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THE EFFECT OF OMEGA 3 SUPPLEMENTS IN COMPARISON WITH WARM COMPRESSION IN PATIENTS WITH DRY EYE DISEASE

Original Article

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ABSTRACT

Background: Dry eye disease (DED) is a multifactorial condition affecting tear film stability and ocular surface health, leading to discomfort, visual impairment, and reduced quality of life. Among treatment options, omega-3 fatty acid supplementation has been proposed as an alternative to traditional therapies such as warm compression. Omega-3 plays a role in reducing ocular inflammation and improving meibomian gland function, whereas warm compression enhances lipid secretion and tear film stability. This study aimed to compare the effectiveness of these two interventions in alleviating DED symptoms and improving tear film dynamics.

Objective: To evaluate and compare the effectiveness of omega-3 supplementation and warm compression therapy in improving tear function and reducing dry eye symptoms.

Methods: A hospital-based randomized controlled trial (RCT) was conducted on 140 young adults diagnosed with mild to moderate DED. Participants were randomly allocated into two groups: one group received omega-3 supplementation (500 mg eicosapentaenoic acid [EPA] and 250 mg docosahexaenoic acid [DHA] daily for one month), while the other underwent warm compression therapy for one week. OSDI scores, Schirmer test, and tear break-up time (TBUT) were assessed at baseline and after intervention. Statistical analysis was performed using SPSS version 27.

Results: Baseline OSDI score was 25.58 ± 5.091, which reduced to 12.86 ± 3.972 post-treatment, indicating symptom improvement. Schirmer test values increased from 9.58 mm to 14.74 mm, and TBUT improved from 6.24 seconds to 12.26 seconds. The mean post-treatment OSDI score was lower in the omega-3 group (11.61 ± 3.432) compared to the warm compression group (14.10 ± 4.108). Omega-3 supplementation demonstrated superior efficacy in improving tear production and tear film stability compared to warm compression.

Conclusion: Both interventions effectively alleviated DED symptoms; however, omega-3 supplementation provided greater improvements in tear function and ocular surface stability. These findings suggest that omega-3 may serve as a more effective therapeutic option for managing mild to moderate DED.

Keywords: Dry Eye Syndrome, Meibomian Gland Dysfunction, Omega-3 Fatty Acids, Ocular Surface, Schirmer Test, Tear Film Stability, Warm Compression

INTRODUCTION

Dry eye disease (DED) is a multifactorial disorder of the ocular surface characterized by inadequate tear film production and instability, leading to discomfort, visual disturbances, and potential damage to the ocular surface. It manifests through symptoms such as dryness, soreness, foreign body sensation, and visual fatigue, affecting the quality of life of millions worldwide. The tear film, composed of an aqueous, lipid, and mucin layer, plays a crucial role in maintaining ocular surface health. Dysfunction of any of these layers can contribute to the development of DED, with meibomian gland dysfunction (MGD) being one of the most prevalent underlying causes (1). The etiology of DED is complex and influenced by demographic, systemic, and environmental factors, as well as the use of certain medications (2). Conditions such as diabetes and thyroid disorders have been identified as contributing factors due to their impact on tear film stability and secretion (3). The Tear Film & Ocular Surface Society Dry Eye Workshop II (TFOS DEWS II) has classified risk factors and provided guidelines for clinical management based on the latest research, emphasizing the need for targeted treatment approaches tailored to individual patient needs (4). Inadequate aqueous tear production, also known as aqueous-deficient dry eye (ADE), results from lacrimal gland dysfunction, leading to increased ocular surface friction and inflammation. Artificial tears and anti-inflammatory agents are commonly used for symptom relief, while severe cases may require interventions such as punctal plugs or surgical procedures to enhance tear retention (5).

Among the treatment strategies for DED, omega-3 fatty acids have gained attention for their anti-inflammatory properties and potential role in improving meibomian gland function. These essential fatty acids, found in fish oil and plant-based sources, are known to modulate lipid composition in the tear film, reducing tear evaporation and ocular surface inflammation (6). Studies have suggested that omega-3 supplementation can improve symptoms of dry eye and enhance tear stability by promoting healthier meibomian gland secretions (7). On the other hand, warm compression therapy is a widely recommended non-pharmacological intervention that helps to liquefy meibomian gland secretions, improve lipid flow, and reduce tear film instability. The application of localized heat has been shown to alleviate symptoms of MGD and enhance ocular surface hydration (8). Despite these treatment options, there is an ongoing debate regarding the comparative efficacy of omega-3 supplementation and warm compression in managing DED. While both interventions target meibomian gland function, their mechanisms of action differ, and their relative effectiveness remains unclear. Epidemiological data indicate that the prevalence of DED varies across populations, with studies reporting rates ranging from 5% to 34%, depending on geographic and demographic factors (9). However, there is limited research on the effectiveness of different treatment modalities in specific populations, particularly in regions such as Pakistan, where data on DED prevalence and management strategies are scarce (10). Given the burden of DED and its impact on ocular health, further research is warranted to determine the optimal approach to symptom management and long-term ocular surface rehabilitation. This study aims to compare the effectiveness of omega-3 supplementation versus warm compression in patients with DED, providing evidence to guide clinical decision-making and improve patient outcomes.

