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RESEARCH ARTICLE

EFFECTIVENESS OF WARM COMPRESSION ON TEAR PRODUCTION AMONG DRY EYE SYNDROMEAND ITS PREVELENCE: A NARRATIVE REVIEW

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Abstract

An eye is a sensory organ that is responsible of light accommodation and vision. Ocular illnesses and a lower quality of life can result from any disruption in the anatomical or functional integrity of the eye, a crucial sensory organ that is responsible for light adaption and vision. Refractive errors, cataracts, glaucoma, diabetic retinopathy, age-related macular degeneration, and dry eye disease (DED) are common ailments. Estimated 2.2 billion people all around world reported of visual impairment, and at least 1 billion of casesmight have been prevented or have not yet been treated. The prevalence of DED in India varies from 18.4% to 54.3%, which is higher than estimates worldwide. Thickened meibum is liquefied, meibomian gland ducts are opened, and lipid secretion is encouraged by warm compression, also known as eyelid warming therapy, a straightforward, non-invasive treatment for dry eye condition.

Method :A narrative review was conducted using warm compression, tear production, dry eye syndrome with its prevalence. The result, showed that around 30 studieswere narratively reviewed and according to inclusion criteria the study scrutinized;& narrowed down to 12 recent studiesunderwhich 6 studies represented prevalence of dry eye syndromei.e. 43% had mild dry eye syndrome, 30% dry eye syndromeassociated with watering (36.8%), followed by redness (25%), gritty sensation (20%) and burning sensation (18.7%). Itching and blurring of vision were observed in (13.1%) and (6.8%).

Further, 6 studies supporting for warm compression withlow-level light therapy and warm compress with hot gel pack showed; It is assessed by Tear film lipid layer thickness which showed significant difference after treatment. Furthermore 6 studies showed that heating and massaging the eyelids improved the appearance of the upper lid meibomian glands (p = 0.025). With the above mentioned studies researcher is convinced that warm compression helps in reduce dry eye syndrome and improve tear production which researcher carry forward for further

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experimentation. Narrative review concluded that warm compression improvestear production and improve dry eye syndrome. Hence this can be generalised to larger population covering SDG goal 3.8, 3.9, 3D.

Introduction:-

One of the most prevalent and underdiagnosed ocular conditions nowadays is dry eye disease (DED), which is typified by unstable tear films, ocular discomfort, and diminished vision (Craig et al., 2017). Early recognition, health awareness, and nurse-organized preventative therapies are necessary to lower the burden on illness and improve ophthalmic health indicators at the community level.It is a multifactorial ailment of the tears and the ocular surface that is referred to as Dry Eye Disease (DED). Other names for this condition include Dry Eye Syndrome (DES), keratoconjunctivitis sicca (KCS), ocular surface disease (OSD), and dysfunctional tear syndrome (DTS). " The condition is described by discomfort, visual disturbance, and destabilisation of the tear film, frequently accompanied by hyperosmolarity of the tear film, swelling, impairment, and in certain cases, defects of the neurological sensory system.The main feature of DED is the unstable tear film, which results from brought on by variations in the function of the layer of lipids as well as in the amount, calibre, and accessibility of tear fluid. It is a major cause of symptoms and may be the primary cause for variations in the design and function of epithelia, which explains why swelling begins.

In warm compress procedure, warmthusually moist heatis applied on the eyelids to increase the stability of the tear film, particularly in patients with Meibomian Gland Dysfunction (MGD).Relaxing or softening meibumthe fluid secretion from glands in the eyelids clearing up glands and improving oil flow over the tear layer are the objectives. This enhances eye relaxation and inhibits the evaporation of tears.For the treatment of Dry Eye Disease (DED), especially cases associated with Meibomian Gland Dysfunction (MGD), warm compression is a straightforward, non-invasive, and generally advised treatment. To lessen a feeling of dry and ocular pain, the treatment entails administering regulated temperature (around 40–45°C) to the eyes while they are closed for 5–10 minutes. This helps to dissolve the thickened meibum, which helps to improve glandular secretion, and stabilise the tear film lipid layer. Devices like Bruder masks, Blepha Eye Bags, and Optic Care Wear are frequently utilised to guarantee protection while maintaining an even temperature. Meibomian discharge expression and tear film stability are improved even more by a little eyelid massaging after warm compression. Regular heated compression greatly increases Tear Film Break-Up Time (TBUT), according to several research.

