



## DIAGNOSTIC AND THERAPEUTIC SIGNIFICANCE OF LIPCOF ASSESSMENT IN CHEMICAL EYE BURNS

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*Chemical eye burns, LIPCOF, conjunctival folds, tear film instability, dry eye syndrome, photodynamic therapy, diagnostic tool.*

### ABSTRACT

*This study highlights the diagnostic and therapeutic value of LIPCOF conjunctival fold assessment in patients with chemical eye burns. A strong correlation was identified between LIPCOF severity and clinical symptoms, such as dry eye syndrome, emphasizing its role as a reliable marker for monitoring inflammatory processes and treatment outcomes. In the main group, advanced therapies, including photodynamic therapy, led to significant reductions in LIPCOF grades, fold area (LIPCOF-A), and fold number (LIPCOF-C), achieving clinical improvement in 89% of cases compared to 75% in the control group. The simplicity and non-invasiveness of LIPCOF assessment make it an effective tool for routine clinical use, enabling early diagnosis and improved treatment monitoring.*

### Actuality.

The significance of addressing chemical eye burns lies in their widespread occurrence, severe consequences, and the challenges associated with their treatment. Accounting for 7% to 18% of all ocular injuries, chemical eye burns predominantly occur in workplaces (60%) and domestic settings (40%). Globally, approximately 1.5 to 2 million cases are reported annually, a substantial number of which result in visual impairment or blindness [1, 5, 9].

Severe burns, such as those of the second and third degree, frequently cause irreversible damage to the cornea and adjacent ocular structures, necessitating prolonged and multifaceted treatments, including surgical procedures and tissue transplants. The prevalence of these injuries is notably higher in developing countries, where unsafe working environments and inadequate protective measures are common [2, 4, 12].

The complexity of managing chemical burns stems from the critical need for immediate first aid and continuous monitoring of the patient's condition [3, 6, 7, 11]. These burns often lead to chronic inflammation, scarring, xerosis, and conjunctivochalasis, requiring long-term follow-up and the application of non-invasive diagnostic methods, such as tear meniscus and LIPCOF assessments. Consequently, the development and implementation of reliable diagnostic and monitoring techniques, like LIPCOF, are essential to improving patients' quality of life and mitigating the risk of severe complications [8, 10].

The study of morphometric parameters of the tear meniscus, particularly in the context of conjunctival folds (LIPCOF), is highly relevant due to their critical role in identifying and monitoring conditions associated with tear film instability and increased eyelid friction. Chemical eye burns, being among the most challenging ophthalmic conditions, require prompt and precise intervention. Persistent inflammation and the activation of matrix metalloproteinases (e.g., MMP9) exacerbate conjunctival tissue degradation, leading to instability of the tear meniscus and impaired tear film quality [4, 9, 10].

LIPCOF evaluation provides a non-invasive, straightforward, and effective method for assessing tear meniscus and diagnosing conjunctivochalasis. As the number of patients with chemical eye burns continues to rise, analyzing conjunctival folds enables the early detection of chronic inflammatory changes and facilitates the monitoring of treatment efficacy. Therefore, the application of LIPCOF as a screening tool for managing chemical eye burns is highly relevant and contributes significantly to improved clinical outcomes [6, 7, 9].

#### **Research objective.**

To assess the role of LIPCOF conjunctival folds in diagnosing and monitoring chemical eye burns and evaluating treatment effectiveness.

#### **Materials and Methods of research.**

This study involved an analysis of medical records from 60 patients (78 eyes) admitted to the emergency ophthalmic microsurgery department with varying degrees of chemical eye burns. Patients were stratified into three groups based on the severity of their burns: Group 1 included 30 patients (36 eyes) with first-degree burns, Group 2 comprised 20 patients (28 eyes) with second-degree burns, and Group 3 consisted of 10 patients (14 eyes) with third-degree burns.

The etiology of the burns varied: 58% were linked to workplace accidents, while 42% occurred in domestic settings. The interval between injury and hospital admission ranged from 30 minutes to 5 days.

Clinical data were meticulously gathered from patient records, encompassing complaints, medical history, the adequacy of first aid administered, and any coexisting conditions. Standard ophthalmologic diagnostic techniques were employed, including visometry (to measure visual acuity), biomicroscopy (to evaluate the anterior segment of the eye using a slit lamp), and intraocular pressure measurement.