METHODS

This randomized controlled trial (RCT) was a hospital-based study conducted over a three-month period following approval from the institutional review board (IRB) and adherence to ethical guidelines, including informed consent from all participants. The study aimed to compare the effectiveness of omega-3 supplementation with warm compression therapy in patients diagnosed with dry eye disease (DED). A total of 140 participants were enrolled using a stratified random sampling technique, with 70 individuals assigned to each intervention group. Participants were aged between 20 and 39 years and had a confirmed diagnosis of DED based on clinical evaluation. Inclusion criteria required a documented history of dry eye symptoms and positive diagnostic findings, while individuals with ocular infections, recent ocular surgery, systemic inflammatory diseases, or the use of concurrent dry eye treatments were excluded.

Participants underwent a comprehensive ophthalmic assessment, including a structured questionnaire, fluorescein staining, tear breakup time (TBUT), and the Schirmer test to evaluate tear film stability and production. The first group received omega-3 supplements consisting of 500 mg of eicosapentaenoic acid (EPA) and 250 mg of docosahexaenoic acid (DHA) daily for one month. The second group underwent warm compression therapy, which involved the application of hot-soaked compresses for one week using a standardized technique. At the second follow-up visit, clinical outcomes were reassessed, including the Ocular Surface Disease Index (OSDI) score, TBUT, and Schirmer test findings to determine changes in dry eye severity in both groups. Statistical analysis was conducted using SPSS version 27. Descriptive statistics were used to summarize baseline characteristics, and inferential tests were applied to compare pre- and post-intervention outcomes between groups. Ethical approval for the study was obtained, ensuring compliance with international research standards.

RESULTS

The study included 140 participants diagnosed with mild to moderate ocular surface disease, as indicated by a mean baseline Ocular Surface Disease Index (OSDI) score of 25.58. Following treatment, the mean OSDI score decreased to 12.86 ± 3.972, demonstrating symptomatic improvement. Tear production, as measured by the Schirmer test, increased from a mean of 9.58 mm to 14.74 mm, while tear film stability, assessed via Tear Break-Up Time (TBUT), improved from 6.24 seconds to 12.26 seconds. Gender distribution showed

that 99 participants (70.7%) were male, while 41 (29.3%) were female. Normality tests using the Kolmogorov-Smirnov test revealed that baseline OSDI scores followed a normal distribution in both treatment groups ($p = 0.200$), whereas TBUT and Schirmer test values deviated significantly from normality ($p < 0.05$). Post-treatment values for OSDI, Schirmer, and TBUT also showed non-normal distribution in most cases, particularly in the Omega-3 group.

Comparative analysis of treatment outcomes revealed that the Omega-3 group demonstrated statistically greater improvements across all parameters compared to the warm compression group. The mean OSDI score reduction was greater in the Omega-3 group (11.61) than in the warm compression group (14.10). Schirmer test results improved more significantly in the Omega-3 group (15.44 mm) than in the warm compression group (14.03 mm). TBUT values increased more substantially in the Omega-3 group (13.70 seconds) compared to the warm compression group (10.83 seconds), indicating better tear film stability. Analysis of variance (ANOVA) confirmed no significant baseline differences between the two groups for OSDI ($p = 0.877$), Schirmer test ($p = 0.842$), or TBUT ($p = 0.892$). However, post-treatment differences were statistically significant across all parameters. OSDI scores showed a significant difference ($p < 0.001$), with the Omega-3 group achieving greater symptom relief. The Schirmer test also demonstrated significant improvement ($p = 0.010$), and TBUT exhibited the most pronounced difference between groups ($p < 0.001$), favoring the Omega-3 intervention. Both interventions effectively alleviated dry eye symptoms, but Omega-3 supplementation resulted in superior improvements in ocular surface health, tear production, and stability compared to warm compression therapy.

