

## Eye-Light Therapy in the Management of Dry Eye Symptoms: An Observational Study

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Conflict of interest: Nil

### Abstract

**Aim:** The aim of the present study was to examine the effectiveness of eye-light therapy in improving the dry eye symptoms.

**Methods:** The present study was conducted in the Department of Ophthalmology, Netaji Subhas medical college and Hospital, Bihta, Patna, Bihar, India where medical records of subjects who had undergone Eye-light® therapy were analyzed. Adheres to the tenets of declaration of Helsinki. Since this was retrospective study, informed consent was not obtained.

**Results:** We noted significant negative association between OSDI and NBUT. We also noted borderline significant negative association of OSDI with lipid layer thickness and tear height. OSDI was positively associated with upper lid meibography and lower lid meibography. We noted reduction in OSDI score post therapy however it did not reach statistical significance. NBUT was similar post therapy. The lipid layer thickness and tear height was found to increase post light therapy however the difference was not statistical significant. Meibography of upper lid was reduced post therapy however meibography of lower lid did not alter much. In grade 2 there was significant improvement in tear height however did not found any significant changes in NBUT, LLT, meibography of Upper and lower lid. In grade 3, we did not find significant improvement in any of the parameters.

**Conclusion:** Eye-light therapy is effective in reducing dry eye related symptoms with minimal immediate effect on tear film parameters post therapy. Eye-light therapy acts as an adjunct to ameliorate MGD, which being a chronic disease requires sustained topical medication with environmental changes. Long term evaluation is required to assess the tear film changes and the pattern of efficacy of light therapy.

**Keywords:** Dry eye, Intense pulsed light, Ocular surface disease index (OSDI), Meibography

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### Introduction

Dry eye is common, affecting approximately 14–33% of the population which affects their work, their lifestyle and their comfort. [1] It causes visual disturbance and ocular discomfort. Tear hyperosmolarity, disruption of the ocular surface, and tear film instability induce dry eye syndrome. [2] Changed tear composition and decreased tear production result in damage to the ocular surface, inflammation, and apoptosis of epithelial cells. [3] The current treatments for dry eye are tear supplementation, tear stimulation, anti-inflammatory, and immunomodulatory medications. [4] Low-level light therapy (LLLT) has been utilized in the treatment of various disorders. It induces biomodulation in the cellular metabolism as well as analgesic and anti-inflammatory effects. [5] Some in vivo and clinical studies have been made regarding the effect of LLLT on ocular surface or

dry eye disease, and have proved the positive effect of LLLT for ophthalmic application. [6-9]

Dry eye disease (DED) is a multifactorial disorder that manifests on the ocular surface as loss of homeostasis of the tear film, ocular symptoms, tear film instability, hyperosmolarity, ocular surface inflammation, damage, and neurosensory abnormalities. [10] The primary symptoms of patients with dry eye (DE) are dryness, discomfort, foreign body sensation, burning sensation, and decreased visual quality, which has the tendency to affect their quality of life. [11,12] Depending on the demographics surveyed, it is estimated that the prevalence of DE ranges from 5% to 50%. [13] Because of deleterious lifestyle changes, an aging population, chronic illness, and the use of certain medications, the prevalence of DED has continued

to increase, burdening the healthcare system and expenses year over year. [14]

According to the Tear Film and Ocular Surface Society's Dry Eye Workshop II (TFOS DEWS II), DED is divided into the aqueous deficient dry eye (ADDE), evaporative dry eye (EDE) due to meibomian gland dysfunction (MGD), and a combination of ADDE and EDE. Varying severity of hypo-secretion of meibum by the meibomian glands (MG) is considered the most likely cause of EDE. [15] Conventional treatments such as preservative-free drops, omega-3, and fatty acid supplementation can be used for mild disease. For moderate DED, high viscosity eye drops and gel or ointment, warm compresses, eyelid massage [16], eyelid expression, and lacrimal plugs have been proven to be useful.

The aim of the present study was to examine the effectiveness of eye-light therapy in improving the dry eye symptoms.

### Materials and Methods

The present study was conducted in the Department of Ophthalmology, Netaji Subhas medical college and Hospital, Bihta, Patna, Bihar, India for one year where medical records of subjects who had undergone Eye-light® therapy were analyzed. adheres to the tenets of declaration of Helsinki. Since this was retrospective study, informed consent was not obtained.

