders, and informed consent. Exclusion criteria included retired professionals, individuals not exposed to DED patients, and non-response (less than 80% response rate).

Adapted the survey tool from a validated questionnaire used in prior international DED studies¹⁰. Adaptation involved content validity through expert panel review, forward-backwards translation into Urdu, pilot testing with 15 practitioners, and revision based on feedback. The final survey included 42 questions in five areas: demographics, diagnostic practices, treatment approaches, resource availability and perceived challenges.

We used online (Google Forms) and paper-based questionnaires to collect data. The analysis of data was performed using IBM SPSS version 25.0. We calculated descriptive statistics, including frequencies and percentages, for all categorical variables. The University of Lahore Ethical Review Committee approved the study (UOL/IREB/25/12/0019).

RESULTS

A total of 171 eye care professionals completed the survey. **Table I** presents respondent characteristics and DED subtype distribution. The majority were male (56.1%, n=96), aged 30–34 years (34.5%, n=59), and optometrists (63.7%, n=109). Independent private practice was the most common setting (55.0%, n=94). Most practitioners (97.7%, n=167) routinely managed DED, with evaporative dry eye being the predominant subtype (50.3%, n=86), followed by mixed etiology (37.4%, n=64).

Table I: Respondent Characteristics and DED Subtype Distribution (n=171)

Characteristics	n	%
Gender		
Male	96	56.1
Female	75	43.9
Professional Category		
Optometrist	109	63.7
Ophthalmologist	62	36.3
Practice Setting		
Independent/Private	94	55.0
Government Hospital	43	25.1
Trust Hospital	29	17.0
Academic/Teaching	5	2.9
DED Subtype Most Diagnosed		
Evaporative Dry Eye	86	50.3
Mixed Etiology	64	37.4
Aqueous-Deficient	21	12.3

Clinical history was the most commonly used diagnostic approach (97.7%, n=167), with 75.4% (n=129) rating it as most useful. **Table II** summarizes diagnostic method utilization. Fluorescein TBUT was used by 49.1% (n=84), followed by non-invasive TBUT (47.36%, n=81) and Schirmer's test (42.7%, n=73). Advanced modalities were used far less often: tear osmolarity (8.2%, n=14), MMP-9 testing (3.5%, n=6), and meibography (2.9%, n=5).

Table II: Utilization of Diagnostic Methods for DED (n=171)

Diagnostic Method	n	%
Clinical History/Symptom Assessment	167	97.7
Symptom Questionnaire (OSDI, DEQ-5)	152	88.9
Slit Lamp Examination	118	69.0
Fluorescein Tear Break-Up Time	84	49.1
Non-Invasive Tear Break-Up Time	81	47.36
Schirmer's Test	73	42.7
Tear Osmolarity	14	8.2
MMP-9 Testing	6	3.5
Meibography	5	2.9

Table III presents treatment modalities by severity. For mild DED, 83.0% of practitioners recommended lifestyle modifications only. Treatment escalated with increasing severity: non-preserved artificial tears were prescribed by 17.0%, 63.2%, and 78.4% for mild, moderate, and severe cases, respectively. Corticosteroid use increased from 8.7% (moderate) to 95.3% (severe). Eyelid hygiene was universally recommended across all severity levels.

Table III: Treatment Modalities by DED Severity (n=171)

Treatment Modality	Mild (%)	Moderate (%)	Severe (%)
No Treatment/Lifestyle Only	83.0	—	—
Non-Preserved Artificial Tears	17.0	63.2	78.4
Oral Tetracycline/Doxycycline	—	70.8	90.6
Topical NSAIDs	—	4.1	67.8
Topical Corticosteroids	—	8.7	95.3
Cyclosporine A	—	12.3	45.6
Eyelid Hygiene/Warm Compress	100	100	100

A significant proportion (97.1%, n=166) reported difficulties with DED management. **Table IV** is a summary of reported barriers. The most common issue was the inability to find effective DED medications in the local market (74.9%, n=128), followed by insufficient access to diagnostic devices (62.0%, n=106) and patients' inability to cover treatment costs (58.5%, n=100). Insufficient training was mentioned as a barrier by only 5.3% (n=9) of respondents.

