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Management of postoperative surface discomfort of the eye

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INTRODUCTION

Ocular surface disorders in patients undergoing refractive or cataract surgery are a common problem long observed in clinical practice. Despite achieving optimal refractive outcomes, many patients report persistent ocular surface discomfort, which often interferes with daily functioning. In such cases, postoperative symptoms become the primary concern, while even excellent refractive results are perceived as secondary. Patients frequently report symptoms such as ocular dryness, foreign body sensation, burning, excessive tearing, and, in many cases, impaired vision. These symptoms may arise not only after cataract or refractive surgery, but also following retinal procedures, glaucoma surgeries, and repeated intravitreal injections [1–7].

CAUSES OF DEVELOPMENT OF DRY EYE SYNDROME AND POSTOPERATIVE PAIN

Ocular surface disorders following anterior segment procedures, including cataract and refractive surgery, may be either temporary or permanent. Most commonly, they manifest as transient discomfort resulting from corneal incisions and subsequent damage to the superficial corneal nerve plexus, which in turn induces inflammation. Additional factors contributing to postoperative disruption of the ocular surface include disinfectants (e.g., povidone-iodine), local anesthesia, the use of a blepharostat, intraoperative desiccation under the microscope light, irregular wound surfaces (tunnel incisions), and the toxic effects of postoperative medications [6].

According to the literature, dry eye syndrome develops in approximately 32% of patients within 6 months after cataract surgery, with 10% experiencing more

advanced symptoms. Moreover, 34% of patients develop chronic postoperative pain (PPP), of which 18% is classified as neuropathic pain (NOP) [1–4, 8].

Thus, this condition can be described as iatrogenic dry eye driven by inflammation. It involves epithelial cell apoptosis, loss of goblet cells, and reduced glycocalyx expression, all of which perpetuate the vicious cycle of post-cataract iatrogenic dry eye. Initially, activation of nociceptive receptors produces pain that typically subsides over time. However, nerve fiber damage may either resolve spontaneously or progress into a chronic inflammatory process that further damages nerve fibers, ultimately leading to persistent dry eye with associated neuropathic pain [9].

POSTOPERATIVE PAIN

The incidence of postoperative pain is estimated at 10–50% of all surgical procedures and is primarily attributed to nerve fiber damage. Many symptoms of dry eye overlap with those characteristic of neuropathic pain syndrome, including burning, hypersensitivity to wind, and photoallodynia. These symptoms often show an incomplete response to artificial tear therapy. Reported risk factors for the development of postoperative pain include a history of chronic pain, depressive or anxiety disorders, younger age, and the use of medications such as antihistamines, antireflux agents, antidepressants, anxiolytics, and sleep medications [3]. In refractive surgery, ocular surface disorders result from denervation due to extensive damage to corneal nerve fibers. Following LASIK, symptoms of dry eye are reported in 33–57% of patients within 6 months postoperatively. After SMILE, recovery is faster, with approximately 20% of patients experiencing dry eye symptoms at 6 months. In contrast, after PRK, up to 37% of patients report symptoms of dry eye in the first postoperative months [10]. De Paiva's study, one of the few to evaluate corneal nerves, demonstrated that 3 years after LASIK, the number of nerve fibers remained reduced by approximately 35% [11].

Similarly, in refractive surgery, iatrogenic dry eye syndrome may develop, with underlying mechanisms including neurogenic inflammation, tear film instability, loss of goblet cells, altered osmolarity, and neurosensory disturbances that perpetuate the vicious cycle of dry eye [9, 12–14].

Thus, it is evident that after commonly performed surgical procedures, appropriate treatment should be implemented to prevent the development of postoperative dry eye syndrome, as well as the worsening of symptoms and the onset of PPP or NOP. Such therapy must act at multiple points within the vicious cycle, aiming to restore and maintain ocular surface homeostasis, ensure tear film stability and osmolarity, replenish deficient or altered components, and promote healing.

Currently, there is a trend in the treatment of dry eye syndrome toward the use of combination formulations, so-called multiple-action therapies, which target different components and improve all layers of the tear film as well as the ocular surface [15].