A central aspect of the study was the evaluation of conjunctival folds (LIPCOF) located parallel to the free edge of the lower eyelid. These assessments were conducted using a slit lamp in the temporal and nasal regions of the bulbar conjunctiva above the lower eyelid. Magnification levels ranging from 18x to 27x were applied under perpendicular lighting, without the use of fluorescein.

Statistical analysis focused on the relationship between the severity of LIPCOF folds (measured as LIPCOF-A, cross-sectional area, and LIPCOF-C, number of folds) and various clinical factors. Statistical significance was determined using the Mann-Whitney test ( $p < 0.05$ ). Morphometric analysis of the folds was conducted using ImageJ 1.50 software, while the Wilcoxon test was employed to compare subjective evaluations of LIPCOF severity with objective imaging data.

Furthermore, the study examined correlations between LIPCOF fold severity, patient age, and the presence of chronic inflammatory processes, including those driven by protease

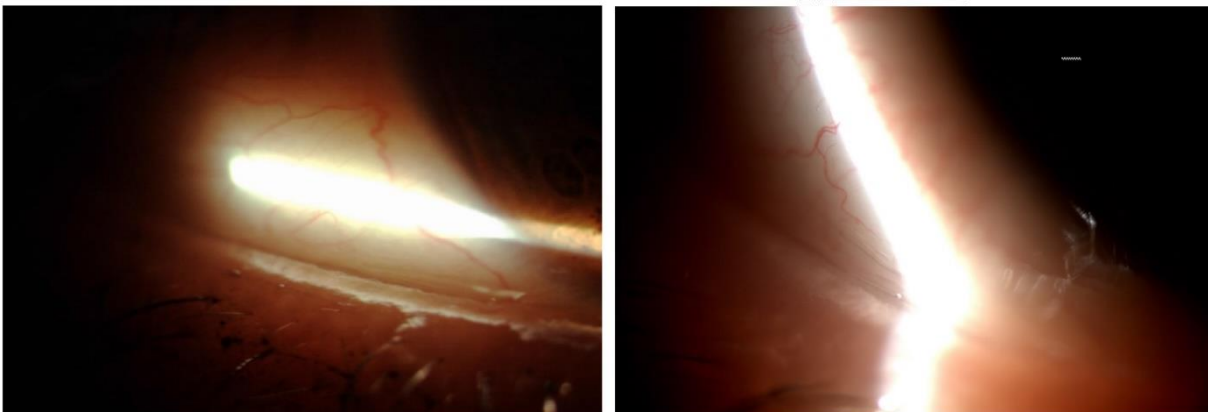
activation, such as matrix metalloproteinase-9 (MMP9). These analyses provided a comprehensive understanding of the link between conjunctival fold morphology and underlying pathophysiological mechanisms.

Conjunctival folds were assessed in both the temporal and nasal regions of the bulbar conjunctiva using a slit lamp with magnification as needed. The evaluation demonstrated that LIPCOF fold severity increased with the degree of chemical burn severity. Patients with second- and third-degree burns exhibited more pronounced folds, both in number and depth. Statistically significant correlations ( $p < 0.05$ ) were found between LIPCOF-A and LIPCOF-C and the burn severity.

A significant association was also observed between LIPCOF severity and patient age, with older patients presenting with more pronounced folds, indicative of tissue degeneration and chronic inflammation. Additionally, the severity of LIPCOF folds was directly linked to dry eye symptoms, highlighting the clinical importance of LIPCOF as a marker of tear film instability. Higher LIPCOF grades (2 and 3) were associated with more severe symptoms compared to lower grades (0 and 1).

Objective parameters, including LIPCOF-A and LIPCOF-C, were analyzed using ImageJ 1.50 software. The Wilcoxon test was used to assess differences between subjective and objective evaluations, while the Mann-Whitney test was employed to explore correlations between clinical grades and severity indicators. Statistical significance was set at  $p < 0.05$ .

This study underscores the relevance of LIPCOF assessment as a non-invasive, reliable method for monitoring tear film stability, evaluating dry eye progression, and tracking treatment outcomes in patients with chemical eye burns.



