The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 5, 2025

COMPARISON OF ANTI-INFLAMMATORY EFFECTS OF INTENSE PULSED LIGHT THERAPY WITH TOBRAMYCIM/DEXAMETHASONE PLUS WARM COMPRESS ON DRY EYE ASSOCIATED MEIBOMIAN GLAND DYSFUNCTION

Dr Asma Habib[*1], Dr Aisha Fawad[2], Dr Fakhar Humayun[3], Dr Neha Nadeem[4], Dr Iqra Sajjad[5], Dr Sheena Liaqat[6]

[*1,2,3,4,5,6]*Armed Forces Institute of Ophthalmology*

[*1]asmahabib379@gmail.com

DOI: https://doi.org/10.5281/zenodo.15516953

Keywords
dry eye illness, Meibomian gland dysfunction, and strong pulsed light.

Article History
Received on 15 April 2025
Accepted on 15 May 2025
Published on 26 May 2025

Corresponding Author: *
Dr Asma Habib

Abstract

Introduction: *One of the most common eye conditions for which individuals seek medical care is Dry eye disease (DED) also known as keratoconjunctivitis sicca, dry eye syndrome, or dysfunctional tear syndrome. The anti inflammatory effect of IPL was compared with conventional therapy including topical Tobra plus Dexa along with Warm compresses by the patient*
Dry eye associated with MGD were investigated in this study.

Materials and Procedures: Patients Pstients having *Dry eye disease (DED) and meibomian gland dysfunction (MGD) were split into two groups of 54 patients, each with 27 members. IPL was used to treat Group A, whereas a warm compress and tobramycin/dexamethasone were used for Group B for 1 month. TBUT and OSDI were measured before and one month after treatment.*

Results: *At one month following therapy, both Group A and Group B showed improvements in OSDI and TBUT as compared to baseline, which were statistically significant (P<0.05). Group A's TBUT was improved more than Group B's at one month (P=0.0001) and so was OSDI (P<0.05).*

Conclusion: *Our study concluded that IPL treatment was superior to tobramycin/dexamethasone plus warm compress treatment for improving TBUT and OSDI in patients with DED associated MGD over a one-month treatment period.*

INTRODUCTION

Keratoconjunctivitis sicca, dry eye syndrome, or dysfunctional tear syndrome are other names for dry eye disease (DED), one of the most prevalent eye disorders for which patients seek therapy. Depending on the diagnostic criteria and geographic location, it affects 5 to 50% of the population. This complex disease can strike at any age, but it is more common in women and the elderly. Although the symptoms can vary, they typically show up as blurred vision, stinging, dry eyes, discomfort, and a foreign body sensation that interferes with day-to-day activities and

quality of life. Due to the significant loss of job productivity and the utilization of medical resources, DED consequently places a significant financial burden on patients as well as society.[1]

DED is thought to be primarily caused by Meibomian gland dysfunction (MGD).[2] Obstruction of the terminal duct and/or qualitative/quantitative abnormalities in the glandular secretions are the typical characteristics of this diffuse and chronic disorder.[3] Warm compresses, improved eyelid cleanliness through the removal of clogged meibum, anti-inflammatory drugs, antibiotics, and omega-3 fatty acid supplements are some of the standard therapy approaches for MGD that do not provide good long-term effects. Consequently, it is now essential to investigate novel therapeutic strategies.[4,5]

In 2015, intense pulsed light (IPL), which was first created for dermatology, was used to treat MGD.[6] Since then, efforts have been undertaken to improve this novel strategy. In order to selectively cause thermal damage to the target, the IPL device, also known as flashlamp therapy, is a light-emitting apparatus that emits filtered polychromatic broad-bandwidth wavelengths with variable pulse durations.[7] As long as appropriate eye protection is used, numerous studies have documented the safe administration of this treatment with no negative consequences.[8-10] It has been proposed that it reduces telangiectasia, eliminates Demodex mites, causes meibum to become thermally soft and liquefiable, alters the secretion of pro- and anti-inflammatory molecules, and inhibits matrix metalloproteinases, though the precise mechanisms behind its positive effects are intricate and still poorly understood.[11,12]

Not been studied in detail the anti-inflammatory benefits of IPL with tobramycin/dexamethasone with warm compress, despite the fact that numerous studies have already demonstrated the therapeutic effects of IPL on DED linked MGD.[10-12] In this study, the anti-inflammatory effects of IPL and tobramycin/dexamethasone + warm compress were compared on MGD associated with DED.

