

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.

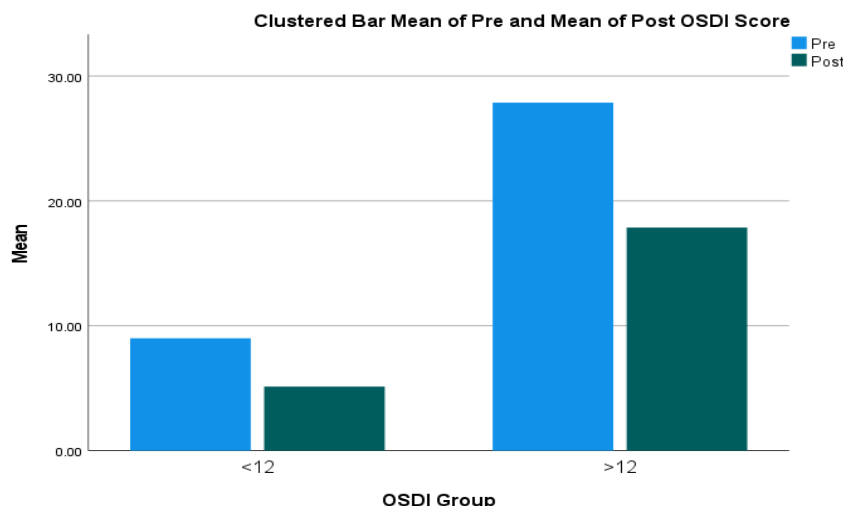


Figure 1: Clustered bar chart comparing mean pre- and post MGE Ocular Surface Disease Index (OSDI) scores. X-axis shows two OSDI groups, Normal OSDI Score group (<12) and Mild to Severe OSDI Score group (>12) and Y-axis shows Mean OSDI Score.

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.

References:

1. Messmer EM. The pathophysiology, diagnosis, and treatment of dry eye disease. *Dtsch Arztebl Int.* 2015;112(5):71–81; quiz 2.
2. Luo CK, Tan QQ, Tea Y, Pang Y. The prevalence of dry eye disease symptoms and its association with screen time in young adults aged 21–30 years. *Ophthalmic Physiol Opt.* 2025;45(5):1195–200.
3. Hisey EA, Galor A, Leonard BC. A comparative review of evaporative dry eye disease and meibomian gland dysfunction in dogs and humans. *Vet Ophthalmol.* 2023;26 Suppl 1(Suppl 1):16–30.
4. Sabeti S, Kheirkhah A, Yin J, Dana R. Management of meibomian gland dysfunction: a review. *Surv Ophthalmol.* 2020;65(2):205–17.
5. Amano S, Inoue K. Clinic-Based Study on Meibomian Gland Dysfunction in Japan. *Invest Ophthalmol Vis Sci.* 2017;58(2):1283–7.
6. Schiffman RM, Christianson MD, Jacobsen G, Hirsch JD, Reis BL. Reliability and validity of the Ocular Surface Disease Index. *Arch Ophthalmol.* 2000;118(5):615–21.
7. Guarnieri A, Carnero E, Bleau A-M, López de Aguilera Castaño N, Llorente Ortega M, Moreno-Montañés J. Ocular surface analysis and automatic non-invasive assessment of tear film breakup location, extension and progression in patients with glaucoma. *BMC Ophthalmol.* 2020;20(1):12.
8. Ban Y, Shimazaki-Den S, Tsubota K, Shimazaki J. Morphological evaluation of meibomian glands using noncontact infrared meibography. *Ocul Surf.* 2013;11(1):47–53.
9. Lee G. Evidence-Based Strategies for Warm Compress Therapy in Meibomian Gland Dysfunction. *Ophthalmol Ther.* 2024;13(9):2481–93.
10. Arita R, Fukuoka S. Non-pharmaceutical treatment options for meibomian gland dysfunction. *Clin Exp Optom.* 2020;103(6):742–55.
11. Calonge M. The Treatment of Dry Eye. *Surv Ophthalmol.* 2001;45:S227–S39.
12. Rolando M, Merayo-Llodes J. Management Strategies for Evaporative Dry Eye Disease and Future Perspective. *Curr Eye Res.* 2022;47(6):813–23.
13. Sheppard JD, Nichols KK. Dry Eye Disease Associated with Meibomian Gland Dysfunction: Focus on Tear Film Characteristics and the Therapeutic Landscape. *Ophthalmol Ther.* 2023;12(3):1397–418.
14. Swiderska K, Blackie CA, Maldonado-Codina C, Fergie M, Read ML, Morgan PB. Evaluation of Meibomian gland structure and appearance after therapeutic Meibomian gland expression. *Clin Exp Optom.* 2024;107(5):504–14.
15. Kaiserman I, Rabina G, Mimouni M, Sadi Optom NB, Duvdevan N, Levartovsky S, et al. The Effect of Therapeutic Meibomian Glands Expression on Evaporative Dry Eye: A Prospective Randomized Controlled Trial. *Curr Eye Res.* 2021;46(2):195–201.
16. Ballesteros-Sánchez A, Sánchez-González JM, Carmen Sánchez-González M, Rocha-de-Lossada C, Gargallo-Martínez B. Efficacy of meibomian gland expression combined with Home-Based therapy in the management of dry eye Disease: A systematic review and Meta-Analysis. *Cont Lens Anterior Eye.* 2024;47(2):102107.
17. Semp DA, Dutta D, Wolffsohn JS. Randomized clinical trial: MGrx versus standard debridement and expression for meibomian gland dysfunction. *Optom Vis Sci.* 2025;102(1):20–7.
18. Kim HJ, Park JH. Clinical Efficacy of Immediate Manual Meibomian Gland Expression After Thermal Pulsation