**Fig. 1. Cross-sectional area of LIPCOF (LIPCOF-A) and number of folds (LIPCOF-C)**

### **Results of research.**

The study revealed significant improvements in conjunctival fold severity (LIPCOF grades) and associated clinical outcomes in patients with chemical eye burns, particularly in the main group, which underwent advanced therapeutic interventions. In the main group ( $n = 50$  eyes), the proportion of eyes classified as grade 1 increased from 30% (15 eyes) before treatment to 42% (21 eyes) after treatment, demonstrating a notable shift towards less severe fold formation. Meanwhile, grade 2 folds, present in 46% of eyes (23 cases) before treatment, showed a dramatic reduction to 4% (2 eyes) after treatment. Severe folds (grade 3) also decreased significantly, from 24% (12 eyes) prior to treatment to 6% (3 eyes) following therapy. In comparison, the control group ( $n = 60$  eyes), which received standard treatment,

exhibited more modest improvements. Grade 1 folds increased slightly from 37% (22 eyes) before treatment to 43% (26 eyes) after treatment. Grade 2 folds were reduced from 38% (23 eyes) to 2% (1 eye), while grade 3 folds decreased from 17% (10 eyes) to 1% (1 eye). These findings indicate that although both groups experienced improvements, the main group achieved significantly greater reductions in LIPCOF severity, particularly for grades 2 and 3, underscoring the efficacy of advanced therapeutic interventions (see table 1).

Table 1

**Conjunctival folds parallel to the free edge of the lower eyelid**

Groups	Control group n=60 (number of eyes)						Main group n=50 (number of eyes)					
	I		II		III		I		II		III	
Degree/ Grade												
n	27		23		10		15		23		12	
	efor e	fter	efore	fter	efore	fter	efore	fter	efor e	fter	efor e	fter
Grade 0												
Grade 1	2	6		2			2*	14*		1		8
Grade 2			8					1	0		0	3
Grade 3								-				-
Grade 0/1/2/3	18/45/51/48						22/52/23/11*					

\* - statistical difference (p value) <0.05

Morphometric analysis of the conjunctival folds further supported these results.

The cross-sectional area of folds (LIPCOF-A) in the temporal region decreased from  $0.0676 \pm 0.0236 \text{ mm}^2$  before treatment to  $0.0389 \pm 0.0352 \text{ mm}^2$  after treatment, representing a 42% reduction. In the nasal region, the fold area declined from  $0.0573 \pm 0.0258 \text{ mm}^2$  to  $0.0241 \pm 0.0203 \text{ mm}^2$ , reflecting a 58% decrease. The number of folds (LIPCOF-C) also showed significant reductions. In the temporal region, the average number of folds dropped from  $1.67 \pm 0.82$  to  $0.69 \pm 0.78$ , a 59% reduction, while in the nasal region, the fold count decreased from  $1.43 \pm 0.86$  to  $0.57 \pm 0.80$ , a 60% reduction. These improvements were more pronounced in the main group, indicating the superior effectiveness of the advanced therapeutic protocol used.

Subjective complaints reported by patients further correlated with the severity of LIPCOF grades. Before treatment, patients with higher grades (2 and 3) reported significantly more severe dry eye symptoms compared to those with lower grades (0 and 1). In the main group, 46% of cases (23 eyes) exhibited grades 2 and 3 before treatment, with this proportion dropping to 10% (5 eyes) post-treatment. Clinical improvement was reported by 89% of patients in the main group, reflecting the efficacy of the therapeutic interventions. In contrast, the control group showed a decrease in grades 2 and 3 from 38% (23 eyes) to 3% (2 eyes) after treatment, with 75% of patients reporting improvement. These results confirm a strong correlation between higher LIPCOF grades, increased symptom severity, and ocular surface

damage. The significant reduction in LIPCOF grades post-treatment was associated with a corresponding alleviation of dry eye symptoms, particularly in the main group.

Overall, the study demonstrates that LIPCOF conjunctival folds are a valuable clinical marker for diagnosing and monitoring chronic inflammatory processes and tear film instability in patients with chemical eye burns. The reduction in LIPCOF grades and morphometric parameters (LIPCOF-A and LIPCOF-C), particularly in the main group, highlights the effectiveness of advanced therapeutic interventions, achieving a clinical improvement rate of 89%. In comparison, the control group achieved an improvement rate of 75%, further validating the superiority of advanced treatment approaches. The simplicity, non-invasiveness, and diagnostic value of LIPCOF assessments make them a practical tool for routine ophthalmological examinations. Incorporating LIPCOF evaluation into standard clinical protocols can enhance early diagnosis, improve treatment monitoring, and lead to better outcomes for patients suffering from chemical eye burns.

