

Editorial

*Corresponding author

Daniel H. Scorsetti, MD, PhD

Chairman and Professor
Department of Ophthalmology
Universidad del Salvador
Buenos Aires, Argentina

E-mail: dscorsetti@gmail.com

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Dry Eye Post Surgery Update

Daniel H. Scorsetti, MD, PhD*

Department of Ophthalmology, Universidad del Salvador, Buenos Aires, Argentina

A number of studies have mentioned high incidence of asymptomatic dry eye syndrome before cataract surgery and more specifically refractive surgery with Excimer Láser. Ocular surgeries play an important role that can trigger or exacerbates this condition.¹

According to the new definition in the DWES II Report: “*Dry eye is a multifactorial ocular surface disease, characterized by a tear film loss of homeostasis, accompanied by ocular symptoms, in which tear film instability, hyperosmolarity, ocular surface inflammation and damage and neurosensory abnormalities play etiological roles*”.²

The prevalence of dry eye in the USA is around 11-33% and is directly proportional to age.³ The main objective to reduce or eliminate dry eye symptoms completely is by implementing new strategies of pre-surgical diagnosis and management.

Recent advances in the field of refractive surgery have prioritized visual quality as a primary clinical parameter in the treatment of these patients. Dry eye symptoms are one of the most frequent causes of complaints of those patients who undergo refractive or cataract surgery, most often in the immediate post-operative phase. The patients who undergo cataract surgery show relatively higher chances to present dry eye symptoms following surgery, and most commonly disappears within a short span of time.

For this reason, it is important to consider the detection for dry eye syndrome prior to any ocular surgery. In cases where this is confirmed, an appropriate treatment should be performed prior to the proposed surgical procedure, because otherwise one runs the risk of suffering associated complications, for example, error calculation for intraocular lenses in cataract surgery or low post-operative visual quality in refractive surgeries.⁴

Patients who already experienced dry eyes before surgery underwent greater discomfort and slower recovery. For some of these patients, most frequently the elderly, who already suffered from dry eyes before surgery, the use of peri-surgery medication, intensive treatment with antibiotics, anti-inflammatory drugs and other highly used drops can result in toxic effects to the ocular surface and consequently lead to dry eye.

On the other hand, the inflammatory processes generated during the surgery can lead to tear accessories gland damage, which can be further aggravated in prolonged surgeries (the complicated ones or surgeries performed by residents in training who lack adequate experience) based on the application of photolysis for extensive thermic impact on the ocular surface following an exposure to the light microscope.

During phacoemulsification the neurological damage is relatively lesser due to refractive surgeries.

On the basis of our knowledge, the cornea is densely populated by sensory nerves originating from the trigeminal ganglion ophthalmic division and the autonomic nervous system; parasympathetic fibers and lesser number of sympathetic nerves arising from the superior cervical ganglion. Corneal nerves are divided into branches in the peripheral cornea.

Some of these branches are connected with each other creating the stromal neural net-

work; however, most of these branches penetrate through the epithelium, to create long beam which supplies the central epithelium. Two of the most commonly performed refractive surgeries, photorefractive keratectomy (PRK), laser assisted *in-situ* keratomileusis (LASIK), lead to damage of the corneal nerves.

In the PRK procedure, the excision of the corneal epithelium damages the epithelial nerves. The application of laser beam in surgery has also been associated with damage to the anterior stromal nerves in the ablation area; therefore, a commonly encountered PRK complication is dry eye. It has been observed that a long-term damage to the ocular surface, (2 years following the PRK surgery) showed a roughly 80% chance of neuronal corneal density recovery. Existing reports suggest that even 5 years after the PRK procedure, some of the patients have still not been able to recover their normal sub-basal neuro-morphology.

Having mentioned this, is clear that, after refractive surgery, the regeneration of the corneal nerves becomes a prerequisite in order to ensure a complete recovery of the ocular surface.

With respect to LASIK, the disruption of the corneal nerves while performing the flap and subsequent photo ablation, is the main cause of post-LASIK dry eye symptoms, thus being associated with the most significant adverse effect of this procedure. It has been reported that in the long-term, post-LASIK damage, up to 95% of the patients may experience dry eye symptoms, 60% of which experience mild to severe dry eye symptoms during the 1st month post-surgery, while some keep on experiencing these symptoms in the long-term, with a chronic incidence of dry eye ranging from 20% to 50%, 6 months after the surgery.⁵

It has been observed that nerves can regenerate after LASIK, but even 5 years after the surgery, the neuronal density seems to be lesser than that prior to surgery. There has been a decline of 90% of the central nervous fibers density during the post LASIK phase in the first month, which could take years to restore to the normal values, pre-surgery.

The reduction in neural innervations has diminished the corneal sensitivity, disrupting the interaction between the afferent sensory nerves of the ocular surface and the efferent autonomous nerves of the tear glands. Other mechanisms suggested, such as blinking frequency reduction may increase the tear evaporation rate. Damage to the corneal epithelium increases the levels of pro-inflammatory cytokines and interleukins (IL-6, IL-8) in tears.

