Volume 3, Issue 5, May 2025 ISSN (E): 2938-3765

EVALUATION OF THE EFFECTIVENESS OF COMBINED THERAPY USING OMEGA-3 FATTY ACIDS AND IPL IN MILITARY PERSONNEL WITH DRY EYE SYNDROME

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Abstract
Objective of the Study. To determine the effectiveness of combined therapy including omega-3 fatty acids and IPL compared to monotherapy in military personnel with dry eye syndrome. Material and Methods. The study involved 120 military personnel (240 eyes), divided into three groups. Group 1 received tear substitutes and EPA/DHA, group 2 — only tear substitutes, and group 3 — tear substitutes, EPA/DHA, and IPL. Assessment was conducted using OSDI, Schirmer's test, Norn's test, meibography, and measurement of the tear meniscus height over a 12-week period. Results. The most significant improvement across all parameters, including increased tear film break-up time and meibomian gland density, was observed in group 3. Tear film break-up time increased to 9.75±1.16 seconds, meibomian gland density — to 38.2±6.9%, and meibomian gland dysfunction index decreased to 0.74±0.19. These results were statistically significantly different from those in groups 1 and 2 ($p<0.05$). Conclusion. Combined treatment using EPA/DHA and IPL is more effective in correcting symptoms and morphological disturbances in dry eye syndrome than monotherapy, especially in the presence of meibomian gland dysfunction.

Keywords: Dry eye syndrome, meibomian glands, omega-3 fatty acids, intense pulsed light, military personnel.

Introduction

Dry eye syndrome (DES) is one of the most common ophthalmologic disorders, characterized by tear film instability, inflammation, and dysfunction of the meibomian glands. In recent years, the prevalence of DES has been increasing, particularly among young individuals exposed to significant visual and psychophysiological stress, such as military personnel.

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DES is classified into aqueous-deficient and evaporative types, the latter being more frequently associated with meibomian gland dysfunction (MGD). Current treatment recommendations include not only local therapy (artificial tear preparations) but also nutraceutical supplementation and instrumental treatment methods, including intense pulsed light (IPL). The role of omega-3 fatty acids in the pathogenesis of DES is attributed to their anti-inflammatory properties and their ability to normalize the lipid composition of meibomian gland secretions. IPL acts on the meibomian glands, improving their function and promoting structural restoration.

This study aims to conduct a comparative analysis of the effectiveness of various treatment approaches for DES in military personnel, with a focus on the combined application of EPA/DHA and IPL, which is of considerable interest for the development of clinical therapeutic algorithms.

Objective of the Study

To assess the clinical effectiveness of various therapeutic approaches, including the combined use of artificial tear substitutes, omega-3 fatty acids (EPA/DHA), and intense pulsed light (IPL) in military personnel with symptoms of dry eye syndrome (DES), particularly in cases of pronounced meibomian gland dysfunction.

Material and Methods

The study included 120 military personnel (240 eyes) complaining of ocular discomfort associated with DES symptoms (burning, itching, foreign body sensation, dryness), serving in various units of the Armed Forces of the Republic of Uzbekistan. The mean age of the participants was 23.4±4.5 years; 95 (79.2%) were male and 25 (20.8%) female.

Inclusion Criteria:

Conscription age (18–27 years);

Complaints of ocular discomfort associated with DES symptoms (burning, itching, foreign body sensation, dryness);

Signed informed consent to participate in the study.

Exclusion Criteria:

History of ophthalmologic diseases causing secondary DES (chemical burns, severe conjunctivitis, etc.);

Presence of ophthalmic conditions potentially distorting the study results (except DES);

Refractive laser surgery within the last 3 months;

Presence of chronic somatic diseases in the decompensated stage.

During the study, military personnel with symptoms of dry eye syndrome were divided into three groups. Group 1 included 45 participants (90 eyes) who, in addition to using artificial tear preparations, received 1000 mg of EPA/DHA (omega-3 fatty acids) daily. Group 2 consisted of 45 participants (90 eyes) who used only artificial tear substitutes and did not receive additional supplements. Group 3 included 30 military personnel (60 eyes) who received a comprehensive treatment consisting of tear substitutes, EPA/DHA, and IPL. The duration of observation was 12 weeks.

The dynamic assessment of outcomes was performed using the same methods as at baseline: OSDI, Schirmer's test, Norn's test, meibography, and measurement of tear meniscus height. The

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analysis allowed for the evaluation of the clinical effectiveness of each approach and revealed the advantages of combination therapy including IPL in correcting severe forms of DES, particularly in patients with meibomian gland dysfunction.

Results

At the initial stage, tear film break-up time (TFBUT) was reduced across all groups (ranging between 5.2–5.6 seconds), indicating tear film instability and a high risk of the evaporative component of dry eye syndrome. Upon completion of the treatment, the most significant improvement was observed in group 3 — up to 9.75±1.16 seconds, in group 1 — up to 9.18±1.95 seconds, whereas in group 2 the increase reached only 7.02±1.98 seconds. The observed differences were statistically significant compared to baseline and between groups (Table 1).

