

ESTIMATION OF LACRIMAL DYSFUNCTION INDICES IN PATIENTS WITH RECURRENT PTERYGIUM

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✧ The rationale of the research is driven by the severity of dry eye syndrome (DES) in the pterygium recurrences development as well as by the necessity to investigate tear dysfunction and methods for its optimal correction in this patient population. **Purpose of the study.** To assess the impact of tear dysfunction indices on the development of recurrent pterygium. **Materials and methods.** We observed 60 patients (67 eyes) with recurrent pterygium. Patients were divided into four observation groups depending on the number of recurrences. In order to study the dynamics of the DES manifestations during the postoperative period, pathogenetic therapy was used, which included a tear fluid substitute. All patients underwent a comprehensive assessment of subjective and objective DES indices before and after surgery. **Results.** A positive dynamics of subjective manifestations and objective indices of DES under the action of a tear substitute after surgery was reliably confirmed. A decrease in the number of patients with type III and IV crystallization after surgery was confirmed. **Conclusion.** The obtained data indicate an increase in the mucin content in the tear fluid composition, which leads to a stabilization of the tear film and to a decrease in the DES intensity.

✧ **Keywords:** pterygium; recurrent pterygium; dry eye syndrome; crystallography; tear fluid substitutes.

ОЦЕНКА ПОКАЗАТЕЛЕЙ СЛЁЗНОЙ ДИСФУНКЦИИ У ПАЦИЕНТОВ С РЕЦИДИВИРУЮЩИМ ПТЕРИГИУМОМ

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✧ **Введение.** Актуальность исследования обусловлена высокой степенью выраженности синдрома сухого глаза (ССГ) при развитии рецидивов птеригиума и необходимостью исследований по изучению слёзной дисфункции и методов её оптимальной коррекции у данного контингента пациентов. **Цель исследования.** Оценить влияние показателей слёзной дисфункции на развитие рецидивирующего птеригиума. **Материал и методы исследования.** Под наблюдением находились 60 пациентов (67 глаз) с рецидивирующим птеригиумом, которые были разделены на четыре группы наблюдения в зависимости от количества рецидивов. С целью изучения динамики проявлений ССГ в послеоперационном периоде применялась симптоматическая терапия, включавшая заменитель слёзной жидкости. Всем пациентам проводилось комплексное исследование субъективных и объективных показателей ССГ до и после операции. **Результаты.** Достоверно подтверждена положительная динамика субъективных и объективных проявлений ССГ под действием заменителя слезы после операции. Подтверждено снижение количества пациентов с III и IV типами кристаллизации после операции. **Заключение.** Полученные данные свидетельствуют об увеличении содержания муцина в составе слёзной жидкости, что приводит к стабилизации слёзной пленки и снижению интенсивности ССГ.

✧ **Ключевые слова:** птеригиум; рецидивирующий птеригиум; синдром сухого глаза; кристаллография; заменители слёзной жидкости.

INTRODUCTION

Pterygium has been identified as a common disease of the ocular surface, which is associated with the growth of fibrovascular tissue from the conjunctiva through the limbal area to the cornea. This often causes subjective complaints from the patient and produces a cosmetic defect [1, 2].

A number of studies conducted by researchers in different countries have independently confirmed that the causes of pterygium are multifactorial. Despite the fact that the association between the development of pterygium and its relapses with dry eye syndrome (DES) has been reliably confirmed, the question of which of these pathological conditions is primary still remains unanswered. Most authors have pointed to the primacy of pterygium, which leads to the disorder of the anatomic-physiological relationships on the ocular surface and a change in the tear film distribution [2–4].

Acceleration of the tear break-up time was seen to occur for many reasons, the most significant of which are its increased evaporation rate or after microtrauma resulting from microparticles of dust or ice [5]. Despite the fact that the DES pathogenesis is uniform, there is a number of specific aspects with pterygium that are caused by dystrophic processes developing in the conjunctiva [7, 8]. In this regard, we conducted a comprehensive study that included an assessment of subjective and objective signs of DES, as well as a study of tear production, tear break-up time (TBUT), and lachrymal fluid crystallography in patients with recurrent pterygium. This study aimed to evaluate the effect of tear dysfunction indicators on the development of recurrent pterygium.