GLICOPRO®

One such product is a formulation containing the GlicoPro® complex. It has been used in Italy for 3 years with very good results, while in Poland it is a new product. GlicoPro® is a multimolecular complex derived from the mucus of the snail *Helix aspersa* Müller. It has long been used in cosmetology for its adhesive, soothing, and moisturizing properties. In addition, it demonstrates prolonged retention on the ocular surface and promotes regenerative processes.

GlicoPro® contains sulfur- and non-sulfur glycosaminoglycans as well as proteins, including the polypeptide opiorphin, within a mucin base consisting of hydroxypropylmethylcellulose (HPMC). Glycosaminoglycans and hypromellose support the reintegration of mucin components on the ocular surface, prolong the residence time of the product, provide hydration, and exert protective effects. Glycosaminoglycans bind to the mucins of the glycocalyx and can serve as ligands for various molecules, such as growth factors and anti-inflammatory cytokines [16].

An interesting component of GlicoPro® is opiorphin, a natural antinociceptive modulator that increases the concentration of enkephalins. Enkephalins are endogenous opioids-neurotransmitters that bind to opioid receptors and modulate pain perception [17].

A clinical study in patients with corneal foreign body-induced eye pain (n = 34) demonstrated higher tear opiorphin levels compared with a healthy control group (n = 32), as measured by ELISA. These findings suggest that opiorphin release may play a role in modulating ocular pain as a physiological mechanism of pain relief [18].

In preclinical studies of GlicoPro® conducted by Mencucci et al. on epithelial cell lines and on corneas from an ocular tissue bank with experimentally induced symptoms of advanced dry eye syndrome, treatment with GlicoPro® resulted in pro-inflammatory cytokine and metalloproteinase concentrations that were nearly identical to those observed in the control group [16].

The use of GlicoPro®, whose multicomponent mucopolysaccharides interact with both the mucus and aqueous layers of the tear film, prevents and/or reduces molecular and structural changes characteristic of dry eye syndrome at the corneal epithelium level [16]. A scratch test on an epithelial cell line demonstrated that GlicoPro® induced faster scratch regeneration in HCE-2 cell monolayers compared to samples treated with 0.15% sodium hyaluronate [16].

In a clinical trial involving 60 patients unresponsive to artificial tear therapy for dry eye syndrome, a 2-month treatment with GlicoPro® (2 drops, 4 times daily) led to a reduction in disease parameters and an increase in enkephalin levels. Notably, tear film break-up time improved after just one month of treatment. A significant improvement in tear film volume was also observed, which correlated with a subjective sense of relief reported by patients in the SANDE (Symptom Assessment in Dry Eye) questionnaire. After the first month, an increase in active peptide concentration was noted. The study authors concluded that GlicoPro® alleviates discomfort and enhances tear film stability, emphasizing that the observed elevation of enkephalins may have contributed to this effect [19].

Another study using the same dosage (2 drops, 4 times daily) was conducted in a group of 30 patients with advanced dry eye syndrome who had not responded to treatment with artificial tear preparations. In this study, all evaluated parameters improved, including symptom questionnaires, the Ocular Surface Disease Index (OSDI), tear film break-up time, and a significant reduction in ocular surface symptoms and discomfort [20].

CONCLUSIONS

The use of GlicoPro® provides hydration and protection of the ocular surface, exerting soothing, mucoadhesive, and anti-inflammatory effects. The formulation demonstrates prolonged residence time on the ocular surface, promotes epithelial repair, reduces pain perception, and supports tissue healing and regeneration.

GlicoPro® is used following cataract and refractive surgery. It alleviates symptoms of dry eye, mitigates the inflammatory process, and helps to disrupt the vicious cycle of dry eye syndrome. By promoting physiological processes that support epithelial repair and by reducing pain perception, i.e., one of the most common postoperative complaints, it represents an effective option for improving ocular surface comfort after surgical procedures.

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The content presented in the article complies with the principles of the Helsinki Declaration, EU directives and harmonized requirements for biomedical journals.