During the application of suction rings and the use of microkeratome, Goblet cells are lost resulting in a decrease in the secondary mucin secretion, which when existing normally would stabilize the tear film and avoid the evaporation.

A decrease in the density of nerve fibers causes affects not only in the tear film quality, but also the tear secretion, decreasing the blinking rate and the wound healing property of the epithelium. All these factors are associated with the pathogenesis of post-refractive surgical dry eye.

A reduction in tear secretion caused due to the suppression of afferent fibers increases the osmolarity. And this generates greater presence of inflammatory substances triggering a cascade with release of chemical mediators (IL-1 alpha and beta, TNF-alpha) and matrix metalloproteinases (MMP-9) thus producing instability of the tear film.⁶

In patients with a history of dry eye, it is important to take it into account, the osmolarity prior to surgery as a reference, since its increase generates more chances to present post-operative discomfort.⁷

Medical attention should be given to reduce the risks and control factors that induce dry eye such as toxic substances, systemic drugs, contact lenses, environmental factors, systemic diseases, nutritional parameters, anxiety and chronic stress. The tear film stability needs to be improved with the use of lacrimal occlusions, artificial tears improving the lipid layer, a lid margin exfoliation and meibomian gland probing. The application of corticosteroid pulses, immunosuppresses such as tacrolimus, cyclosporine A-MMP-9 inhibitors, doxycycline 50 mg/d. can help improve inflammation, infection and osmolarity associated with dry eyes. The treatment strategy should be aimed towards improving the tissue status by providing vitamin A and artificial tears with protector effects and mediating the use of 20% autologous serum and therapeutic contact lenses, which are important tools for the conventional treatment of dry eyes.

The new therapeutic approaches include the recommendation of the intake of essential fatty acids omega 3 (eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA)) intake before ophthalmological surgery, aiming to prevent and treat any post-surgical dry eye conditions. The indicators of the tear film show to have greater stability with the additional effect it provides the diet rich in omega 3 pre- and post-surgery.⁸

It is very important to ensure that source of the omega 3 is seafood and not vegetables (chia or flax). Several studies have showed that following the intake of ALA chia capsules, only 5% of its composition transforms into EPA and <0.5% into DHA, leaving behind an insignificant fraction of the useful constituent, thus leading to the conclusion that the anti-inflammatory effects of chia capsules is too low.⁹

The Omega 3 supplement with EPA and DHA functions in many ways to relieve and to treat the symptoms of dry eyes, improving the quality of the secretion of meibomian glands, stimulating aqueous tear secretion by the affected lacrimal glands, reparation and reduction of apoptosis in the tear gland, and eliminating inflammation in the conditions of blepharitis and meibomitis.

Omega 3 has also been observed to improve the potential neuronal regeneration (with higher epithelial subbasal neuronal cells plexus proliferation after surgery). The DHA supplementation improves neuronal regeneration after lesion, increasing anti-inflammatory activity and supporting the recovery of goblet cells that increase the levels of secreted mucin, improving the adherence and permanence of the tear to the ocular surface.^{10,11}

It must be considered in some way that during the prelude of cataract surgery, the corneal epithelium must be protected, and the use of 2% hydroxypropyl methylcellulose is recommended for proper hydration, thus reducing the symptomatology of dry eye syndrome.¹² Also Nepafenac 0.1% was safe for corneal epithelium after phacoemulsification.¹³

Another new alternative is the use of IPL (Intense Pulsed Light) because it has led to the improvement of dry eye symptoms post-surgery to show an analgesic, anti-inflammatory, anti-microbial (Bacteria's and Demodex) effect and a biostimulatory and neurotropic activity.¹⁴ On the basis of the general principle underlying Arndt Shuktz's Law in the Phototherapy, IPL has been observed to accentuate the vital cells activity.

The analgesic effect of IPL lowers the concentration of the mediators of inflammation (such as cytokines and interleukins) which activate the pain receptors.¹⁵ Decreasing the threshold of the pain when the ionic concentration is stabilized on both sides of the cellular membrane during sensitive terminations affects the sensory nerve fibers thereby delaying neuronal depolarization.

Also, it has an effect on the central nucleus of pain by activating the thalamus and blocks perception of pain by increasing the endorphin and beta-endorphins levels.

The anti-inflammatory effect of IPL in local vasodilatation is attributed to a thermal effect and the partial blockage of a precapillary sphincter with a marked increase in the histamine levels and nitric oxide concentration, a greater oxygen and nutrient supply and reabsorption of edema and necrotic material from the inflamed area.

IPL has a direct antimicrobial effect against bacteria, viruses, fungi and mites.

Biostimulation and tissue regeneration is thus facilitated, which is associated with increased cellular mitosis and tissue repair, increased collagen and fibroblast production and an improvement in the neuro-trophic activity.¹⁶

Although, Omega 3 and IPL treatment strategies did not demonstrate local or systemic adverse effects; however, further studies are necessary to confirm these potential benefits of the mentioned dry eye post-surgery treatment approaches.