MATERIALS AND METHODS:

This quasi experimental study ran from July 2024 to December 2024 in a Tertiary Care Hospital ,Rawalpindi ,for a total of six months. We selected patients with a diagnosis of MGD accompanied with DED. Prior to the study,informed concent was sought from all the patients. Ethical review committee approval was also taken. The Tear Film and Ocular Surface Society (TFOS) criteria were used to classify patients with MGD [25]–[26]: 1) eye symptoms; 2) aberrant lid morphology; and 3) changes in meibomian gland secretion. Patients may be diagnosed with MGD if they have either 1) + 2) or 1) + 3. Using the Dry Eye Workshop's (DEWS) criteria, patients were also diagnosed with DED in the interim [27]: 2) positive corneal fluorescein staining (CFS) with tear film breakage time (TBUT) ≤5s or 5s <TBUT ≤10s; 1) Ocular Surface Disease Index (OSDI) >13.

Patients who fulfilled each of the following requirements were not allowed to participate in the study: 1) under the age of eighteen; 2) ocular infection and allergy; 3) hormone drug allergy; 4) anatomical abnormalities or eyeball movements; 5) ocular trauma or surgical history within the last three months; 6) having a history of radiotherapy or chemotherapy within the last year; 7) lactation or pregnancy. With a two-sided significance level (1-alpha) of 95 and a power (1-beta, percentage chance of detecting) of 80, a total sample size of 54 (27 in each group) was determined using OpenEpi Software online for cohort studies, maintaining an odds ratio of 10.8 for the risk of dry eye disease with keratoconus .[13]

Procedure for Intervention

A computer-generated randomization tool was used to randomly divide the patients into two groups. Only the more severely affected eye was included in the study, even though patients underwent bilateral therapy. Group A patients received four daily doses of sodium hyaluronate eye drops and one monthly IPL treatment. Group B patients received sodium hyaluronate eye drops four times a day, tobramycin/dexamethasone ointment, and a warm compress once at night.

The IPL device was used in this investigation (M22, Lumenis, USA). The intensity range of the pulses was 12–14 J/cm2. The pulse's width was 6 ms. The IPL therapy which was provided by same operator

included the following: Clean the treatment areas on the top and below eyelids with cotton swabs; 2) apply a 30-minute application of Beijing Unisplendour Pharmaceutical Co., Ltd.'s compound lidocaine cream to induce affect 3) shield the cornea and sclera with a shield and cover the other eye; 4) use IPL on the upper and lower eyelids' periocular areas (8 mm × 15 mm each); 5) apply a cold compress for ten minutes to the treatment area.

For a month, patients in Group B received tobramycin/dexamethasone ointment and a warm compress at home that was 45°C to 50°C for 10 minutes each night. Prior to therapy (sometimes referred to as baseline), one week, and one month after treatment, patients participated to fill OSDI and got clinical examination to record TBUT.

Clinical Assessment:

Tests were given in a manner that reduced the influence of one test on subsequent tests in order to compare the clinical effects of the two groups. 1) The patients' subjective symptoms were evaluated using the OSDI questionnaire. 2) The bulbar conjunctiva was treated with sodium fluorescein using a fluorescein sodium ophthalmic strip, and TBUT was measured with a blue exciter filter in both eyes. The mean of each patient's three TBUT measurements was calculated.

The data was analyzed using SPSS 26. The mean±standard error of the mean (SEM) was used to express the data. TBUT and OSDI were compared between both groups. The Mann Whitney U test was used to analyze the differences between Groups A and B. Results were deemed significant if P was less than 0.05.

RESULTS:

This study involved 54 patients. In Group A, 27 patients (17 men and 10 women) with a mean age of 32.78±8.0 years were examined. Group B consisted of 27 patients, with a mean age of 32.22±5.66 years, {consisting of 18 men and 09 females.}.OSDI and TBUT at the pre- treatment baseline did not differ between Group A and Group B (P>0.05). (Table 1).

At one month following therapy, both Group A and Group B showed improvements in OSDI and TBUT as compared to baseline, which were statistically significant (all P<0.05). (Table 1). Group A's TBUT was greater than Group B's at one month (P=0.0001). At one month, however, there were significant changes between Group A and Group B in terms of OSDI (all P<0.05).

Table-VI: Comparison of the mean TBUT and OSDI at baseline and after 1 month between both groups.