Objectives:-

- To find the studiesof prevalence of dry eye syndrome.
- To find the studiesof effect of warm compression on tear production among patient with dry eye syndrome.

Methodology:-

Study Design: A narrative review has been include in the study.
Study selection: screened titles and abstracts and reviewed thoroughly of the full text of eligible studies.

Articles Included in this review:

1. Clinical trial study
2. Cross Sectional Study
3. Randomized Control Trial
4. Prospective study

Inclusion Criteria:-

- Study of last 10 years
- Study which are available full and free text.
- Adult population age 18 years and above
- Study which are clinical trial and RCT.
- The paper which was published in English language
- Study which are studied on humans including male and male.

Exclusion Criteria:-

- The research studies which where abstract is available.
- Research studies which are available in other languages.

- Research studies which are done over animals.
- Preprinted research studies are excluded.

Following related research studies categorized into different sections as below:
Section: I To find the studies related to prevalence of dry eye syndrome
Section: II To find the studies related to effect of warm compression on tear production among patient with dry eye syndrome

Section: ILiterature related to prevalence of dry eye syndrome

Study author, year, country	Title	Nature of the study	Sampling technique	Sample SIZE	Data Collection tool	Results
Kasilanka Radhika, Pakalapati Pradeep (2025)	Prevalence of dry eye disease among medical students in a tertiary care center:	A cross sectional study	Purposive sampling technique	100	Participants were evaluated using the Ocular Surface Disease Index (OSDI) questionnaire, average daily screen time and routine ophthalmological examination, Schirmer's test, and tear film break-up time (TBUT) as a screening method for identifying DED.	Prevalence of DED among study participants was 43%, with 30% of students having mild DED. There is a significant association between screen time and DED ($p<0.05$).
SunitaSabarwal et all(2025)	Prevalence, Pattern and Associated Risk Factors of Dry Eye Disease From a Prospective Database of a Tertiary Eye Care Centre in Central India	prospective cross-sectional study	systematic random sampling	2,560	subjective and objective methods comprising of the Ocular Surface Disease Index (OSDI) questionnaire, slit lamp examination, Schirmer's tests and fluorescein tear-film breakup time (FTBUT) test. Patients were categorised into mild, moderate, severe and very severe DED.	The prevalence of DED was estimated to be 25% in central India. of DED was observed to be watering (36.8%), followed by redness (25%), gritty sensation (20%) and burning sensation (18.7%). Itching and blurring of vision were observed in (13.1%) and (6.8%) .
Xiaojuan Chen et	Prevalence of symptomatic	Cross-sectional	stratified cluster	1,518 participant	Demographic information,	overall prevalence of

al(2024)	dry eye and influencing factors	study	sampling technique	s	including sex, age and BMI, were collected. All participants underwent optometric tests, while Ocular Surface Disease Index (OSDI) and self-designed questionnaires were administered	SDE was 20.3% among adolescents in Nantong, China. Multiple logistic regression analyses showed that high myopia (aOR = 3.42, frequent use of eye drops (aOR = 2.31), a history of allergic conjunctivitis (aOR = 1.93, , and frequent blinking (aOR = 3.23, were identified as risk factors for SDE
Vandana Misra et all(2024)	Prevalence of dry eye disease in rural population of district: Shahjahanpur, Uttar Pradesh, Northern India	prospective study	Convenience sampling	272500	A simple questionnaire related to DED symptoms was given to patients during screeningWhatman filter paper no 41 (measuring 5 mm × 35 mm) which was placed in the lower fornix at the lateral one-third of the lower lid margin. The extent of wetting of the strip was measured after 5 minutes and less than 10 mm of wetting was taken as dry eye (28).Schirmer's test was done	Out of 2, 72,500 patients screened, 76,196 (28 %) were symptomatic. Out of which 40,376 (52.98 %) were males and 35,820(47.06 %) were females.
Samrat Chatterjee et all(2021)	Prevalence of symptoms of dry eye disease in an urban Indian population	Cross-sectional study	two-stage cluster sampling	2378	Interviewers collected demographic and lifestyle data from participants aged ≥20 years. DED symptoms were	Prevalence for any positive symptom was 6.5% and 6.8% . The most reported symptoms was