### **Conclusion**

This study established that LIPCOF conjunctival folds are a reliable clinical marker for diagnosing and monitoring chronic inflammatory processes and tear film instability associated with chemical eye burns. A strong correlation was observed between the severity of LIPCOF folds and clinical symptoms such as dry eye syndrome, confirming the relevance of this method in routine ophthalmological practice.

In the main group, where advanced treatments, including photodynamic therapy, were applied, a significant reduction in fold severity and depth was observed, leading to clinical improvement in 89% of cases. In contrast, the control group, receiving standard care, showed improvement in 75% of cases. Higher-grade folds (grades 2 and 3) significantly decreased in prevalence in both groups, with the main group achieving superior results.

Morphometric analysis further demonstrated reductions in the cross-sectional area (LIPCOF-A) and number of folds (LIPCOF-C) after treatment, particularly in the main group. These findings validate LIPCOF assessment as a non-invasive, simple, and effective tool for diagnosing, monitoring, and optimizing the treatment of chemical eye burns. Integrating this method into routine clinical practice facilitates early detection, improved treatment monitoring, and better patient outcomes.

### **References:**

1. Alexander KS, Wasiak J, Cleland H. Chemical burns: Diphoterine untangled. *Burns*. 2018 Jun;44(4):752-766. doi: 10.1016/j.burns.2017.09.017. Epub 2017 Oct 10. PMID: 29029860.
2. Arifovna, Bakhritdinova Fazilat, et al. "Biochemical evaluation of the efficacy of complex treatment of eye burn." *International Journal of Medical Sciences And Clinical Research* 3.01 (2023): 33-37.
3. Abdukarimovich, Oralov Behruz. "Use of photodynamic therapy in chemical burns of different etiologies of the surface of the eye." *International Journal of Medical Sciences And Clinical Research* 2.11 (2022): 36-41.
4. Bakhritdinova, F. A., et al. "The assessment of lacrimal film condition in patients with dry eye syndrome during therapy." *Russian ophthalmological journal* 12.4 (2019): 13-18.
5. Bilalov, E. N., et al. "Impact of burns and eye injuries on patients' quality of life." *Western European journal of medicine and medical science* 2.4 (2024): 21-26.

6. Gelston CD. Common eye emergencies. *Am Fam Physician*. 2013 Oct 15;88(8):515-9. PMID: 24364572.
7. Gicquel JJ. Management of ocular surface chemical burns. *Br J Ophthalmol*. 2011 Feb;95(2):159-61. doi: 10.1136/bjo.2010.187104. Epub 2010 Nov 11. PMID: 21071758.
8. Narzikulova, Kumri I., et al. "Development and evaluation of the effectiveness of photodynamic therapy in inflammatory diseases of the ocular surface." *Ophthalmology Reports* 13.3 (2020): 55-65.
9. Бахритдинова Ф.А., Билалов Э.Н., Оралов Б.А. и др. Оценка состояния слезного комплекса у пациентов с синдромом сухого глаза в процессе лечения. *Российский офтальмологический журнал*. 2019; 12 (4): 13-8. <https://doi.org/10.21516/2072-0076-2019-12-4-13-18>
10. Бахритдинова, Ф. А., et al. "Динамика цитологических показателей конъюнктивы в процессе комплексного лечения ожогов глаз с использованием низкоинтенсивного лазерного излучения." *The EYE Глаз* 21.3 (127) (2019): 7-11.
11. Бахритдинова, Ф. А., et al. "Клинико-биохимические параметры оценки эффективности лечения воспалительных заболеваний переднего отрезка с включением фотодинамической терапии." *Таврический медико-биологический вестник* 22.4 (2019): 7-16.
12. Нарзикулова К.И., Бахритдинова Ф.А., Миррахимова С.Ш., Оралов Б.А. Разработка и оценка эффективности фотодинамической терапии при воспалительных заболеваниях глазной поверхности. *Офтальмологические ведомости*. 2020; 13 (3): 55-65. <https://doi.org/10.17816/OV33828>

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