e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2023; 15(12); 798-802

Original Research Article

An Observational Study to Examine the Effectiveness of Eye-Light Therapy in Improving the Dry Eye Symptoms

Gautam Garg[1], Sujata Kumari[2], Alok Ranjan[3], Nageshwar Sharma[4]

[1]Senior Resident, Department of Ophthalmology, Patna Medical College and Hospital, Patna, Bihar, India

[2]Senior Resident, Department of Ophthalmology, Patna Medical College and Hospital, Patna, Bihar, India

[3]Assistant Professor, Department of Ophthalmology, Patna Medical College and Hospital, Patna, Bihar, India

[4]Professor and HOD, Department of Ophthalmology, Patna Medical College and Hospital, Patna, Bihar, India

Received: 12-09-2023 Revised: 15-10-2023 Accepted: 22-11-2023
Corresponding author: Dr. Sujata Kumari
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. where medical records of subjects who had undergone Eye-light® therapy were analyzed and 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

Introduction

Meibomian gland dysfunction (mgd) is the leading cause of evaporative dry eye disease (DED). [1–4] Patients with this disease produce an abnormal meibum that is more viscous than the usual olive-oil-like secretion. [5,6] These patients can have severe inflammation and bacterial overgrowth that exacerbates the problem. Most standard treatments, such as anti-inflammatory drops or oral antibiotics, [7,8] aim at decreasing the inflammation associated with this disease. [9] Another treatment has been to use warm compresses in an effort to melt the thick meibum produced by these secretions. [10] Finally, doctors have recommended lid scrubs to lower the bacterial load and cleanse the lid margin. [11] Such treatments have been only somewhat effective for patients with MGD, leading some to suggest the need for a multifaceted treatment approach. [12,13]

Intense pulse light (IPL) has been used in dermatology practices for several years as a treatment for rosacea and acne. [14] IPL uses Xenon flash lamp to emit wavelengths of light from 400 to 1200 nm. When placed on the light, a filter restricts the wavelength to the visible light range of ~500 nm. When applied to the skin, this 500 nm light causes the blood cells in the abnormal telangiectasias to absorb the light, coagulate, and, finally, to close the blood vessels. In the case of

rosacea, these abnormal blood vessels secrete inflammatory mediators over time that damages the skin. Closing of the telangiectasias and the inflammatory mediators they secrete is one of the mechanisms proposed to explain how IPL improves the skin in rosacea patients. [15]

Normal meibum contains antimicrobial properties that keep the lid margin clear from overgrowth. [16] Abnormal blood vessel growth from chronic inflammation called telangiectasias surround the meibomian glands and secrete inflammatory mediators that cause malfunction of the glands. [17] This dysfunction leads to formation of an abnormal meibum. Potentially, IPL near the lid should cause closing of the abnormal blood vessels secreting inflammatory mediators and decrease bacterial overgrowth; an eventuality we began to observe early in the practice when some of the patients treated with IPL showed improvement in their MGD and DED.

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. [18] 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 [19], 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, Patna Medical College and Hospital and Multicentric Hospital , Patna, Bihar, India for one year.were 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 30 patients aged 18 years with dry eyes who presented with symptoms such as burning sensation, sandy grity feeling, foreign body reaction, photophobia, and heavy lids as classified by OSDI score 13, clinically significant signs of MGD[20] 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 evalautes 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 infromation about tear volume. Small tear volume may result in dry eye symptoms especailly aqeuous 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 respectievly 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-whiteney 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
LLT Grade 1	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
LLT Grade 2	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
LLT Grade 3	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. [21-23] DED causes significant effects on individuals, including impairment in social functioning, occupational functioning, and reduced quality of life, irrespective of the severity of symptoms. [23,24] DED has been broadly demarcated into aqueous-deficient and

evaporative type with major cause being meibomian gland dysfunction. [22,25]

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. [26] Craig, Chen and Turnbull [27] reported significant improvement in NIBUT after 3 (at 45 days) treatment sessions in the treated eye versus control eye (14.1±9.8 seconds versus 8.6±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. [28,29]

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. [30] 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. [31] IPL employs electromagnetic waves of desired wavelengths to dilate the capillaries, making them to involute. [32] 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. [33] 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. [34]

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.

References

1. Nichols KK, Foulks GN, Bron AJ, Glasgow BJ, Dogru M, Tsubota K, Lemp MA, Sullivan DA. The international workshop on meibomian gland dysfunction: executive summary. Invest Ophthalmol Vis Sci. 2011 Mar 30;52(4):1922-9.
2. Lemp MA, Crews LA, Bron AJ, Foulks GN, Sullivan BD. Distribution of aqueous-deficient and evaporative dry eye in a clinic-based patient cohort: a retrospective study. Cornea. 2012 May;31(5):472-8.
3. Korb DR, Blackie CA. Meibomian gland diagnostic expressibility: correlation with dry eye symptoms and gland location. Cornea. 200 8 Dec;27(10):1142-7.
4. Korb DR, Blackie CA. Restoration of meibomian gland functionality with novel thermodynamic treatment device-a case report. Cornea. 2010 Aug;29(8):930-3.
5. Korb DR, Blackie CA. Meibomian gland therapeutic expression: quantifying the applied pressure and the limitation of resulting pain. Eye Contact Lens. 2011 Sep;37(5):298-301.
6. Olson MC, Korb DR, Greiner JV. Increase in tear film lipid layer thickness following treatment with warm compresses in patients with meibomian gland dysfunction. Eye Contact Lens. 2003 Apr;29(2):96-9.
7. Facts About Dry Eye. Dry Eye, Facts About [NEI Health Information]. (n.d.).
8. Tu E. Dry Eye. Ophthalmology 2008.
9. Ehlers JP, Shah CP, Fenton GL, Hoskins EN, Shelsta HN. The Wills eye manual: office and emergency room diagnosis and treatment of eye disease. (No Title). 2008.
10. Dry Eye Disease. American Academy of Ophthalmology, n.d.
11. Care of the patient with ocular surface disorders. American Optometric Association, 2010.
12. Caceres V. Ocular surface treating dry eye. Eye World, 2011.
13. Bowling E, Russell G. Topical steroids and the treatment of dry eye. Review of Cornea and Contact Lenses, 2011.
14. Papageorgiou P, Clayton W, Norwood S, Chopra S, Rustin M. Treatment of rosacea with intense pulsed light: significant improvement