Table: Descriptive statistics

	N	Range	Mean	Std. Deviation
OSDI Scoring 1	140	15	25.83	4.353
Schirmer Test 1	140	7	6.38	2.114
TBUT 1	140	4	6.99	1.235
OSDI scoring 2	140	17	12.86	3.972
Shirmer Test 2	140	15	14.74	3.282
TBUT 2	140	11	12.26	2.830

Table: Gender Statistics

	Frequency	Percent
Female	41	29.3
Male	99	70.7
Total	140	100.0

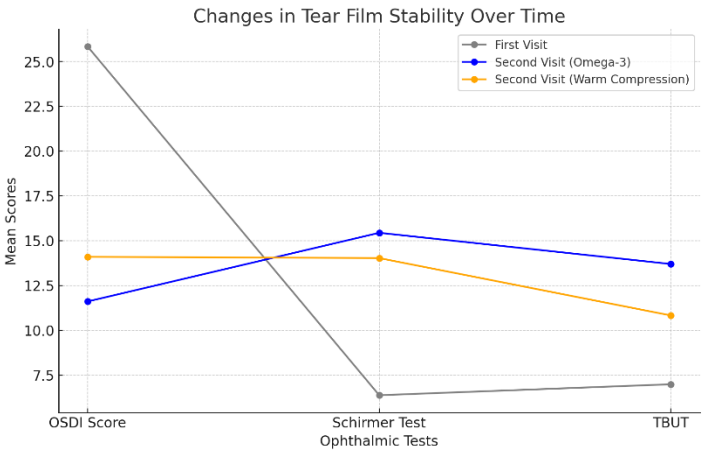
Table: ANOVA Significance Test Statistics

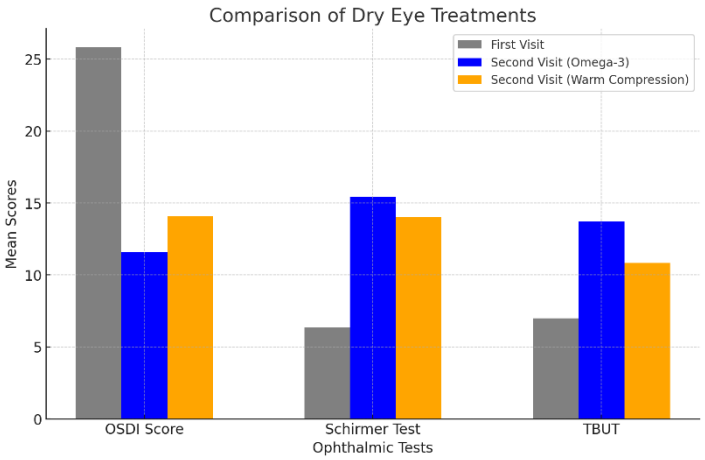
		Sum of Squares	df	Mean Square	F	Sig.
OSDI Scoring 1	Between Groups	0.457	1	0.457	0.024	0.877
	Within Groups	2633.429	138	19.083		
	Total	2633.886	139			
Schirmer Test 1	Between Groups	0.179	1	0.179	0.040	0.842
	Within Groups	620.757	138	4.498		
	Total	620.936	139			
TBUT 1	Between Groups	0.029	1	0.029	0.019	0.892
	Within Groups	211.943	138	1.536		
	Total	211.971	139			
OSDI scoring 2	Between Groups	216.257	1	216.257	15.096	0.000
	Within Groups	1976.886	138	14.325		
	Total	2193.143	139			
Shirmer Test 2	Between Groups	70.007	1	70.007	6.769	0.010
	Within Groups	1427.214	138	10.342		
	Total	1497.221	139			
TBUT 2	Between Groups	288.579	1	288.579	48.292	0.000

	Within Groups	824.643	138	5.976		
	Total	1113.221	139			

Table: Comparative Statistics

Study Group			OSDI Scoring	Schirmer Test	TBUT
Omega 3	First Visit	Mean	25.77	6.41	6.97
		Std. Deviation	4.381	2.123	1.227
	Second Visit	Mean	11.61	15.44	13.70
		Std. Deviation	3.432	3.348	2.330
	Total	Mean	18.69	10.93	10.34
		Std. Deviation	8.114	5.322	3.853
Warm Compression	First Visit	Mean	25.89	6.34	7.00
		Std. Deviation	4.356	2.119	1.251
	Second Visit	Mean	14.10	14.03	10.83
		Std. Deviation	4.108	3.079	2.554
	Total	Mean	19.99	10.19	8.91
		Std. Deviation	7.264	4.670	2.776
Total	First Visit	Mean	25.83	6.38	6.99
		Std. Deviation	4.353	2.114	1.235
	Second Visit	Mean	12.86	14.74	12.26
		Std. Deviation	3.972	3.282	2.830
	Total	Mean	19.34	10.56	9.63
		Std. Deviation	7.715	5.011	3.426





