

Efficacy of omega-3 fatty acids in Meibomian Gland Dysfunction

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Abstract

Background: Meibomian Gland Dysfunction (MGD) is a common cause of evaporative dry eye disease and significantly affects ocular comfort, visual quality, and daily activities. Conventional management includes lid hygiene, lubricants, and anti-inflammatory agents. Omega-3 fatty acids have gained attention as a potential adjunct therapy due to their anti-inflammatory properties and role in improving meibomian gland secretions.

Aim & Objectives: To evaluate and compare the clinical outcomes of standard treatment alone versus standard treatment combined with oral omega-3 fatty acid supplementation in patients with Meibomian Gland Dysfunction.

Material and Methods: This hospital-based interventional study was conducted on 150 patients with slit-lamp-confirmed MGD. They were divided into two equal groups of 75 each. Group A received standard treatment, while Group B received standard treatment along with oral omega-3 fatty acids (500 mg twice daily) for six months. Objective evaluation included meibum quality grading, fluorescein tear film break-up time (TBUT), and Schirmer I test. Data was analyzed using SPSS version 30 and $p < 0.05$ was considered statistically significant.

Results: Both groups showed improvement following treatment; however, Group B demonstrated significantly better outcomes. Post-treatment meibum quality improved more in Group B ($p = 0.047$). TBUT showed a marked and highly significant improvement in the oral omega-3 group compared to standard therapy alone ($p < 0.0001$). Schirmer test values also improved significantly in Group B ($p = 0.01$), indicating better tear secretion. Subjective symptoms were reduced in both groups, with greater relief observed in patients receiving oral omega-3 supplementation.

Conclusion: Oral omega-3 fatty acid supplementation as an adjunct to standard therapy provides superior improvement in objective clinical parameters in patients with Meibomian Gland Dysfunction.

Keywords: Meibomian gland dysfunction, omega-3 fatty acids, dry eye disease, tear film break-up time, Schirmer test.

INTRODUCTION

The human eye is a delicate and complex organ that is in continual contact with the outside world. The ocular surface depends on a steady and healthy tear film to preserve comfort and image clarity. A growing amount of research indicates that the meibomian glands play a crucial role in preserving the stability of the tear film. Dryness of eye is typically linked to either decreased tear production or increased tear evaporation. These glands, which are nestled along the eyelids' tarsal plate, secrete lipids that make up the tear film's outermost layer, preventing evaporation and maintaining the integrity of the ocular surface. [1][2] When these glands become blocked or their secretions change in quantity or quality, it is known as meibomian gland dysfunction (MGD). [3] Despite its initial appearance as a relatively benign or bothersome condition, MGD can have a significant impact on a person's daily comfort, visual function, and quality of life. Particularly while

engaging in lengthy visual activity like reading or using a screen, patients may suffer burning, redness, a feeling of a foreign body sensation, or fluctuating vision. ^[4] Globally, the prevalence of MGD varies greatly. Estimates of the condition's prevalence in Asian populations range from 46% to 70%, according to extensive epidemiological studies. ^[5] According to research, omega-3 fatty acids increase the meibomian gland secretions, change composition, lowering local inflammatory activity and making them less viscous and easier to express. ^[6] Omega-3 supplementation is a desirable adjuvant in the treatment of MGD because of its dual mechanism of enhancing gland function and decreasing inflammation. ^[7] Despite increasing interest in omega-3 fatty acid supplementation for Meibomian Gland Dysfunction (MGD), uncertainties persist regarding its optimal dosage, duration, and overall efficacy. Conflicting clinical evidence suggests that while some patient subgroups may benefit, but it remains unclear whether omega-3 supplementation provides additional therapeutic advantage over standard treatment alone. The present comparative study aims to evaluate the role of oral omega-3 fatty acids as an adjunct to conventional therapy in MGD by assessing objective clinical parameters, including tear film break-up time, Schirmer's test, and meibum quality, with the goal of improving patient comfort and quality of life.

AIM & OBJECTIVES

To analyse and compare the clinical outcomes in the patients of meibomian gland dysfunction taking standard treatment and taking standard treatment along with oral omega 3 fatty acid supplementation.

