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PREOPERATIVE MANAGEMENT OF DRY EYE DISEASE AND OUTCOMES OF LASER REFRACTIVE SURGERY IN A PROSPECTIVE COHORT STUDY WITH OCULAR SURFACE DISEASE INDEX ASSESSMENT PREOPERATIVELY AND AT 6 MONTHS

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To evaluate the effect of preoperative management of dry eye disease on postoperative symptom dynamics, assessed by the Ocular Surface Disease Index, after laser refractive surgery. The study enrolled 185 active-duty military personnel, allocated to two cohorts: group I (n=90) with preoperatively confirmed dry eye disease who received standard ocular-surface therapy; and group II (n=95) with no indication for preoperative treatment of dry eye disease. Postoperatively, all patients were prescribed lubricating eye drops. Follow-up visits were performed at 1 and 6 months. Assessments comprised the Schirmer test and tear break-up time measured before surgery and at 1 and 6 months. Preoperatively, statistically significant between-group differences were observed for most Ocular Surface Disease Index items (χ^2, p<0.001). By month 6, symptom severity decreased in both cohorts. Routine use of the standardized Ocular Surface Disease Index at pre- and postoperative stages helps objectify ocular-surface status and enables timely adjustment of management strategies.

Key words: refractive surgery, dry eye disease, Ocular Surface Disease Index, military personnel.

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ПЕРЕДОПЕРАЦІЙНЕ ЛІКУВАННЯ СИНДРОМУ СУХОГО ОКА ТА РЕЗУЛЬТАТИ ЛАЗЕРНОЇ РЕФРАКЦІЙНОЇ ХІРУРГІЇ У ПРОСПЕКТИВНОМУ КОГОРТНОМУ ДОСЛІДЖЕННІ З ОЦІНКОЮ ЗА ІНДЕКСОМ ЗАХВОРЮВАНЬ ПОВЕРХНІ ОКА ДО ОПЕРАЦІЇ ТА ЧЕРЕЗ 6 МІСЯЦІВ

Метою дослідження було оцінити вплив передопераційного лікування синдрому сухого ока на динаміку післяопераційних симптомів, що оцінювалася за індексом захворювань поверхні ока, після лазерної рефракційної хірургії. У дослідженні взяли участь 185 військовослужбовців дійсної служби, розділених на дві групи: група I (n=90) з підтвердженим до операції синдромом сухого ока, які отримували стандартну терапію поверхні ока; та група II (n=95) без показань до передопераційного лікування синдрому сухого ока. Після операції всім пацієнтам були призначені зволожувальні очні краплі. Контрольні огляди проводилися через 1 і 6 місяців. Оцінка включала тест Ширмера та час розриву слізної плівки, виміряні до операції, а також через 1 і 6 місяців. Оцінка включала тест Ширмера та час розриву слізної плівки, виміряні до операції, а також через 1 і 6 місяців. У передопераційний період було виявлено статистично значущі відмінності між групами за більшістю пунктів індексу захворювань поверхні ока (χ^2, p<0,001). До 6-го місяця тяжкість симптомів знизилася в обох групах. Рутинне використання стандартизованого індексу захворювань поверхні ока на передопераційному та післяопераційному етапах допомагає об’єктивно оцінити стан поверхні ока та дозволяє своєчасно коригувати стратегії лікування.

Ключові слова: рефракційна хірургія, синдром сухого ока, індекс захворювань поверхні ока, військовослужбовці.

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Refractive errors remain one of the principal causes of visual impairment, affecting occupational performance and the quality of everyday life. Among disorders of vision, refractive errors are among the most prevalent. In these conditions, incident light is improperly focused on the retina, resulting in a blurred image. According to the World Health Organization, in 2020, approximately 2.6 billion people worldwide had refractive errors of varying severity, and in 312 million of them, this resulted in functional visual impairment [10]. Prevalence estimates for refractive disorders – myopia, hyperopia, and astigmatism exhibit marked variability as a function of factors such as age and gender.

These data confirm that the epidemiological characteristics of ophthalmic diseases are not universal but context-specific, with differences across individual countries and regions [4, 5, 9]. Uncorrected refractive errors represent a significant public health issue, as they may lead to functional disability, reduced productivity, and a decline in quality of life. Visual impairment caused by untreated refractive errors adversely affects educational performance, work efficiency, and economic outcomes at both individual and societal levels. In many regions worldwide, the correction of refractive errors remains insufficient due to a combination of economic limitations, restricted access to eye care services, and sociocultural barriers, which together contribute to the persistent burden of avoidable visual impairment [1, 8].