MATERIALS AND METHODS

Sixty patients (67 eyes) with recurrent pterygium, who received treatment at the Department of Ocular Diseases of the Multidisciplinary Clinic of the Tashkent Medical Academy, were monitored from 2013 to 2019. History revealed that the majority of patients ($n = 46$; 76.7%) were permanent residents of rural areas of the republic, whereas the number of urban residents was found to be much lower ($n = 14$; 23.3%). The patients examined included 31 men (51.7%) and 29 women (48.3%). Among the study group, age groups from 31 to 50 years old (41.7%) and 51 to 65 years old (50%) prevailed. The disease duration among the patients was determined to be diverse: less than 2 years in 6 patients (10%), 2 to 5 years in 18 patients (30%), and more than 5 years in 36 patients (60%). The ophthalmic history revealed that all patients underwent previous surgical interventions for

primary pterygium or its relapse. Various modifications of pterygium removal were applied.

The patients were divided into four study groups, depending on the number of relapses. Group 1 included 32 eyes (47.7%) of patients who experienced 1 relapse, Group 2 included 13 eyes (19.4%) with 2 relapses each, Group 3 included 12 eyes (17.9%) with 3 relapses each, and Group 4 included 10 eyes (14.9%) with 4 relapses each. Ten patients (20 eyes) without signs of DES or a history of pterygium comprised the control group. All patients underwent surgery using the combined method of persistent recurrent pterygium removal with autoconjunctival pedunculated grafting according to our modification [6].

To examine the dynamics of DES manifestations in the postoperative period, pharmacological support was used, including a standard set of drugs for prevention of infectious and inflammatory complications (antibacterial, anti-inflammatory, and re-epithelialization stimulating agents), as well as a drug from a group of lacrimal substitutes. Lacrimal substitute was represented by Gilan Ultra Comfort 0.3% sterile unpreserved sodium hyaluronate solution (Solopharm, St. Petersburg, Russia).

This study examined the intensity of subjective clinical manifestations of DES using the Ocular Surface Disease Index questionnaire [7]. The Schirmer test was also performed using test strips of filter paper manufactured by Bausch & Lomb (Heidelberg, Germany) in order to study the general tear production (production of main and accessory lacrimal glands). Basic secretion (i. e., secretion of accessory lacrimal glands) was evaluated in a similar way, but only after preliminary anesthesia of the eye surface with tetracaine solution (Jones' test). The TBUT was measured using the TBUT system on an HRK 9000A automatic refractor-keratometer (Huvitz, Gyeonggi-do, Republic of Korea). For measurements in the TBUT mode, Fluoro Touch fluorescent strips (Madhu Instruments, Delhi, India) were used [8]. These studies have been performed before the surgery and within 2 weeks, 1 month, and 3 months postoperatively.

In order to assess the osmolarity of the lacrimal fluid, crystallography was performed. To conduct this test, 2 to 3 microliters of lacrimal fluid were collected using a capillary tube from the lower fornix of the conjunctiva without previous anesthesia. Lacrimal fluid was instilled onto a clean glass slide and dried at room temperature [9]. After drying, under microscopy, crystallization in the form of a branching fern was determined. The degree of branching depended on the qualitative composition and osmotic properties of the lacrimal fluid. The results of crystallog-

raphy were evaluated as per the criteria of Rolando [10]. According to these criteria, crystallization of the lacrimal fluid is classified into four types depending on the branches, which can be seen under a light microscope (view lens $\times 10$, lens $\times 40$).

- Type I consists of large homogeneous crystals in the form of ferns arranged in an order and branching in the form of a tree.
- Type II shows smaller and single fern-like crystals with a small branching in the form of a tree.
- Type III appears as small fern-like crystals almost without branches and with many empty spaces.
- Type IV shows a totally absent fern pattern, but lumps of mucin may be noted (Fig. 1).

Statistical processing was performed using the Microsoft Excel software package (Microsoft Corp., Redmond, WA), with calculation of arithmetic mean, mean square deviation, and standard error. Student's t-test was used to assess the significance of the statistical study results. The significance of differences in the average values for independent variables and related paired series, as determined by the tables, was considered significant at a 95% confidence level.

RESULTS

It was established that the majority of patients in all groups analyzed had clinical symptoms typical for DES compared with the control group (see Table). The most common subjective symptoms of the di-

sease were identified as follows: a foreign body sensation in the eye, complaints of lacrimation, burning sensation, and pain, as well as poor tolerance of smoke and wind.