MATERIAL AND METHODS

The present hospital-based interventional study was conducted in the Department of Ophthalmology, Muzaffarnagar Medical College, Muzaffarnagar. A total of 150 patients diagnosed with Meibomian Gland Dysfunction (MGD) attending the ophthalmology outpatient department were enrolled using purposive sampling after obtaining Institutional Ethics Committee approval and written informed consent.

Patients aged 18–80 years of either sex with slit-lamp-confirmed MGD were included, while those with ocular infections, corneal pathology, contact lens use, seafood allergy, pregnancy or lactation, diabetes mellitus, systemic bleeding disorders, use of beta-blockers and anticoagulants were excluded.

The participants were equally divided into two groups: Group A (n=75) received standard treatment consisting of hot fomentation with lid massage, oral doxycycline 100 mg twice daily, vitamin C 500 mg twice daily, Pantoprazole 40 mg once daily, and carboxymethylcellulose 0.5% eye drops four times daily, while Group B (n=75) received the same standard treatment along with oral omega-3 fatty acid supplementation at a dose of 500 mg twice daily for six months.

All patients underwent comprehensive ophthalmic examination, including assessment of visual acuity, intraocular pressure measurement, slit-lamp biomicroscopy, and fundus examination. Symptom severity was assessed using the Ocular Surface Disease Index (OSDI) questionnaire, while objective evaluation included Schirmer I test without topical anaesthesia, fluorescein tear film break-up time, corneal fluorescein staining graded using the Oxford grading scale, and assessment of meibum quality and meibomian gland expressibility as per standard grading systems.

Data were entered and analysed using SPSS version 30, with quantitative variables expressed as mean \pm standard deviation and compared using Student's t-test, while categorical variables were analysed using the Chi-square test; a p-value <0.05 was considered statistically significant.

RESULTS

Table 1 shows a significant difference in meibum character between the two groups at baseline ($p = 0.0038$), with Group B having a higher proportion of patients with more severe meibum changes. After treatment, improvement in meibum quality was observed in both groups; Group B showed a greater proportion of patients achieving normal meibum character (49.33%) compared to Group A (40%), and this difference was statistically significant ($p = 0.047$), indicating better response with omega-3 supplementation.

Table 2 compares the fluorescein tear film break-up time (TBUT) in both groups before and after treatment. At baseline, TBUT distribution was comparable between Group A and Group B, with most patients having TBUT between 6–10 seconds, and the difference was not statistically significant ($p = 0.694$). Following treatment, a marked improvement in TBUT was observed in both groups; Group B showed a greater shift towards higher TBUT values, with a larger proportion of patients achieving TBUT ≥ 14 seconds compared to Group A. The post-treatment difference between the two groups was highly statistically significant ($p < 0.0001$), indicating superior improvement in tear film stability with omega-3 supplementation.

Table 3 compares the Schirmer test values in both groups before and after treatment. At baseline, the distribution of Schirmer test values was similar in Group A and Group B, with most patients recording values between 6–10 mm, and the difference was not statistically significant ($p = 0.22$). Following treatment, improvement in tear secretion was observed in both groups; however, Group B demonstrated a greater shift towards higher Schirmer values, with more patients achieving readings ≥ 16 mm compared to Group A. The post-treatment difference between the two groups was statistically significant ($p = 0.01$), suggesting better improvement in tear production with omega-3 fatty acid supplementation.

Table 1: Comparison of meibum character in both groups pre and post treatment: (N=150)

Meibum character	Group A (%)	Group B (%)	p value
Pre treatment			
1	30 (40%)	14 (18.67%)	0.0038
2	33 (44%)	33 (44%)	
3	12 (16%)	28 (37.33%)	
Post treatment			
0	30 (40%)	37 (49.33%)	0.047
1	28 (37.33%)	30 (40%)	
2	17 (22.67%)	08 (10.67%)	

Table 2: Comparison of Fluorescein Tear film break up time (TBUT) in both groups pre and post treatment: (N=150)

Fluorescein Tear film break up time (TBUT) (in seconds)	Group A (%)	Group B (%)	p value
Pre treatment			
4-6	14 (18.67%)	15 (20%)	0.694
6-8	31 (41.33%)	35 (46.67%)	
8-10	30 (40%)	25 (33.33%)	
Post treatment			
8-10	01 (1.33%)	03 (4%)	<0.0001
10-12	35 (46.67%)	08 (10.67%)	
12-14	32 (42.67%)	31 (41.33%)	
14-16	07 (9.33%)	20 (26.67%)	
16-18	00 (0%)	09 (12%)	
18-20	00 (0%)	04 (5.33%)	