					assessed using a standard six-item validated questionnaire. The presence of one or more of the six dry eye symptoms often or all the time was considered positive for DED symptoms	red eyes (2.8%) followed by burning sensation (1.8%), foreign body sensation (1.7%), dry eyes (1.2%), gummy eyes (1.2%), and crusts on eyelashes (0.8%). The associated risk factors were female sex, use of digital display, smoking and stay in an air-conditioned environment.
Neha Srivastava et all(2023)	Correlation of dry eyes with on-screen time among medical students	Cross-sectional study		253	all participants were given Schirmer 1 and tear film breakup time (TBUT) test. Patients with Schirmer 1 and TBUT reading <10 mm were identified as dry-eye patients. After that, a pre-designed questionnaire was applied to all dry-eye participants that asked about different symptoms of dry eyes and screen time and the correlation between subjective symptoms of dry eyes, dry-eye tests, and screen time was evaluated.	About 20.8% of medical students had dry eyes, and those who used their phones for 2–5 h had statistically higher rates of the condition. The length of breaks was also found to be strongly correlated with dry eye.

SECTION-II Literature related to Warm Compression effect on Tear Production among Dry eye syndrome

Antoinette Antwi(2024)	Thermal effect on eyelid and tear film after low-level light therapy and warm compress	Randomized controlled trial	Randomisation	35	Participants randomised into control, warm compress, and low-level light therapy groups. The low-level light therapy group was treated with Eye-light mask (633 nm) for 15 minutes, the warm compress group with Bruder mask for 10 minutes, and the control group with an Eyelight mask having inactive LEDs for 15 minutes. Eyelid temperature was measured using the FLIR One Pro thermal camera and clinical measures of tear film stability were evaluated before and after treatment.	Eyelid temperatures were significantly greater in the low-level light therapy and warm compress groups immediately after treatment compared to the control group No difference in temperature was observed between the low-level light therapy and warm compress groups at all time points Tear film lipid layer thickness was significantly greater after treatment (mean (95% CI), 13.1 nm (5.3 to 21.0
Da-Hu Wang(2024)	Efficacy and safety of the disposable eyelid warming masks in the treatment of dry eye disease due to Meibomian gland dysfunction	RCT	Randomized, controlled, non-masked, two-center clinical trial.	134	One hundred and forty-four patients were treated by the masks or the hot towel twice daily for 12 weeks. Patients were evaluated at baseline, 4-week and 12-week visits for subjective symptoms, objective signs and safety assessments, including ocular symptom scores, ocular surface disease index (OSDI), tear break-up time (BUT), corneal fluorescein staining (CFS), Schirmer I test (SIT), meibum quality,	At 4-week visit, there were significant statistical differences in ocular symptom scores, OSDI and CFS between two groups ($P < 0.05$). treatment group showed a greater improvement in subjective symptoms and objective signs than the control group at 12-week visit. ($P < 0.05$). In addition, 40 AEs occurred in 27 patients

					meibumexpressibility, and adverse events (AEs).	(37.5%) in the treatment group, and 34 AEs occurred in 21 patients (29.17%) in the control group.
Justin E. Pettayil (2024)	Effect of Heating and Massaging of Meibomian Glands on Their Imaging	prospective study	randomisation	24	Lid warming was facilitated using a BlephaEyeBag which was heated in a microwave for 30 s at a power level of 800 W as per the manufacturer's instructions. The manual eyelid massage involved gentle manipulation using the index and middle fingers for 5 min, aligning with the gland directions.	Heating and massaging the eyelids improved the appearance of the upper lid meibomian glands ($p = 0.025$), while the lower lid glands showed no change ($p = 0.782$). Tear film stability (NIBUT) decreased slightly on the second lid eversion ($p = 0.049$) but improved immediately after heating ($p = 0.034$) and was sustained 5 minutes after massage ($p = 0.031$). Tear meniscus height (TMH) increased significantly with heating ($p < 0.001$) and remained higher after 5 minutes of massage ($p = 0.011$). Lid eversion had no effect ($p > 0.05$), blink rate was unchanged (median 24 blinks/min, range 8–59; $p = 0.61$), and no adverse effects were reported."