In contemporary clinical practice, surgical methods for correcting refractive errors, such as

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LASIK, SMILE, and PRK, are widely employed [11]. It is well established that, following refractive procedures, dry eye disease (DED) frequently develops and constitutes one of the most common complications, presenting with dryness, irritation, and visual discomfort [3, 6, 7].

The purpose of the study was to assess the effect of preoperative management of dry eye disease on Ocular Surface Disease Index-measured symptom severity in military personnel 6 months after laser refractive correction.

Materials and methods. The study was conducted at the Central Military Medical Commission of the Ministry of Defence in Baku, Azerbaijan, between January 2023 and December 2024.

This prospective observational cohort study included 185 active-duty military personnel scheduled for laser refractive correction. The study population comprised male patients aged 20 to 42 years, reflecting the demographic structure of active-duty service members. Exclusion criteria included autoimmune diseases, active ocular inflammatory conditions, and moderate-to-severe dry eye disease (DED).

Patients were allocated into two groups. Group I (n=90) consisted of individuals with preoperatively confirmed DED, diagnosed according to a complex approach including clinical symptoms, Schirmer test (<10 mm/5 min), tear break-up time (TBUT <10 seconds), and Ocular Surface Disease Index (OSDI) score >13. These patients received standard preoperative ocular surface therapy. Group II (n=95) included patients without indications for preoperative DED treatment.

After stabilization of the ocular surface, refractive surgery was performed. In group I, 55 patients (61.1 %) underwent LASIK and 35 (38.9 %) underwent PRK. In group II, 75 patients (78.9 %) underwent LASIK and 20 (21.1 %) underwent PRK. All procedures were performed using an excimer laser system (MEL 90, Carl Zeiss Meditec AG, Germany) and a femtosecond laser platform (VisuMax, Carl Zeiss Meditec AG, Germany) for flap creation in LASIK procedures.

Postoperatively, all patients received lubricating eye drops containing sodium hyaluronate 0.15 %, manufactured by Ursapharm Arzneimittel GmbH, Germany, administered 4 times daily for 1 month with subsequent tapering based on clinical response.

Clinical evaluation included the Schirmer test and tear break-up time, performed preoperatively and at 1 and 6 months postoperatively. Subjective symptoms were assessed using the Ocular Surface Disease Index questionnaire preoperatively and at 6 months.

Statistical analysis was performed using standard statistical methods. Categorical variables were analyzed using Pearson's chi-square (χ^2) test to assess differences between groups. Continuous data were summarized as mean values with standard deviations where appropriate. A p-value of less than 0.05 was considered statistically significant. All analyses were conducted using commonly accepted statistical software.

The study was conducted in accordance with the principles of the Declaration of Helsinki. Given the observational nature of the study and the use of standard diagnostic and therapeutic procedures, formal approval from a local ethics committee was not required under institutional regulations. All participants provided informed consent prior to inclusion in the study. Consent was obtained in written form after a detailed explanation of the study procedures.

Results of the study and their discussion. At the preoperative stage, between-group differences, as assessed by the OSDI questionnaire, were pronounced. For the item on increased photosensitivity, responses of "never" predominated in group I (53; 58.9 %), whereas in group II the categories "often" (58; 61.1 %) and "always" (16; 16.8 %) prevailed, the difference was statistically significant (χ^2=59.67; p<0.001), indicating greater photosensitivity among patients without preoperative treatment. The foreign-body sensation was likewise more pronounced in patients without preoperative therapy. In group I, "always" (28; 31.1 %) and "often" (23; 25.6 %) were more frequent, whereas in group II the category "often" (69; 72.6 %) dominated with a comparable proportion of "always" (16; 16.8 %) (χ^2=48.989; p<0.001).