It was determined that the average Ocular Surface Disease Index values increased significantly as the number of relapses increased. Thus, the highest indices were found in patients of Groups 3 and 4 (29.23 ± 1.32 and 26.44 ± 2.16 points, respectively).

Analysis of the total and basal tear production enabled identification of statistically significant differences in the performance of patients with pterygium compared with the control group patients. It was revealed that the average TBUT values in all examined patients with pterygium was lower than the normal values and decreased as the number of relapses increased. Thus, in patients in Group 4, the average TBUT was 8.20 ± 0.83 seconds, which was 1.21 times lower than the indices of Group 1, in which the average TBUT was 9.95 ± 0.71 seconds.

Analysis of the lacrimal fluid crystallography results in patients in Group 1 showed that type I crystallization occurred in 7 eyes (21.8%), type II occurred in 15 eyes (46.8%), type III was observed in 7 eyes (21.8%), and, lastly, type IV was found in 3 eyes (9.3%). In patients with two relapses of pterygium, type II crystallization was found to occur in two eyes (15.3%), type III was found in

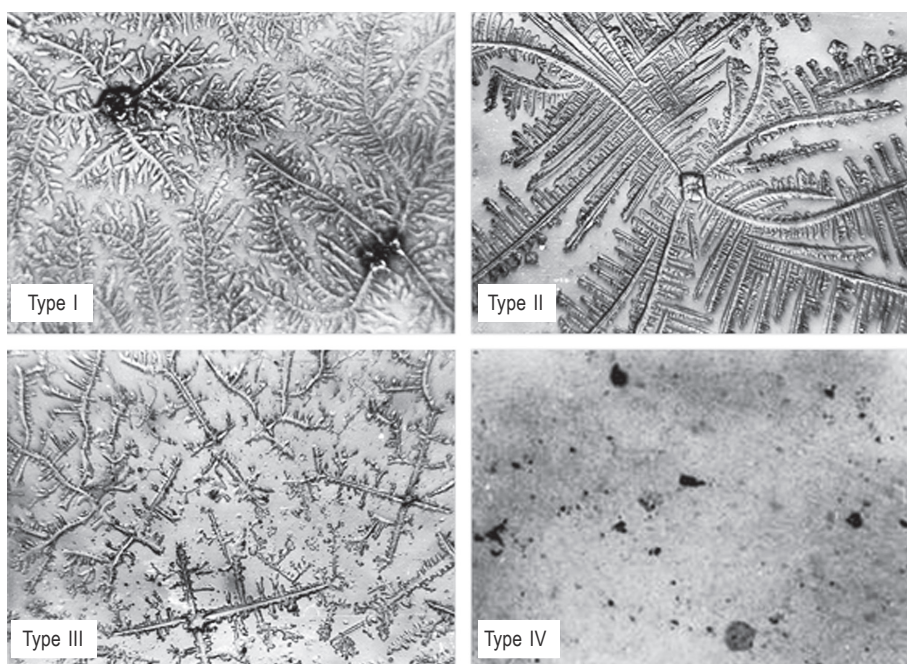


Fig. 1. Types of tear fluid crystallization (Mag: oc. $\times 10$, ob. $\times 40$)

Рис. 1. Виды кристаллизации слёзной жидкости (ок. $\times 10$, об. $\times 40$)

The results of clinical and functional DES indices in patients with recurrent pterygium before surgery, $M \pm m$

Результаты клинических и функциональных показателей синдрома сухого глаза у пациентов с рецидивирующим птеригиумом до операции, $M \pm m$

| Indicator | Group 1 (n = 32) | Group 2 (n = 13) | Group 3 (n = 12) | Group 4 (n = 10) | Control group (n = 20) |
|-----------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------------|
| OSDI (mean score) | 18.15 ± 1.25*^ | 24.27 ± 2.55*^ | 26.44 ± 2.16*^ | 29.23 ± 1.32*^ | 6.15 ± 1.15 |
| Total tear production, mm/5 min | 16.85 ± 1.19 | 16.58 ± 0.96 | 16.60 ± 0.72 | 16.13 ± 1.16 | 16.15 ± 1.03 |
| General tear production, mm/5 min | 11.75 ± 0.69 | 11.20 ± 0.92 | 11.78 ± 0.59 | 11.09 ± 1.01 | 12.09 ± 1.01 |
| TBUT, s | 9.95 ± 0.71*^ | 9.37 ± 0.71*^ | 8.72 ± 0.50*^ | 8.20 ± 0.83*^ | 11.95 ± 0.52 |