DISCUSSION

The findings of this study demonstrated that both omega-3 supplementation and warm compression therapy effectively improved symptoms and clinical markers of dry eye disease (DED). The mean OSDI score significantly decreased post-treatment, reflecting symptomatic relief, while improvements in Schirmer test results and tear break-up time (TBUT) indicated enhanced tear production and tear film stability. Comparatively, omega-3 supplementation yielded superior results across all parameters, suggesting its greater efficacy in managing DED symptoms and ocular surface health (11). Previous research has consistently highlighted the benefits of omega-3 fatty acids in improving tear film stability and reducing inflammation in patients with DED. Clinical trials assessing omega-3 supplementation have shown significant improvements in OSDI scores, Schirmer test results, and TBUT values, aligning with the current study's findings. Studies investigating the effects of omega-3 on meibomian gland dysfunction have further emphasized its role in modifying lipid composition in tear secretions, thereby reducing evaporative dry eye. Conversely, warm compression therapy has been recognized for its ability to enhance meibomian gland function by increasing lipid flow and improving tear film stability. Research evaluating different

warm compression techniques has suggested that sustained heat application can effectively relieve symptoms of dry eye, although variations exist in the effectiveness of different heating methods (12).

A randomized clinical trial evaluating the impact of re-esterified triglyceride omega-3 supplementation on DED associated with meibomian gland dysfunction reported significant symptomatic improvement in patients receiving omega-3 supplementation. The study demonstrated a greater reduction in OSDI scores in the omega-3 group compared to the control, reinforcing the efficacy of dietary fatty acid supplementation in DED management. Another investigation assessing the efficacy of moist heat compresses and dietary omega-3 intake in patients with ocular surface disease found that omega-3 supplementation led to superior improvements in OSDI and TBUT scores, with a substantial proportion of patients achieving symptomatic relief. The findings of the present study align with these observations, further supporting the role of omega-3 in improving ocular surface health (13,14). Despite the promising results, certain limitations must be acknowledged. The study duration varied between the two intervention groups, with omega-3 supplementation administered for a longer period than warm compression therapy. The lack of long-term follow-up data limits the ability to determine the sustained effects of each treatment modality. Additionally, factors such as patient adherence, dietary variations, and environmental influences on dry eye symptoms were not controlled, which may have contributed to variability in treatment response. The study sample predominantly comprised younger adults, which may limit the generalizability of findings to older populations who are at higher risk for DED (15).

Strengths of this study include its randomized controlled design, which minimized bias and enhanced the reliability of the findings. The use of standardized clinical assessments, including OSDI scoring, Schirmer test, and TBUT measurements, ensured objective evaluation of treatment outcomes. Furthermore, the study contributes to the growing body of evidence supporting omega-3 supplementation as a viable treatment option for DED, particularly in cases associated with meibomian gland dysfunction (16,17). Future research should focus on evaluating the long-term effects of omega-3 supplementation and warm compression therapy in diverse populations, including individuals with varying degrees of dry eye severity. Studies incorporating combination therapies, such as omega-3 supplementation alongside warm compression, could provide insight into potential synergistic effects. Assessing patient adherence to both treatment modalities in real-world settings would further contribute to understanding their feasibility and long-term effectiveness in DED management.

CONCLUSION

This study evaluated the effectiveness of omega-3 supplementation and warm compression therapy in managing dry eye disease and improving ocular surface health. The findings demonstrated that while both interventions provided symptomatic relief and enhanced tear film stability, omega-3 supplementation showed greater efficacy in reducing dry eye symptoms and improving tear production. The results highlight the potential of omega-3 fatty acids as a valuable therapeutic option for individuals suffering from dry eye disease, particularly in cases associated with meibomian gland dysfunction. These insights contribute to the growing body of evidence supporting dietary interventions for ocular health and emphasize the need for further research to optimize treatment strategies for long-term management.

AUTHOR CONTRIBUTION

Author	Contribution
Iqra Shahzad	Conceptualization, Methodology, Formal Analysis, Writing - Original Draft, Validation, Supervision
Sarmad Siddiqui	Methodology, Investigation, Data Curation, Writing - Review & Editing
Ubaidullah Jan	Investigation, Data Curation, Formal Analysis, Software
Tahir Shaukat	Software, Validation, Writing - Original Draft
Muhammad Sheeraz Bashir	Formal Analysis, Writing - Review & Editing

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