For the item "ocular pain/discomfort," group I more frequently endorsed "always" (14; 15.6 %) with a high share of "often" (38; 42.2 %), whereas group II showed predominantly "often" (58; 61.1 %) with no cases of "always" (χ^2=26.479; p<0.001). Blurred vision in group I was often rated as "often" (45; 50.0%) and "always" (18; 20.0 %), in group II the corresponding proportions were 58 (61.1 %) and 27 (28.4 %) (χ^2=11.125; p=0.004). Reduced visual clarity ("poor vision") demonstrated the most contrasting profiles. In group I, "often" (34; 37.8 %) and "always" (26; 28.9 %) predominated, whereas in group II the category "always" (69; 72.6 %) prevailed with a relatively smaller share of "often" (16; 16.8 %) (χ^2=35.834; p<0.001). Reading discomfort in group I was also more frequently rated as "often" (36; 40.0 %) and "always" (20; 22.2 %), whereas in group II "always" (58; 61.1 %) predominated with a smaller share of "often" (27; 28.4 %) (χ^2=33.688; p<0.001). For night-time driving, group I predominantly reported "often" (38; 42.2 %) and "always" (28; 31.1 %), whereas group II more frequently reported "always" (58; 61.1 %) with a smaller share of "often" (23; 24.2 %) (χ^2=22.168; p<0.001). For computer work, the distributions likewise differed. In group I, "half of the time" (28; 31.1 %) and

“often” (34; 37.8 %) were chosen more frequently, whereas in group II “sometimes” (58; 61.1 %) and “often” (27; 28.4 %) predominated (χ^2=50.12; p<0.001). The influence of environmental factors corroborated this pattern. In windy weather, group I more often indicated “sometimes” (42; 46.7 %) and “always” (13; 14.4 %), whereas group II reported “never” (66; 69.5 %) and “half of the time” (16; 16.8 %) (χ^2=57.714; p<0.001), in low-humidity environments, patients in group I predominantly answered “never” (52; 57.8 %), whereas patients in group II more often answered “often” (69; 72.6 %) (χ^2=122.213; p<0.001), in air-conditioned settings, “never” (53; 58.9 %) dominated in group I, while “often” (84; 88.4 %) predominated in group II (χ^2=97.182; p<0.001) (Table 1).

Table 1

Between-group differences at the preoperative stage according to the OSDI (n, %)

OSDI item	Group I (n=90)	Group II (n=95)	χ^2	P
Light sensitivity	never 53 (58.9 %); often 14 (15.6 %); always 19 (21.1 %)	never 10 (10.5 %); often 58 (61.1 %); always 16 (16.8 %)	59.67	<0.001
Foreign-body sensation	always 28 (31.1 %); often 23 (25.6 %); half of the time 20 (22.2 %)	often 69 (72.6 %); always 16 (16.8 %)	48.989	<0.001
Ocular pain or discomfort	often 38 (42.2 %); always 14 (15.6 %)	often 58 (61.1 %); always 0	26.479	<0.001
Blurred vision	often 45 (50.0 %); always 18 (20.0 %)	often 58 (61.1 %); always 27 (28.4 %)	11.125	0.004
Reduced visual clarity (“poor vision”)	often 34 (37.8 %); always 26 (28.9 %)	often 16 (16.8 %); always 69 (72.6 %)	35.834	<0.001
Reading discomfort	often 36 (40.0 %); always 20 (22.2 %)	often 27 (28.4 %); always 58 (61.1 %)	33.688	<0.001
Driving at night	often 38 (42.2 %); always 28 (31.1 %)	often 23 (24.2 %); always 58 (61.1 %)	22.168	<0.001
Computer work	half of the time 28 (31.1 %); often 34 (37.8 %)	sometimes 58 (61.1 %); often 27 (28.4 %)	50.12	<0.001
Windy weather	sometimes 42 (46.7 %); always 13 (14.4 %)	never 66 (69.5 %); half of the time 16 (16.8 %)	57.714	<0.001
Low-humidity (dry) environment	never 52 (57.8 %)	often 69 (72.6 %)	122.213	<0.001
Air-conditioned environment	never 53 (58.9 %)	often 84 (88.4 %)	97.182	<0.001