and long-lasting results. Br J Dermatol. 2008 Sep;159(3):628-32.
15. Toyos R. Intense pulsed broadband light: a novel treatment for dry eye disease. ASCRS 2005 Research Grant Winner, 2005.
16. Holland E. Management of meibomian gland disease and ocular surface inflammation. Healio Ophthalmology, 2009.
17. Geerling G, Tauber J, Baudouin C, Goto E, Matsumoto Y, O'Brien T, Rolando M, Tsubota K, Nichols KK. The international workshop on meibomian gland dysfunction: report of the subcommittee on management and treatment of meibomian gland dysfunction. Invest Ophthalmol Vis Sci. 2011 Mar 30;52(4):2050-64.
18. Chhadva P, Goldhardt R, Galor A. Meibomian Gland Disease: The Role of Gland Dysfunction in Dry Eye Disease. Ophthalmology. 2017 Nov;124(11S):S20-S26.
19. Wang MTM, Feng J, Wong J, Turnbull PR, Craig JP. Randomised trial of the clinical utility of an eyelid massage device for the management of meibomian gland dysfunction. Cont Lens Anterior Eye. 2019 Dec;42(6):620-624.
20. Xue AL, Wang MT, Ormonde SE, Craig JP. Randomised double-masked placebo-controlled trial of the cumulative treatment efficacy profile of intense pulsed light therapy for meibomian gland dysfunction. The Ocular Surface. 2020 Apr 1;18(2):286-97.
21. Dana R, Bradley JL, Guerin A, Pivneva I, Stillman IÖ, Evans AM, Schaumberg DA. Estimated prevalence and incidence of dry eye disease based on coding analysis of a large, all-age United States health care system. American Journal of Ophthalmology. 2019 Jun 1;202:47-54.
22. Messmer EM. The Pathophysiology, Diagnosis, and Treatment of Dry Eye Disease. Dtsch Arztebl Int. 2015;112(5):71–82.
23. Gayton JL. Etiology, prevalence, and treatment of dry eye disease. Clinical ophthalmology. 2009 Jul 14:405-12.
24. Pflugfelder SC. Prevalence, burden, and pharmacoeconomics of dry eye disease. Am J Manag Care. 2008 Apr;14(3 Suppl):S102-6.
25. Lemp MA, Crews LA, Bron AJ, Foulks GN, Sullivan BD. Distribution of aqueous-deficient and evaporative dry eye in a clinic-based patient cohort: a retrospective study. Cornea. 2012 May 1;31(5):472-8.
26. Wei S, Ren X, Wang Y, Chou Y, Li X. Therapeutic effect of intense pulsed light (IPL) combined with meibomian gland expression (MGX) on meibomian gland dysfunction (MGD). Journal of ophthalmology. 2020 Apr 13;2020.
27. Craig JP, Chen YH, Turnbull PRK. Prospective trial of intense pulsed light for the treatment of meibomian gland dysfunction. Invest Ophthalmol Vis Sci. 1965;56(3):1965–70.
28. Vora GK, Gupta PK. Intense pulsed light therapy for the treatment of evaporative dry eye disease. Curr Opin Ophthalmol. 2015; 26:314–8.
29. Arita R, Mizoguchi T, Fukuoka S, Morishige N. Multicenter Study of Intense Pulsed Light Therapy for Patients With Refractory Meibomian Gland Dysfunction. Cornea. 2018; 37(12):1566–71.
30. Thulasi P, Djalilian AR. Update in current diagnostics and therapeutics of dry eye disease. Ophthalmology. 2017 Nov 1;124(11):S27-33.
31. Anderson RR, Parrish JA. Selective photothermolysis: precise microsurgery by selective absorption of pulsed radiation. Science. 1983 Apr 29;220(4596):524-7.
32. Onesti MG, Fioramonti P, Fino P, Sorvillo V, Carella S, Scuderi N. Effect of enzymatic debridement with two different collagenases versus mechanical debridement on chronic hard-to-heal wounds. Int Wound J. 2016 Dec; 13(6):1111-1115.
33. Vegunta S, Patel D, Shen JF. Combination therapy of intense pulsed light therapy and meibomian gland expression (IPL/MGX) can improve dry eye symptoms and meibomian gland function in patients with refractory dry eye: a retrospective analysis. Cornea. 2016 Mar 1;35(3):318-22.
34. Suwal A, Hao JL, Zhou DD, Liu XF, Suwal R, Lu CW. Use of intense pulsed light to mitigate meibomian gland dysfunction for dry eye disease. International journal of medical sciences. 2020;17(10):1385.