Table IV: Challenges Reported in DED Management (n=171)

Challenge	n	%
Lack of effective medications in local market	128	74.9
Inadequate access to advanced diagnostic tools	106	62.0
Patient inability to afford treatment	100	58.5
Patient non-compliance with treatment	87	50.9
Limited patient awareness	72	42.1
Insufficient training/education	9	5.3

DISCUSSION

This study represents the first comprehensive, empirical evaluation of dry eye disease (DED) clinical practice patterns, diagnostic methodologies, and therapeutic preferences among eye care professionals in Lahore, Pakistan. Our findings reveal a complex, resource-constrained clinical landscape characterized by strong overall awareness of DED and its subtypes, appropriate severity-based treatment escalation, and severe systemic and structural limitations in terms of advanced diagnostic technology and pharmaceutical availability.

The overwhelming dominance of the evaporative DED subtype (50.3%) identified by practitioners in our cohort is highly consistent with epidemiological data across Asian populations, where Meibomian Gland Dysfunction (MGD) remains the primary driver of ocular surface disease^{5,11,12}. However, this high prevalence of evaporative DED must also be understood within the specific, harsh environmental and behavioral context of Lahore. Lahore is a rapidly growing mega-city that consistently ranks among the most air-polluted cities globally, experiencing severe seasonal smog and high ambient levels of suspended particulate matter (PM_{2.5} and PM₁₀). These airborne chemical pollutants, combined with high summer temperatures and low indoor relative humidity from widespread air conditioning, act as chronic ocular irritants that damage the goblet cells and destabilize the delicate lipid layer of the tear film. Furthermore, the exponential growth of digital device dependency for vocational, administrative, and academic activities dramatically reduces blink rates, accelerating tear film evaporation. The synergy of environmental air pollution and modern digital lifestyles likely explains why almost all surveyed practitioners (97.7%) routinely manage DED in their practice, establishing it as a major public health concern in the region.

Our study exposes a stark 'diagnostic gap' between the contemporary international standard of care and local clinical realities. While advanced objective metrics—such as tear osmolarity (8.2%), MMP-9 testing (3.5%), and meibography (2.9%) are established as essential diagnostic and classification tools in the global TFOS DEWS II guidelines,⁷ their clinical utilization in Lahore is virtually negligible. Instead, diagnostic practice relies overwhelmingly on clinical history and subjective symptom assessment (97.7%), supplemented by basic slit-lamp examination (69.0%) and traditional, low-cost objective tests such as fluorescein tear break-up time (49.1%) and Schirmer's test (42.7%). This clinical discrepancy is a direct reflection of resource constraints rather than practitioner ignorance. In a developing economy like Pakistan, the high capital cost of advanced diagnostic hardware, combined with the lack of institutional procurement, absence of local technical maintenance infrastructure, and lack of standardized ophthalmic insurance reimbursement models, makes the routine adoption of meibography or tear osmolarity testing financially non-viable for both private clinics and public hospitals. While clinical history and symptom questionnaires (used by 88.9%) are invaluable for identifying patient discomfort, the lack of objective structural imaging means meibomian gland structural loss (such as gland dropout) and subclinical ocular inflammation often go undetected, potentially leading to under-diagnosis or suboptimal staging of early-stage disease.

The therapeutic strategies reported by Lahore's eye care practitioners demonstrate a strong adherence to severity-based escalation, reflecting solid clinical training and alignment with international frameworks^{7,13}. The universal recommendation of eyelid hygiene and warm compresses (100% across all severity levels) reinforces the widespread clinical recognition of MGD as a primary etiological driver. For mild cases, reliance on lifestyle modifications (83.0%) is appropriate, emphasizing patient self-care and cost-effective management. However, as DED

severity escalates, a critical clinical and safety paradox emerges regarding anti-inflammatory therapies. In severe DED cases, 95.3% of practitioners prescribe topical corticosteroids, whereas Cyclosporine A—the primary long-term, non-steroidal immunomodulator recommended for chronic ocular surface inflammation—is prescribed by only 45.6%.