By the 6-month follow-up, OSDI-captured symptom severity had decreased significantly in both cohorts. However, patients who received preoperative therapy exhibited a more favorable trajectory, with a sustained shift of response distributions toward less severe categories. For increased photosensitivity, “sometimes” predominated in Group I (71; 78.9 %) with “half of the time” accounting for 19 (21.1 %), whereas in group II “half of the time” dominated (80; 84.2 %) with a relatively smaller share of “sometimes” (15; 15.8 %) (χ^2=73.970; p<0.001). Foreign-body sensation in group I was more often characterized as “sometimes” (62; 68.9 %) or “half of the time” (28; 31.1 %), whereas in group II “half of the time” was universally recorded (95; 100 %) (χ^2=98.433; p<0.001). Ocular pain/discomfort in all group I patients was described as “sometimes” (90; 100 %), whereas in group II the category “half of the time” predominated (87; 91.6 %) (χ^2=155.591; p<0.001). For blurred vision, group I most often reported “never” (62; 68.9 %), whereas group II reported “half of the time” (87; 91.6 %) (χ^2=129.816; p<0.001). For the items “poor vision,” “reading discomfort,” and “driving at night,” “never” predominated in group I (81; 90.0 % for each item), whereas “half of the time” predominated in group II (87; 91.6 %), between-group differences persisted and remained statistically significant ($\chi^2 \approx$123–136; p<0.001 for each measure). With respect to environmental factors (wind, low humidity, air-conditioning), 70–80 % of responses in group I by month 6 fell into the “sometimes/never” categories, whereas 90-100 % in group II fell into “half of the time”, high χ^2 values were recorded for all three factors (χ^2>120; p<0.001), confirming pronounced between-group differences at this time point (Table 2).

Thus, the overall pattern indicates a more favorable clinical course and a more robust restoration n of ocular-surface homeostasis in patients who underwent preoperative management.

The temporal dynamics of the Schirmer test and TBUT indices in both cohorts (preoperatively, and at 1 and 6 months) are presented below, with proportions of normal and subnormal values. Between-group comparisons were conducted using Pearson’s χ^2 test (α=0.05), enabling evaluation of the contribution of preoperative ocular-surface therapy to early and longer-term changes in tear-film stability. In group I, normal Schirmer test values were observed in 65 patients (72.2 %) versus 25 (27.8 %), subnormal after surface stabilization, at 1 month, in 56 (62.2 %) and 34 (37.8 %), respectively, and by 6 months, in 80 (88.9 %) and 10 (11.1 %). For TBUT (with a normality threshold of ≥10 s) measured preoperatively, normal values were recorded in 62 (68.9 %) and subnormal in 28 (31.1 %), at 1 month, in 54 (60.0 %) and 36 (40.0 %) and at 6 months, in 78 (86.7 %) and 12 (13.3 %).

Table 2

Results of the OSDI re-assessment at the 6-month follow-up (n, %)

OSDI item	Group I (n=90)	Group II (n=95)	χ^2	P
Light sensitivity	sometimes 71 (78.9 %); half of the time 19 (21.1 %)	sometimes 15 (15.8 %); half of the time 80 (84.2 %)	73.970	<0.001
Foreign-body sensation	sometimes 62 (68.9 %); half of the time 28 (31.1 %)	half of the time 95 (100 %)	98.433	<0.001
Ocular pain/discomfort	sometimes 90 (100 %)	half of the time 87 (91.6 %)	155.591	<0.001
Blurred vision	never 62 (68.9 %)	half of the time 87 (91.6 %)	129.816	<0.001
Reduced visual clarity (“poor vision”)	never 81 (90.0 %)	half of the time 87 (91.6 %)	123.000	<0.001
Reading discomfort	never 81 (90.0 %)	half of the time 87 (91.6 %)	130.000	<0.001
Driving at night	never 81 (90.0 %)	half of the time 87 (91.6 %)	136.000	<0.001
Windy weather	70–80 % sometimes/never	90–100 % half of the time	>120	<0.001
Low-humidity (dry) environment	70–80 % sometimes/never	90–100 % half of the time	>120	<0.001
Air-conditioned environment	70–80 % sometimes/never	90–100 % half of the time	>120	<0.001

In group II, at baseline, normal Schirmer test values were identified in 82 patients (86.3 %) with 13 (13.7 %), subnormal, at 1 month, in 59 (62.1 %) and 36 (37.9 %) and by 6 months, in 80 (84.2 %) and 15 (15.8 %) (Fig. 1).

Preoperatively, for TBUT (normality threshold ≥10 s), normal values were recorded in 83 (87.4 %) and subnormal in 12 (12.6 %), at 1 month, in 57 (60.0 %) and 38 (40.0 %) and at 6 months, in 81 (85.3 %) and 14 (14.7 %) (Fig. 2).