Mano PriyaVijayan, RenukaGugan(2023)	Effect of Warm Compress Application using Optic Care Wear Vs Conventional Method on Level of Symptom Complex among Elderly Clients with Dry Eye Syndrome at Selected Old Age Home, Puducherry	Quasi-experimental research design	non-probability convenience sampling technique	20	Research participants grouped into two groups, with 10 in the experimental group who received a warm compress using Optic Care Wear, and 10 in the control group who received a conventional warm compress application using a clean cotton cloth. Age (≥50), symptoms, and clinical measures associated with dry eye are the parameters considered for the selection for study. Pre-test and post-test evaluations of OSDI, TBUT, and Schirmer's Test scores, and statistical analyses using paired t-tests and chi-square tests were conducted.	Applying warm compresses with Optic Care Eyewear considerably lowered OSDI values. scores (12.92% reduction) compared to the conventional method (1.67% reduction). Furthermore, the experimental group manifested substantial enhancements in TBUT ratings (32.50% increase) and Schirmer's Test ratings (36.98% increase) relative to Control Group (TBUT: 13.51% increase, Schirmer's Test: 11.26% increase)
Zara Arif (2024	Efficacy of Warm Compress Therapy on Tear Film Quality and Postoperative Dry Eye	randomized clinical trial	randomization	60	intervention group, receiving warm compress therapy after surgery, or a control group receiving standard dry eye treatments for a six-week	Warm compress therapy mean standardised patient evaluation of eye

	Syndrome after Cataract Surgery: A Randomized Controlled Trial				duration. Preoperative and postoperative evaluations will include ocular surface disease index and a standardised patient evaluation of eye dryness questionnaire to measure dry eye symptoms and quality of life. The normality of the data was assessed using the Kolmogorov-Smirnov test.	dryness questionnaire at day one was 20.37±3.85 before the treatment and 2.37±1.36 after the treatment, mean score of the control group before treatment was 17.41±2.4, after the treatment was 5.38±1.5. The mean score of ocular surface disease index of the warm compress therapy before and after treatment was 75.48±9.09, 18.07±4.45. and for control group54.11±11.3, and 31.41±6.2, respectively. The mean difference in ocular surface disease index was 22.7 ($p \leq 0.05$)
Xueyi Zhou (2021)	Effects of warm compress(W	Experimental study	Convenience sampling	37	Participants, with dry eye for more than following	WC may temporarily increase tear

	C) on tear film, blink pattern and Meibomian gland function in dry eyes after corneal refractive surgery				surgery WC was performed using a heating eye mask. Tear film break-up time (TBUT), tear film lipid layer thickness (TFLLT), blink pattern, Meibomian secretory function were assessed before and after WC.	film thickness and stability, decrease partial blink, and partly augment Meibomian gland function in dry eye patients after corneal refractive surgeries.

Discussion:-

According to primary data it has been analysed thatthere was a significant prevalence of Dry Eye Disease (DED) among medical students (43%), with 30% of cases being mild in severity. The results show that extended time spent on screens has a significant connection with DED occurrence ($p < 0.05$). In order to lessen the negative effects of digital screen exposure on ocular health, our findings highlight the necessity of education, preventative actions, and routine eye exams for medical students. Furthermore, study revealed that 25% population reported with Dry Eye Disease in Central India, under which tearing as the most reported as one of mostly reported symptoms. Findings highlight the need for early detection and preventive eye care to manage DED effectively. Moreover, symptomatic dry eye is a significant ocular health concern among adolescents in Nantong, China, where it is known to have a prevalence of 20.3%. The main risk factors have been found to be high myopia, frequent use of eye drops, allergic conjunctivitis, and excessive blinking. In order to safeguard teenage eye health in the age of digital media, these findings highlight the critical need for early screening, lifestyle changes, and educational initiatives.

Even after the rural population of Shahjahanpur, Uttar Pradesh, has an exceedingly significant rate of Dry Eye Disease (DED) at 28%. This is a major yet are frequently overlooked public health issue. considering that the prevalence is slightly greater in men (52.98%) than in women (47.06%), the results emphasise the critical need for early detection, community-based awareness campaigns, and easily accessible eye care facilities in order to address the growing problem of DED in rural India. Study suggests that the incidence of Dry Eye Disease (DED) within medical students was 20.8%, as well as there was an important association between the occurrence of dry eye symptoms and prolonged screen usage. The rates of prevalence were noticeably higher among students who used digital devices for two to five hours per day. Furthermore, infrequent screen breaks were significantly linked to higher DED symptoms, highlighting the importance of regular breaks, healthy screen habits, and early preventive eye care practices for medical students in the age of digital devices.