This heavy reliance on topical corticosteroids over Cyclosporine A raises significant clinical concerns in a developing-country context. Prolonged steroid therapy carries well-documented risks of elevated intraocular pressure, glaucoma, cataract formation, and opportunistic ocular infections, requiring strict clinical monitoring. However, our results show that patient non-compliance is a major challenge, reported by 50.9% of practitioners. In a healthcare ecosystem where patient follow-up is highly irregular, medical records are decentralized, and compliance is poor, the widespread and potentially unsupervised use of potent corticosteroids presents a substantial risk of secondary ocular morbidity. The underutilization of Cyclosporine A is not due to a lack of clinical preference, but rather a direct consequence of high drug acquisition costs, delayed therapeutic onset (requiring patient counseling which is often cut short in busy clinics), and poor local market availability (74.9%). Cyclosporine requires several weeks or months of continuous use to achieve clinical efficacy, making it economically prohibitive for patients who must pay out of pocket. In contrast, corticosteroids offer rapid, low-cost symptomatic relief. To bridge this gap, practitioners often turn to oral tetracyclines, particularly doxycycline (70.8% in moderate cases, 90.6% in severe cases), as an affordable systemic alternative to manage meibomian gland inflammation, using its matrix metalloproteinase (MMP)-inhibitor properties to stabilize the ocular surface and improve meibum quality.

The structural challenges identified in this study highlight the harsh socioeconomic realities of ophthalmic practice in Pakistan. The most frequently reported barrier was the unavailability of effective DED medications in the local market (74.9%), closely followed by inadequate access to advanced diagnostic tools (62.0%) and patient affordability issues (58.5%). Unlike high-income nations, Pakistan's healthcare is primarily funded through out-of-pocket (OOP) private expenditures, with minimal public health insurance coverage. This economic landscape forces clinicians to practice 'financial prescribing', where the patient's immediate financial capacity, rather than clinical ideals, dictates the choice of therapy. Non-preserved artificial tears, which are crucial for preventing preservative-induced ocular surface toxicity in patients requiring frequent instillation, are significantly more expensive and less available than preserved alternatives, limiting their use to only 63.2% in moderate and 78.4% in severe cases.

Interestingly, only 5.3% of respondents identified a lack of training or education as a barrier. This finding suggests that the primary obstacle to optimal DED management in Lahore is not a knowledge deficit, but infrastructural and economic constraints. Pakistani eye care professionals are well-versed in modern pathophysiology and international management protocols, but they are severely restricted by the tools and therapeutics available to them. Consequently, educational workshops and academic seminars, while valuable, will have a negligible impact on improving clinical outcomes unless accompanied by structural reforms.

To address these systematic barriers, a multi-stakeholder approach is urgently required. Local pharmaceutical manufacturers must be incentivized to produce affordable, high-quality, preservative-free lubricants and generic immunomodulatory formulations (such as cyclosporine and lifitegrast) to reduce dependency on expensive imports and stabilize the local supply chain. Additionally, professional bodies such as the Ophthalmological Society of Pakistan (OSP) should collaborate with optometric associations to develop resource-adapted, localized clinical guidelines. These guidelines should provide clinical pathways optimized for low-resource

environments, emphasizing cost-effective diagnostic algorithms and safe, monitored, steroid-sparing therapeutic strategies.

This study has several limitations that should be acknowledged. The use of purposive sampling and the restriction of the study to Lahore limits the generalizability of the findings to other geographical areas of Pakistan, particularly rural regions where resource constraints and practitioner demographics differ significantly. The cross-sectional design prevents the evaluation of temporal shifts in practice patterns, and the reliance on self-reported data introduces potential recall and social desirability biases. Furthermore, although the survey tool was adapted from internationally validated questionnaires, it has not undergone formal psychometric testing in the Pakistani healthcare population. Future multi-centre, nationwide studies are warranted to provide a more representative assessment of DED practice patterns across diverse clinical environments in Pakistan.

CONCLUSION

DED has become a well-known and common eye care issue that is regularly treated in Lahore, and the most frequent subtype is evaporative dry eye. The shortage of high-quality diagnostics and effective drugs significantly limits management. Clinical history and simple examination remain the pillars of diagnosis, and treatment is escalated by severity. The aforementioned barriers (including medication unavailability, equipment limitation, and patient affordability) need multi-stakeholder interventions. Further work should be based on the enhancement of the availability of resources and creation of context-specific clinical guidelines.

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Data Sharing Statement: The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publicly.

AUTHOR CONTRIBUTION

Saddiqi S: Study conception/design, questionnaire design, supervision, data interpretation, drafting, critical revision, final approval

Tariq QA: Literature search, data collection, data analysis, drafting, critical revision, final approval

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Shams A: Data collection, literature search, data interpretation, drafting, critical revision, final approval

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