Table 3: Comparison of findings of Schirmer test in both groups pre and post treatment: (N=150)

Schirmer test (in mm)	Group A (%)	Group B (%)	p value
Pre treatment			
2-4	07 (9.33%)	08 (10.67%)	0.22
4-6	08 (10.67%)	18 (24%)	
6-8	28 (37.33%)	25 (33.33%)	
8-10	29 (38.67%)	23 (30.67%)	
10-12	03 (4%)	01 (1.33%)	
Post treatment			
8-10	12 (16%)	04 (5.33%)	0.01
10-12	09 (12%)	08 (10.67%)	
12-14	20 (26.67%)	22 (29.33%)	
14-16	30 (40%)	23 (30.67%)	
16-18	04 (5.33%)	14 (18.67%)	
18-20	00(0%)	04 (5.33%)	

DISCUSSION

In present study, meibum quality showed significant improvement with omega-3 supplementation. At baseline, Group B had Grade-3 meibum in 37.33% compared to 16% in Group A . Despite this, post-treatment results favored Group B,

with more patients achieving normal meibum (49.33% vs 40%) and fewer remaining in Grade-2 disease (10.67% vs 22.67%). This difference was statistically significant ($p = 0.047$). Similar improvements in meibum quality with omega-3 supplementation have been reported by Jain C et al. (2018)^[8] and are supported by Macsai et al. (2008),^[9] who demonstrated taking omega 3 fatty acid supplementation resulted in healthier meibum and improved TBUT and better tear film function. TBUT distribution was comparable at baseline in both groups. Group B showed a greater positive shift toward higher TBUT values with TBUT ≥ 14 seconds. The post-treatment difference was highly significant ($p < 0.0001$), indicating superior tear film stabilization with omega-3 supplementation. Jain C et al (2020) study also supports that omega-3 improves TBUT and overall markers of MGD, consistent with our observed superiority in Group B.^[8] In a study done by Nagpal H et al (2017), after 3 months of evaluation, the mean OSDI, TBUT, lid margin inflammation, and MG expression presented improvement from the baseline values, in group taking omega 3 fatty acids supplementation.^[10] Schirmer test values were comparable at baseline in both groups ($p = 0.22$), with most patients showing readings between 6–10 mm. Following treatment, the group taking omega 3 supplementation demonstrated greater improvement, with higher proportions achieving Schirmer values ≥ 16 mm (18.67% at 16–18 mm and 5.33% at 18–20 mm), whereas Group A showed fewer patients in these higher ranges. The post-treatment difference was statistically significant ($p = 0.01$), suggesting superior recovery of tear secretion with omega-3 supplementation. The systematic review by Al-Namaeh M et al (2020) highlighted that across RCTs, Schirmer improvement is inconsistent.^[11] But many studies like Olenik et al. showed improvement in Schirmer test which were statistically significant ($p < 0.01$).^[12]

CONCLUSION

The present study demonstrates that both standard therapy and standard therapy combined with oral omega-3 fatty acid supplementation are effective in improving clinical outcomes in patients with Meibomian Gland Dysfunction. However, patients receiving oral omega-3 supplementation showed significantly greater improvement in meibum quality, tear film break-up time, and Schirmer test values. Oral omega-3 fatty acids contributed to better tear film stability and enhanced glandular function by reducing inflammation and improving lipid secretion. These findings indicate that oral omega-3 supplementation offers a clear therapeutic advantage as an adjunct to conventional treatment. Incorporating oral omega-3 fatty acids into routine management may improve patient comfort and overall quality of life in MGD.

Limitations of the study:

Being a single-center, hospital-based study, the findings may not be fully generalizable to the wider population. In addition, symptoms assessment was based on patient-reported questionnaires, which are prone to recall and reporting bias.

Relevance of the study:

This study is relevant as it highlights the added benefit of oral omega-3 fatty acid supplementation as an adjunct to standard therapy in the management of Meibomian Gland Dysfunction. It provides evidence that oral omega-3 improves tear film stability, gland function, and patient comfort beyond conventional treatment alone. The findings support a simple, safe, and cost-effective strategy to enhance clinical outcomes and quality of life in patients with MGD.

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