	Group A (n=27)	Group B (n=27)	p-value
	Mean ± SD	Mean ± SD	
Baseline TBUT (right eye)	3.81 ± 0.62	3.89 ± 0.58	**0.626**
After 1 month TBUT (right eye)	7.89 ± 0.97	6.33 ± 0.68	**0.0001**
Baseline TBUT (left eye)	3.78 ± 0.79	4.00 ± 0.83	**0.323**
After 1 month TBUT (left eye)	8.67 ± 0.68	6.67 ± 0.68	**0.0001**
Baseline OSDI	31.67 ± 4.42	30.11 ± 2.34	**0.111**
After 1 month OSDI	19.07 ± 4.48	24.11 ± 2.78	**0.0001**

DISCUSSION:

IPL is a brand-new therapy for DED patients with MGD. However, the IPL's treatment strategies for DED associated MGD are still unknown. The likely mechanisms included antibacterial, anti-inflammatory, and heat transfer actions. Hemoglobin's chromophores selectively absorb the light from the IPL device, releasing thermal energy that heat and destroy the abnormal vasculature in the eyelid margin and surrounding conjunctiva. This stopp the meibomian glands from generating inflammatory mediators. Nearly every principle used in classical therapy to treat MGD coupled with DED was covered by the likely mechanisms of IPL. Ophthalmologists frequently utilize tobramycin/dexamethasone together as an antibacterial and anti-inflammatory combination. A pure

glucocorticoid agonist is dexamethasone. Therapeutic doses of dexamethasone have already been demonstrated to significantly reduce the production of inflammatory cytokines like IL-6 while also inhibiting the influx of neutrophils and macrophages.[13] Numerous studies have documented improvements in DED-associated MGD symptoms and indicators following IPL.[14,15] According to certain research, as compared to a placebo group, IPL treatment may reduce the levels of IL-6 and IL-17A in the tears of patients with DED-associated MGD.[16] However, when compared to tobramycin/dexamethasone plus warm compress, the anti-inflammatory benefits of IPL were still unknown.

In this study, we compared tobramycin/dexamethasone + warm compress with IPl for treatment of DED associated MGD. The therapeutic effectiveness of both IPL and tobramycin/dexamethasone with warm compress was demonstrated by the improvements in OSDI and TBUT that both Group A and Group B displayed after therapy. These results were in line with previous investigations.[17] Our research at one month after treatment revealed that IPL was more effective than tobramycin/dexamethasone + warm compress in improving TBUT and OSDI.

Craig et al.[18] conducted the first known randomized, double-masked, controlled experiment in which they administered IPL to one eye and a placebo to the other eye of 28 subjects. Comparing the treated eye to the baseline revealed notable improvements in dry eye symptoms, tear breakup time (TBUT), and lipid layer grade. In addition, the treated eye's lipid grade and TBUT were noticeably better than those of the control eye. The tear meniscus level and tear evaporation rate, however, did not change.[18]

Additionally, Xue et al[19] studied a double-masked, randomized controlled experiment with a placebo. The results confirmed that IPL improved wet film lipid layer thickness, meibomian gland capping, and dry eye symptoms compared to a placebo. Furthermore, compared to sham controls, IPL-treated patients demonstrated improvements in TBUT, meibum quality grades, expressibility grades, and dry eye complaints, according to Piyacomn et al.[10] There was progress as early as day 15, the second therapy session. Following IPL therapy, patients' visual quality also improves, according a recent retrospective study by Wang et al.[20] However, the effect of the IPL could not last for very long.

According to Rong et al[21], the benefits of IPL on the meibomian glands do not last for nine months after treatment. Additionally, they noted that the lower eyelid had a bigger improvement in meibomian gland secretion function than the upper eyelid, which is not surprising considering that the lower lids are typically the focus of treatment.[21]

Jiang and colleagues conducted a prospective open-label trial in 2016 that included 40 MGD patients and examined the safety and efficacy of IPL.[22] Patients received four distinct IPL sessions on days 1, 15, 45, and 75 during the 75-day trial period. Over the course of 75 days, the study showed improvements in meibomian gland function, corneal staining, conjunctival injection, tear meniscus height, tear film break-up time (TBUT), and the subjective perception of ocular dryness.

Two years later, in a controlled cohort analysis of 18 patients with MGD, Yin et al. examined meibomian gland morphological abnormalities in addition to additional clinical tests.[23] Eyelid hygiene was administered to the control group (n = 17), and the patients received three treatments separated by 30 days. While both groups showed increases in OSDI score, TBUT, only the IPL-treated group showed significant changes in meibomian gland morphology.

The brief follow-up period is one of the study's limitations, as it might not adequately reflect the treatment advantages' durability or long-term impacts. Furthermore, the results could not be widely relevant because of a possibly limited or non-representative sample size, which could restrict how extensively the findings can be applied.

CONCLUSION:

Our study concluded that IPL treatment was superior to tobramycin/dexamethasone plus warm compress

treatment for improving TBUT and OSDI in patients with DED associated MGD over a one-month treatment period.

REFERENCES

Nelson JD, Helms H, Fiscella R, Southwell Y, Hirsch JD. A new look at dry eye disease and its treatment. Adv Ther 2000;17:84–93.

Messmer EM. The pathophysiology, diagnosis, and treatment of dry eye disease. Dtsch Ärztebl Int 2015;112:71.