Note. * Differences in comparison with healthy individuals are statistically significant ($p < 0.05$); ^ Differences in comparison with indicators of other comparative groups are statistically significant ($p < 0.05$). OSDI, Ocular Surface Disease Index; TBUT, tear film break-up time.

six eyes (46.1%), and type IV was observed in five eyes (38.4%). In patients with three and four relapses of pterygium, samples of pathological crystallization of types III and IV were noted in 90% and 100% of patients, respectively. It was determined that pathological crystallization types (III and IV) of lacrimal fluid in patients with recurrent pterygium amounted to 59.7% (Fig. 2).

In more than half of all patients with recurrent pterygium, crystallization types III and IV were found according to the Rolando criteria, which may indicate insufficient production of the lacrimal film mucin component by goblet conjunctival cells.

An analysis of DES indicators demonstrated that the inclusion of a lacrimal fluid substitute into the pathogenic therapy in the postoperative period has enabled a decrease in the intensity of DES subjective manifestations and an increase in TBUT after 2 weeks. Indicators of tear production during the follow-up period did not undergo significant changes (Fig. 3).

Figure 4 shows the results of crystallography in patients after surgery, obtained after 3 months of follow-up. The graph illustrates that there was a decrease in cases with pathological crystallization of types III and IV and an increase in the number of patients with crystallization of types I and II in all studied groups.

DISCUSSION

After analysis of the results, we conclude that DES occurred in all of the examined patients with recurrent pterygium. However, based on these studies, it can be assumed that the function of tear production is not affected in patients with recurrent pterygium, but that the qualitative composition and degree of osmolarity of the lacrimal fluid are found to be impaired, which was confirmed by studies.

The data obtained indicated that the inclusion of Gilan Ultra Comfort in the medical support of the

postoperative period of recurrent pterygium enabled a significant reduction in DES manifestations in the short term. Positive changes were determined to be the result of temporary stabilization of the tear film owing to the action of sodium hyaluronate.

The improvement in crystallography results, which showed a decrease in the number of patients with types III and IV crystallization and an increase in the number of patients with types I and II, can be explained by a change in the osmolarity and qualitative composition of the lacrimal fluid and tear film owing to an increase in the mucin content. An increase in the mucin content can be associated with the activation of its synthesis by goblet cells, the number of which increased as a result of grafting with the autoconjunctiva from the upper fornix of the bulbar conjunctiva, where these cells are found to be abundant.

CONCLUSIONS

Patient questionnaire data, studies of total and basal lacrimal production, and TBUT revealed that there is a progressive development of subjective and objective manifestations of DES with recurrent pterygium. Based on the crystallography data of the lacrimal fluid, it was revealed that, with relapsing pterygium, development of DES can be attributed to impaired qualitative composition of the tear film due to a decrease in the mucin content. Assessment of DES indicators showed that the use of Gilan Ultra Comfort lacrimal fluid substitute in the postoperative period enabled to successfully arrest the subjective and objective manifestations of DES. Crystallography after surgery demonstrated that the combined method of removal of persistently recurring pterygium with grafting using pedunculated autoconjunctiva improves the quality composition of the tear film by increasing the mucin content.

Conflict of interest. The authors declare no conflict of interest.