A total of 50 patients aged 18 years with dry eyes who presented with symptoms such as burning sensation, sandy gritty feeling, foreign body reaction, photophobia, and heavy lids as classified by OSDI score 13, clinically significant signs of MGD<sup>17</sup> were included. Patients with history of alkali burns, trachoma, ocular trauma, chronic uveitis, glaucoma, increased mucoid discharge and watery secretion suggestive of vernal keratoconjunctivitis, and ocular surgery within the last 6 months; those with acute ocular infection, corneal opacity or degeneration, impaired eyelid function such as in Bell's palsy, nocturnal lagophthalmos, ectropion, and contact lens users were excluded from the study.

Demographic characteristics, OSDI scores, MGD grades, tear parameters such as NIBUT, lipid layer thickness, tear height of all patients were noted. An OSDI questionnaire was administered to all participants to assess the symptoms of dry eye. OSDI scale was included for subjective evaluation, so as to have a better subjective understanding of the symptoms in relation to its effect on the quality of life.

Assessment of tear film parameters and meibomian gland

Idra Ocular surface analyzer (OSA) (SBM Sistemi, Italy) was used assess tear film parameter. The Instrument automatically provide measurements such as non-invasive break up time (NIBUT), Lipid layer thickness, tear height, upper and lower lid meibography. NIBUT evaluates the tear film stability and regularity by measuring the time between the last complete blink and the appearance of the first discontinuity of the tear film in seconds. Interferometry test assesses the quality and quantity of lipid layer of tear film. It measures the lipid layer thickness using the international grading scale of Dr Guillon and colour coded map. Tear Meniscus height is non invasive measurement related to tear secretion rate and stability, providing information about tear volume. Small tear volume may result in dry eye symptoms especially aqueous tear deficiency. Infrared meibography automatically analyses the images of the both upper and lower lid, providing the percentage of extension and percentage of loss of the meibomian glands.

We also used ME-CHECK® (Espansione Group, Italy) which is a Non Invasive MGD screening module that grade the MGD on a scale of 0-4 and classified the patients as normal, mild, moderate, severe and very severe. It takes the infrared images of the meibomian gland and compared the capture images with a scale developed by Dr Heiko Pult.

### Light Therapy

Eye-light® (Espansione Group, Italy) therapy was given to all dry eye patients. All patients were given combined OPE and LLLT for 5 and 15 minutes respectively for each session. We used manufacturer protocol for providing the treatment which is described in Table 1. For example if patients has grade 1 MGD then patients were given one session of eye-light ® therapy.

All tear parameters measurements before and after eye- light therapy were noted.

### Statistical Analysis

Data were entered in MS Excel (Microsoft Corporation) and analyzed using Minitab 17 Software (Minitab LLC, State University, PA, USA). Means and standard deviation were calculated for continuous variables and proportions for the categorical variables. Paired t test was used for comparison of OSDI and other parameters before and after the light therapy. Further, patients were also divided in to different grades based on meibography grading scale developed by Dr Heiko Pult and sub group data was analyzed using Mann-whitney test. Fisher's exact test was also used to compare the change in different meibography before and after light therapy.

### Results

**Table 1: Mean±SD tear parameter pre and post eye-light therapy**

	Pre	Post	P Value
OSDI	25.35 ± 11.78	18.66 ± 13.67	0.14
NBUT	8.64 ± 0.86	8.652± 1.562	0.98
LLT	33.37 ± 26.44	38.14 ± 33.14	0.18
Tear Height	0.28 ± 0.17	0.32 ± 0.12	0.36
Meibography Upper Lid	35.65 ± 12.88	31.46 ± 12.82	0.17
Meibography Lower Lid	19.18 ± 16.17	19.45 ± 16.74	0.94

We noted significant negative association between OSDI and NBUT. We also noted borderline significant negative association of OSDI with lipid layer thickness and tear height. OSDI was positively associated with upper lid meibography and lower lid meibography. We noted reduction in OSDI score post therapy however it did not reach statistical

significance. NBUT was similar post therapy. The lipid layer thickness and tear height was found to increase post light therapy however the difference was not statistical significant. Meibography of upper lid was reduced post therapy however meibography of lower lid did not alter much.