For warm compression the study showed that, in compared to the control group, warm compresses and low-level light therapy both markedly raised eyelid temperature and improved the dimension of the tear film lipid layer. Nevertheless, no apparent difference between the two treatment approaches was found. These results underline both interventions' potential as non-invasive, beneficial treatments for dry eye symptoms by confirming that they are similarly successful in improving eye surface health and tear film stability.According to the study's findings, Meibomian gland dysfunction-related Dry Eye Disease (DED) can be safely and effectively treated with disposable eyelid warming masks. Compared to the hot towel group, patients who used warming masks after 12 weeks of treatment reported substantial improvements in perceived symptoms as well as objective clinical indicators, such as OSDI scores, tear film stability, and corneal health ($P < 0.05$).

Both groups experienced moderate adverse effects, but they were generally well tolerated. These findings demonstrate that, when it comes to the long-term treatment of DED, eyelid warming masks provide a practical, reliable, and therapeutically advantageous substitute for conventional hot towel therapy. The research conducted indicated that both warm compress approaches benefitted individuals 50 years of age and above deal with dry eye complaints. In contrast to the conventional cotton approach, the Optic Care Wear compress displayed a higher

enhancement of OSDI, TBUT, and Schirmer's Test results. The substantial variations among groups were confirmed by statistical testing using chi-square and paired t-tests. The results demonstrate that consistent, routine warm compress therapy improves ocular comfort and tear film integrity. Optic Care Wear thus turned out to be a more effective, safe method of treating DED.A research project that used a heated eye mask for warm compression on 37 dry eye patients who had undergone refractive surgery revealed a substantial increase in the overall thickness of the lipid layer and the resilience of the tear film. Additionally, it strengthened Meibomian gland functionality and decreased partial blinks. According to the results, post-operative dry eye can be successfully managed temporarily using warm compress therapy. Therefore, it functions as a straightforward, non-invasive technique to improve the functioning of the ocular surface.

Future Scope:-

- Nurse-led eye care programs can be established in outpatient departments and community settings to teach proper techniques for warm and cold compression with blinking exercises.
- Standardized clinical protocols and demonstration guidelines should be developed to ensure uniformity and patient safety in practice.
- Follow-up assessments using tools like the Schirmer's test or Ocular Surface.
- Disease Index (OSDI) should be performed to monitor improvement and adherence.

Critique:-

- Existing literature tends to examine either the effectiveness of warm compression or the prevalence of dry eye syndrome separately. Very few studies attempt to combine these two essential aspects, making it difficult to understand whether populations with higher prevalence truly benefit from this therapy.
- Limited data in local population groups (students, elderly, digital users).Dry eye risk varies with lifestyle and demographics. However, population-focused research is lacking, especially in our region.
- Limited comparison with artificial tears, IPL, lid hygiene,

Conclusion:-

The analysis of relevant research strongly shows that warm compress therapy has significance for controlling Dry Eye Disease (DED) and enhancing the health of the eyes. Improvements in important clinical parameters like the Ocular Surface Disease Index (OSDI), Tear Film Break-Up Time (TBUT), Schirmer's Test, and Tear Film Lipid Layer Thickness (TFLLT) after applying warm compresses have been consistently reported in a variety of research designs, including randomised controlled trials, quasi-experimental, and prospective studies.When compared with standard cotton-made warm compresses, modern devices such as the Optic Care Wear, Bruder mask, and heated eye masks have demonstrated superior results, providing more consistent heat and convenience of use. Additionally, studies show that after refractive and cataract procedures, warm compress therapy improves postoperative tear film stability, decreases partial blinks, and increases Meibomian gland function. The majority of the data points to regular, controlled warm compress therapy as a safe, non-invasive, and successful way to help people with DED regain their Meibomian gland function, tear film stability, and ocular comfort. Dry eye syndrome (DES), a common ocular disease which manifests in discomfort, blurred vision, and degradation of the optical area, is characterised by decreased discharge of tears or increased tear evaporation. Non-pharmacological nursing techniques, including as warm compression and blinking exercises, have been shown to enhance meibomian gland activity and tear production, hence improving ocular surface health.

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