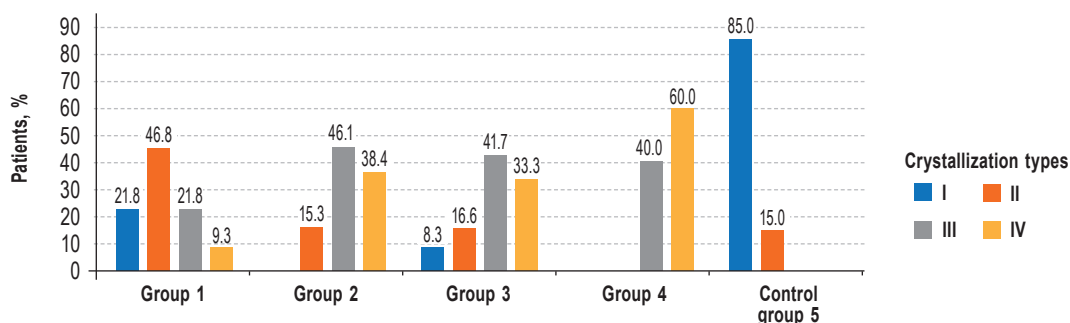


Fig. 2. Crystallography indices in patients before surgery

Рис. 2. Показатели кристаллографии у обследованных до операции

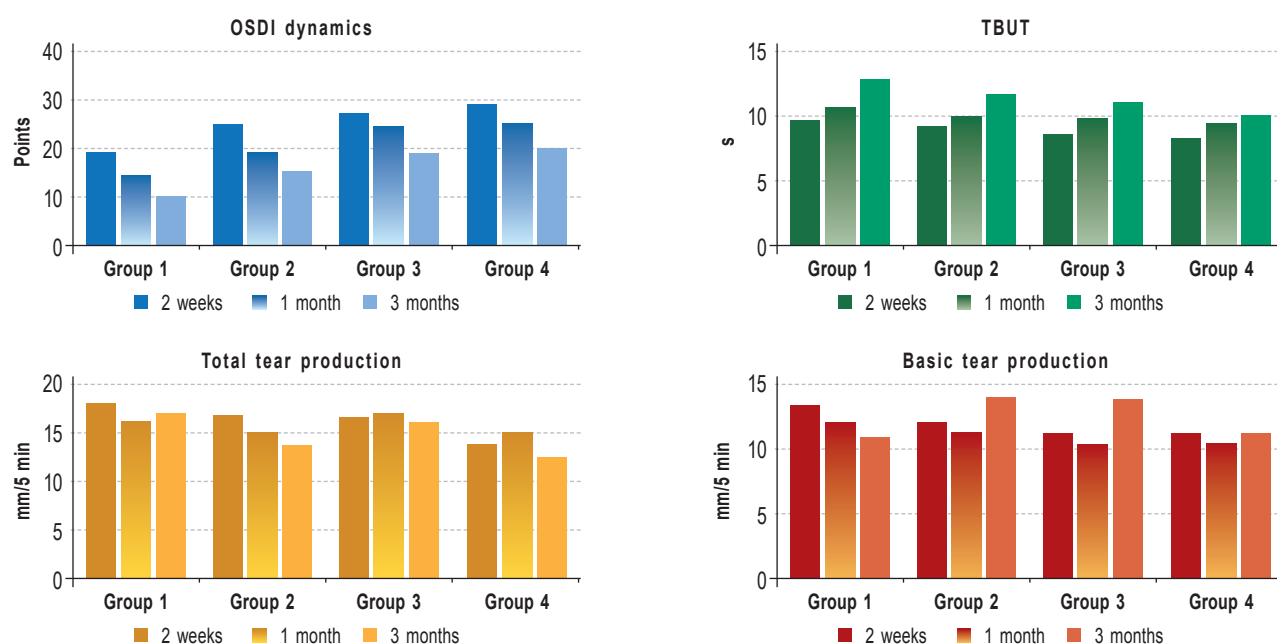


Fig. 3. Dynamics of clinical and functional DES indices of patients after surgery

Рис. 3. Динамика клинко-функциональных показателей ССГ у пациентов после операции

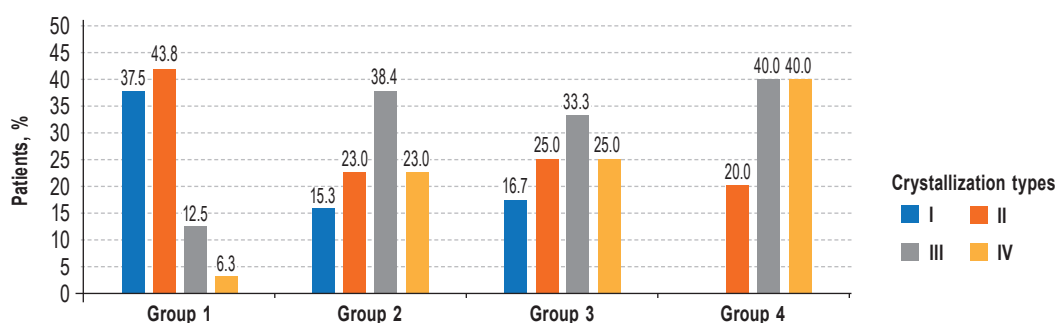


Fig. 4. Crystallography indices in patients 3 months after surgery

Рис. 4. Показатели кристаллографии у обследованных через 3 мес. после операции

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