Table 1 Tear Film Break-Up Time (TFBUT) Dynamics in Military Personnel (n=number of eyes).

Indicators	Timepoint	Group 1 (n=90)	Group 2 (n=90)	Group 3 (n=60)
TFBUT, seconds	Baseline	5.22±2.87	5.62±1.7	5.45±1.41
	After 12 weeks	9.18±1.95*^	7.02±1.98*	9.75±1.16*^

* — statistically significant compared to baseline ($p<0.05$);

^ — statistically significant compared to the corresponding value in group 2 ($p<0.05$)

At baseline, all three study groups demonstrated similar meibomian gland condition indicators. The average gland density was 25.9±13.1% in group 1, 24.09±8.7% in group 2, and 27.2±8.3% in group 3, consistent with moderate atrophy (loss of 25% to 50% of the meibomian gland structure). These findings indicate significant structural gland abnormalities characteristic of the evaporative form of dry eye syndrome in military personnel.

After 12 weeks of treatment, the most pronounced positive changes were recorded in group 3, which received combined therapy with nutraceuticals and IPL. In this group, meibomian gland density increased to 38.2±6.9%, which was statistically significantly higher than both the baseline and the values in group 2 ($p<0.05$). A similar trend was observed in group 1, with a density increase to 36.8±13.2%, while in group 2 the improvement was less substantial — up to 29.9±9.3%.

Table 2 Dynamics of Meibomian Gland Function Indicators in Military Personnel (n=number of eyes).

Indicators	Timepoint	Group 1 (n=90)	Group 2 (n=90)	Group 3 (n=60)
Meibomian gland density (%)	Baseline	25.9±13.1	24.09±8.7	27.2±8.3
	After 12 weeks	36.8±13.2*^	29.9±9.3	38.2±6.9*^
Meibomian gland dysfunction index	Baseline	1.24±0.35	1.23±0.2	1.32±0.32
	After 12 weeks	0.94±0.35*^	1.24±0.27	0.74±0.19*^

* — statistically significant compared to baseline ($p<0.05$);

^ — statistically significant compared to the corresponding value in group 2 ($p<0.05$)

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The analysis of the meibomian gland dysfunction index (MGDI) also revealed pronounced differences over time. Initially, MGDI ranged from 1.23 to 1.32 points across all groups, indicating a moderate degree of dysfunction. After treatment, MGDI in group 3 decreased to 0.74±0.19, reflecting a shift to mild dysfunction. Group 1 also showed a significant reduction to 0.94±0.35. In contrast, MGDI in group 2 remained virtually unchanged at 1.24±0.27, indicating limited efficacy of monotherapy with artificial tears.

Discussion of Results

The results of the study confirmed the hypothesis that combined therapy involving EPA/DHA and IPL demonstrates significantly higher clinical efficacy compared to monotherapy with artificial tears. Group 3 showed improvement across almost all parameters, including tear film break-up time, meibomian gland density, and gland function. A substantial increase in tear film break-up time in patients receiving combined therapy (up to 9.75±1.16 seconds) indicates restoration of tear film stability, a key marker in assessing the progression of dry eye syndrome. Participants who received only artificial tears (group 2) showed the smallest increase in this parameter, confirming the limited effectiveness of monotherapy.

Meibography revealed a marked restoration of meibomian gland density in group 3, reflecting morphological improvements under the influence of IPL and omega-3 supplementation. These changes were accompanied by a reduction in the meibomian gland dysfunction index, suggesting not only symptomatic but also pathogenetic effects of the therapy. Thus, the combination of local therapy, nutraceuticals, and physiotherapeutic intervention represents a promising direction for managing advanced forms of DES, especially in cases with concurrent MGD, and may be recommended for implementation in clinical military medicine practice.

Conclusion

Combined treatment of dry eye syndrome in military personnel using artificial tears, omega-3 fatty acids (1000 mg EPA/DHA daily), and intense pulsed light (IPL) demonstrated the highest clinical effectiveness. After 12 weeks, patients in group 3 exhibited an increase in tear film break-up time from 5.45±1.41 to 9.75±1.16 seconds, an increase in meibomian gland density from 27.2±8.3% to 38.2±6.9%, and a decrease in meibomian gland dysfunction index from 1.32±0.32 to 0.74±0.19. Group 1 (artificial tears + EPA/DHA) showed comparable improvements: TFBUT — 9.18±1.95 seconds, gland density — 36.8±13.2%, MGDI — 0.94±0.35. Group 2, which received only artificial tears, showed minimal improvement: TFBUT — 7.02±1.98 seconds, gland density — 29.9±9.3%, MGDI — 1.24±0.27. These findings are statistically significant ($p<0.05$) and confirm the superiority of combination therapy.

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