**Table 2: Median (IQR) of tear parameters among different grades of MGD pre and post eye-light therapy**

	Pre	Post	P Value
OSDI	26.0 (8.56)	11.0 (16.04)	0.26
NBUT	8.8 (0.7)	9.0 (1.7)	0.007
Grade 1 LLT	31.0 (42)	14.0 (18.4)	0.82
Tear Height	0.43 (0.23)	0.40 (0.18)	0.62
Meibography Upper Lid	30.0 (12.6)	27.0 (14.6)	0.48
Meibography Lower Lid	12.0 (13)	12.0 (15.5)	1.0
OSDI	28.16 (15.95)	20.84 (17.63)	0.42
NBUT	8.8 (0.92)	8.6 (1.4)	0.76
Grade 2 LLT	15.0 (37.5)	38.0 (33.5)	0.68
Tear Height	0.24 (0.06)	0.24 (0.12)	0.04
Meibography Upper Lid	36.0 (22.50)	31.0 (20.52)	0.36
Meibography Lower Lid	23.0 (20.50)	20.0 (26.0)	0.72
OSDI	21.88 (15.52)	12.04 (16.24)	0.15
NBUT	8.7 (1.07)	8.8 (0.50)	0.86
Grade 3 LLT	15.0 (5.75)	28.52 (36.74)	0.32
Tear Height	0.26 (0.24)	0.32 (0.18)	0.26
Meibography Upper Lid	35.50 (8.72)	34.50 (12.5)	0.60
Meibography Lower Lid	24.50 (11.25)	16.0 (15.75)	0.48

In grade 2 there was significant improvement in tear height however did not found any significant changes in NBUT, LLT, meibography of Upper and lower lid. In grade 3, we did not find significant improvement in any of the parameters.

**Discussion**

Dry eye disease (DED) is a multifactorial ocular surface disease that is characterized by symptoms of discomfort, irritation, and visual disturbance. DED is becoming common as the world is becoming digital. DED is a disease which is more symptomatic with or without clinical signs. Its prevalence around the world varies from 5% to 34%, which increases significantly with age. [18-20] DED causes significant effects on individuals, including impairment in social functioning, occupational functioning, and reduced quality of life, irrespective

of the severity of symptoms. [20,21] DED has been broadly demarcated into aqueous-deficient and evaporative type with major cause being meibomian gland dysfunction. [19,22]

We noted significant negative association between OSDI and NBUT. We also noted borderline significant negative association of OSDI with lipid layer thickness and tear height. OSDI was positively associated with upper lid meibography and lower lid meibography. We noted reduction in OSDI score post therapy however it did not reach statistical significance. NBUT was similar post therapy. The lipid layer thickness and tear height was found to increase post light therapy however the difference was not statistical significant. However previous studies of light treatment have reported improvements in measures of tear film stability with serial intense pulsed light treatment. [23] Craig,

Chen and Turnbull [24] reported significant improvement in NIBUT after 3 (at 45 days) treatment sessions in the treated eye versus control eye ( $14.1 \pm 9.8$  seconds versus  $8.6 \pm 8.2$  seconds,  $P < 0.001$ ). Previous studies have reported significant improvement in tear film break up time after a series of monthly intense pulsed light and MGX treatments. [25,26]

Continuous lipid layer is important to retard excessive aqueous tear evaporation. Thus lipid layer thickness forms the important parameter in evaluating tear film stability. Although lipid layer thickness correlates well with symptoms as well as signs of MGD, it does not necessarily reflect quality of the lipid layer. [27] Meibography of upper lid was reduced post therapy however meibography of lower lid did not alter much. In grade 2 there was significant improvement in tear height however did not found any significant changes in NBUT, LLT, meibography of Upper and lower lid. In grade 3, we did not find significant improvement in any of the parameters. Selective photo thermolysis forms the working principle of the IPL, in which thermally mediated radiation damage is limited to have selected epidermal and dermal pigmented targets at the tissue structure or cellular levels and its use has been recorded in cosmetic dermatology. [28] IPL employs electromagnetic waves of desired wavelengths to dilate the capillaries, making them to involute. [29] This causes suppression of the leaked inflammatory mediators, which in turn interrupt the vicious cycle of inflammation and improving symptoms of dry eye. It also works with the aid of thermal pulsation for various patients. [30] This meibum clogs the glands rather than melting into the tear film's lipid layer as it should. Thermal pulsation therapy entails a combination of sustained heat and pressure to liquefy the meibum and thus clear the glands. Expressing the glands manually proves less effective, uncomfortable for patients, and could potentially cause scarring. Thermal pulsation, besides being gentle, is an effective method as well. [31]

### Conclusion

Eye-light therapy is effective in reducing dry eye related symptoms with minimal immediate effect on tear film parameters post therapy. Eye-light therapy acts as an adjunct to ameliorate MGD, which being a chronic disease requires sustained topical medication with environmental changes. Long term evaluation is required to assess the tear film changes and the pattern of efficacy of light therapy.

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