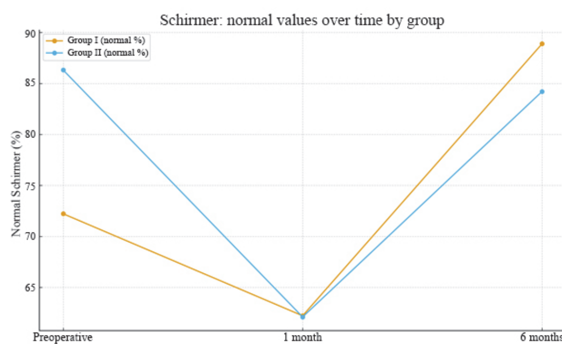

Fig. 1. Schirmer test results in patients who underwent laser refractive correction.

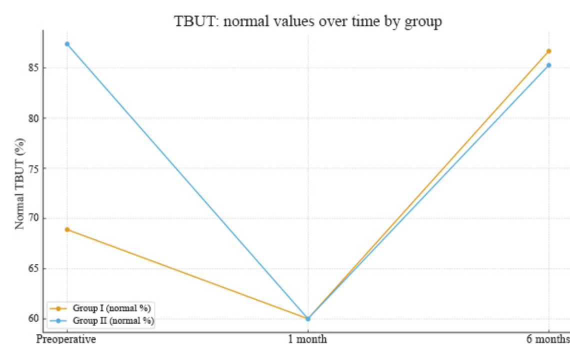

Fig. 2. TBUT results in patients who underwent laser refractive correction.

At the preoperative stage, significant between-group differences are observed across most scale items. By month 6, symptom severity decreases in both cohorts, however, in group I the distributions consistently shift toward less severe categories (“sometimes/never”), whereas in group II “half of the time” more often persists. This indicates a more favorable trajectory of ocular-surface discomfort among patients who received preoperative therapy. Preoperatively, patients without preoperative DED treatment exhibited greater symptom severity across most OSDI items (a high proportion of “often/always” responses), as corroborated by high χ^2 values ($p<0.001$). At 6 months, symptom severity had decreased significantly in both groups. In group I, however, the distributions shifted toward the “sometimes/never” categories, whereas in group II the category “half of the time” more commonly persisted.

Preoperative stabilization of the ocular surface in the cohort with confirmed DED ensured acceptable preoperative parameters, while both groups exhibited the typical transient decline in metrics at 1 month with subsequent recovery by 6 months. By month 6, the proportion of normal values reached 88.9 % in group I and 84.2 % in group II for the Schirmer test, and 86.7 % and 85.3 %, respectively, for TBUT, indicating comparable longer-term outcomes and attenuation of between-group differences (Pearson’s χ^2, $\alpha=0.05$).

This indicates a more stable restoration of ocular-surface homeostasis and visual comfort with preoperative management of DED.

According to studies by Azizoglu S. and colleagues (2017), the prevalence of various ophthalmic pathologies in the pediatric population of Turkey varies substantially across regions, including Istanbul, Ankara, rural areas of Elazığ Province, Malatya, Diyarbakır, and several other localities. These investigations show that refractive errors (myopia, hyperopia, astigmatism), as well as strabismus and amblyopia, occur at different frequencies depending on the region. Such interregional differences may be driven by

socioeconomic conditions, healthcare accessibility, and genetic factors, and they are of substantial significance for assessing the visual health of the pediatric population [3]. Comparable heterogeneity is also characteristic of Azerbaijan. Indeed, several studies conducted by local researchers have documented these disparities and confirmed that the national prevalence of ophthalmic diseases exhibits distinctive epidemiological characteristics [1, 2].

Limitations. The study is limited by the relatively homogeneous sample consisting of active-duty military personnel, which may restrict the generalizability of the findings to the broader population. In addition, the follow-up period of 6 months and reliance on selected diagnostic parameters may not fully capture long-term outcomes and variability in ocular surface status.

Conclusions

1. Preoperative management of DED is associated with a more favorable trajectory across all OSDI items by month 6, with a predominance of "sometimes/never" responses.

2. In the absence of preoperative treatment, symptoms in a number of cases remain in the "half of the time" category, reflecting less complete recovery by month 6.

3. Incorporating the standardized OSDI at pre- and postoperative stages enables objective characterization of ocular-surface status, timely adjustment of management, and informed rehabilitation planning.

4. Despite initially lower values in group I, both cohorts exhibited the typical transient decline in Schirmer and TBUT at 1 month, followed by recovery, indicating comparable longer-term outcomes and supporting the sufficiency of preoperative ocular-surface stabilization in DED for safe refractive-surgery planning.

5. The data support the rationale for routine screening and targeted correction of ocular-surface abnormalities prior to laser refractive surgery in military personnel and other at-risk groups.

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