- (LipiFlow) for Obstructive Meibomian Gland Dysfunction: Comparison With Thermal Pulsation. *Cornea*. 2020;39(8):975–9.
19. Guo X, Li A, Fan Y, Yu Y, Guo W, Jie Y. Combined use of 0.1% fluorometholone and meibomian gland expression improves symptoms of moderate and severe dry eye disease, even in patients with systemic immune disease. *Biotechnology & Biotechnological Equipment*. 2019;33(1):1237–43.
 20. Ballesteros-Sánchez A, Sánchez-González J-M, Gutiérrez-Ortega R, Gargallo-Martínez B. Diamond Bur Microblepharoexfoliation Combined with Intense Pulse Light and Meibomian Gland Expression for Evaporative Dry Eye: A Short-term Controlled Clinical Trial. *Ophthalmol Therap*. 2024;13(5):1223–37.
 21. Liu C, Zhou Q, Gao ZQ. Efficacy of intense pulsed light and meibomian gland expression treatments in meibomian gland dysfunction: A meta-analysis of randomized controlled trials. *Medicine*. 2022;101(51):e32292.
 22. Zhao Y, Veerappan A, Yeo S, Rooney DM, Acharya RU, Tan JH, et al. Clinical Trial of Thermal Pulsation (LipiFlow) in Meibomian Gland Dysfunction With Pretreatment Meibography. *Eye Contact Lens*. 2016;42(6):339–46.
 23. Park HM, Lee WJ, Lim HW, Kim YJ. Immediate and Quantitative Changes in Tear Film Parameters and Meibomian Gland Structures after Warm Compression and Meibomian Gland Squeezing in Meibomian Gland Dysfunction Patients and Normal Subjects. *J Clin Med*. 2022;11(15):4577.
 24. Han D, Kim H, Kim S, Park Y, Cho KJ. Comparative study on the effect of hyperthermic massage and mechanical squeezing in the patients with mild and severe meibomian gland dysfunction: An interventional case series. *PLoS One*. 2021;16(3):e0247365.
 25. Lee H, Kim M, Park SY, Kim EK, Seo KY, Kim TI. Mechanical meibomian gland squeezing combined with eyelid scrubs and warm compresses for the treatment of meibomian gland dysfunction. *Clin Exp Optom*. 2017;100(6):598–602.

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