Nelson JD, Shimazaki J, Benitez-del-Castillo JM, Craig JP, McCulley JP, Den S, et al. The international workshop on meibomian gland dysfunction: report of the definition and classification subcommittee. Investig Ophthalmol Vis Sci 2011;52:1930–7.

Qiao J, Yan X. Emerging treatment options for meibomian gland dysfunction. Clin Ophthalmol 2013;7:1797.

Giannaccare G, Pellegrini M, Sebastiani S, Bernabei F, Roda M, Taroni L, et al. Efficacy of omega-3 fatty acid supplementation for treatment of dry eye disease: a meta-analysis of randomized clinical trials. Cornea 2019;38:565–73.

Toyos R, McGill W, Briscoe D. Intense pulsed light treatment for dry eye disease due to meibomian gland dysfunction; a 3-year retrospective study. Photomed Laser Surg 2015;33:41–6.

Husain Z, Alster TS. The role of lasers and intense pulsed light technology in dermatology. Clin Cosmet Invest Dermatol 2016;9:2.

Li D, Lin SB, Cheng B. Intense pulsed light treatment for meibomian gland dysfunction in skin types III/IV. Photobiomodul Photomed Laser Surg 2019;37:70–6.

Toyos R, Toyos M, Willcox J, Mulliniks H, Hoover J. Evaluation of the safety and efficacy of intense pulsed light treatment with meibomian gland expression of the upper eyelids for dry eye disease. Photobiomodul Photomed Laser Surg 2019;37:527–31.

Piyacomn Y, Kasetsuwan N, Reinprayoon U, Satitpitakul V, Tesapirat L. Efficacy and Safety of Intense Pulsed Light in Patients With Meibomian Gland Dysfunction-A Randomized, Double-Masked, Sham-Controlled Clinical Trial [published correction appears in Cornea. 2020 Jul;39(7):e18]. Cornea 2020;39(3):325–32.

Vora GK, Gupta PK. Intense pulsed light therapy for the treatment of evaporative dry eye disease. Curr Opin Ophthalmol 2015;26:314–8.

Dell SJ. Intense pulsed light for evaporative dry eye disease. Clin Ophthalmol 2017;11:1167.

Vehof J, Snieder H, Jansonius N, Hammond CJ. Prevalence and risk factors of dry eye in 79,866 participants of the population-based Lifelines cohort study in the Netherlands. Ocul Surf. 2021 Jan;19:83-93.

Toyos R, McGill W, Briscoe D. Intense pulsed light treatment for dry eye disease due to meibomian gland dysfunction; a 3-year retrospective study. Photomed Laser Surg. 2015;33(1):41–46.

Vora GK, Gupta PK. Intense pulsed light therapy for the treatment of evaporative dry eye disease. Curr Opin Ophthalmol. 2015;26(4):314–318.

Liu RX, Rong B, Tu P, Tang Y, Song WJ, Toyos R, Toyos M, Yan XM. Analysis of cytokine levels in tears and clinical correlations after intense pulsed light treating meibomian gland dysfunction. Am J Ophthalmol. 2017;183:81–90.

Lee H, Chung B, Kim KS, Seo KY, Choi BJ, Kim TI. Effects of topical loteprednol etabonate on tear cytokines and clinical outcomes in moderate and severe meibomian gland dysfunction: randomized clinical trial. Am J Ophthalmol. 2014;158(6):1172–1183.

Craig JP, Chen YH, Turnbull PRK. Prospective trial of intense pulsed light for the treatment of meibomian gland dysfunction. Invest Ophthalmol Vis Sci 2015; 56:1965–1970.

Xue AL, Wang MTM, Ormonde SE. Randomised double-masked placebo-controlled trial of the cumulative treatment efficacy profile of intense pulsed light therapy for meibomian gland dysfunction. Ocul Surf 2020; 18:286–297.

Whang WJ, Yun J, Koh K. Intense pulsed-light treatment improves objective optical quality in patients with meibomian gland dysfunction. BMC Ophthalmol 2023; 23:191.

Rong B, Tang Y, Liu R, et al. Long-term effects of intense pulsed light combined with meibomian gland expression in the treatment of meibomian gland dysfunction. Photomed Laser Surg 2018; 36:562–567.

Jiang X, Lv H, Song H, Zhang M, Liu Y, Hu X, et al. Evaluation of the safety and effectiveness of intense pulsed light in the treatment of meibomian gland dysfunction. J Ophthalmol 2016;2016:191069.

Yin Y, Liu N, Gong L, Song N. Changes in the meibomian gland after exposure to intense pulsed light in meibomian gland dysfunction (MGD) patients. Curr Eye Res 2018;43:308–13.