In conclusion, while dry eye is a pathology of the ocular surface (understood as a functional unit), it is important to consider that many patients already suffer this condition prior to performing ocular surgeries. Most of these patients are asymptomatic and needs objective studies that allow a correct diagnosis and treatment avoiding inaccurate pre-operative measures or improving the post-operative refractive results. In general, dry eye is not an absolute contraindication for many eye surgeries, but should be considered and treated appropriately to achieve the desired welfare effect according to the surgical procedure performed.

REFERENCES

1. Kasetsuwan N, Satitpitakul V, Changul T, Jariyakosol S. Incidence and pattern of dry eye after cataract surgery. *PLoS One*. 2013; 8: e78657. doi: [10.1371/journal.pone.0078657](https://doi.org/10.1371/journal.pone.0078657)
2. Craig JP, Nichols KK, Akpek EK, et al. TFOS DEWS II definition and classification. *Ocul Surf*. 2017; 15(3): 276-283. doi: [10.1016/j.jtos.2017.05.008](https://doi.org/10.1016/j.jtos.2017.05.008)

3. Bron AJ, Tomlinson A, Foulks GN, Pepose JS, Baudouin C, Geerling G. Rethinking dry eye disease: A perspective on clinical implications. *Ocular Surf*. 2014; 12(Suppl 2): S1-S31. doi: [10.1016/j.jtos.2014.02.002](https://doi.org/10.1016/j.jtos.2014.02.002)
4. Montes-Mico R. Role of the tear film in the optical quality of the human eye. *J Cataract Refract Surg*. 2007; 33: 1631-1635. doi: [10.1016/j.jcrs.2007.06.019](https://doi.org/10.1016/j.jcrs.2007.06.019)
5. Horwath-Winter J, Berghold A, Schmut O, et al. Evaluation of the clinical course of dry eye syndrome. *Arch Ophthalmol*. 2003; 121(10): 1364-1368. doi: [10.1001/archoph.121.10.1364](https://doi.org/10.1001/archoph.121.10.1364)
6. Chotikavanich S, de Paiva CS, De Quan Li, et al. Production and activity of matrix metalloproteinase-9 on the ocular surface increase in dysfunctional tear syndrome. *Invest Ophthalmol Vis Sci*. 2009; 50(7): 3203-3209. doi: [10.1167/iovs.08-2476](https://doi.org/10.1167/iovs.08-2476)
7. González-Mesa A, Moreno-Arrones JP, Ferrari D, Teus MA. Role of tear osmolarity in dry eye symptoms after cataract surgery. *Am J Ophthalmol*. 2016; 170: 128-132. doi: [10.1016/j.ajo.2016.08.002](https://doi.org/10.1016/j.ajo.2016.08.002)
8. Mohammadpour M, Mehrabi S, Hassanpoor N, Mirshahi R. Effects of adjuvant omega-3 fatty acid supplementation on dry eye syndrome following cataract surgery: A randomized clinical trial. *J Curr Ophthalmol*. 2016; 29: 33-38. doi: [10.1016/j.joco.2016.05.006](https://doi.org/10.1016/j.joco.2016.05.006)
9. Ong NH, Purcell TL, Roch-Levecq AC, et al. Epithelial healing and visual outcomes of patients using omega-3 oral nutritional supplements before and after photorefractive keratectomy: A pilot study. *Cornea*. 2013; 32(6): 761-765. doi: [10.1097/ICO.0b013e31826905b3](https://doi.org/10.1097/ICO.0b013e31826905b3)
10. He J, Bazan HE. Omega-3 fatty acids in dry eye and corneal nerve regeneration after refractive surgery. *Prostaglandins Leukot Essent Fatty Acids*. 2010; 82(4-6): 319-325. doi: [10.1016/j.plefa.2010.02.004](https://doi.org/10.1016/j.plefa.2010.02.004)
11. Mohammadpour M, Mehrabi S, Hassanpoor N, Mirshahi R. Effects of adjuvant omega-3 fatty acid supplementation on dry eye syndrome following cataract surgery: A randomized clinical trial. *J Curr Ophthalmol*. 2017; 29: 33-38. doi: [10.1016/j.joco.2016.05.006](https://doi.org/10.1016/j.joco.2016.05.006)
12. Yusufu M, Liu X, Zheng T, Fan F, Xu J, Luo Y. Hydroxypropyl methylcellulose 2% for dry eye prevention during phacoemulsification in senile and diabetic patients. *Int Ophthalmol*. doi: [10.1007/s10792-017-0590-7](https://doi.org/10.1007/s10792-017-0590-7)
13. Kawahara A, Utsunomiya T, Kato Y, Takayanagi Y. Comparison of effect of nepafenac and diclofenac ophthalmic solution on cornea, tear film, and ocular surface after cataract surgery: The results of a randomized trial. *Clin Ophthalmol*. 2016; 64: 10: 385-391. doi: [10.2147/OPTH.S101836](https://doi.org/10.2147/OPTH.S101836)
14. Dell S. Intense pulsed light for evaporative dry eye disease. *Clin Ophthalmol*. 2017; 11: 1167-1173. doi: [10.2147/OPTH.S139894](https://doi.org/10.2147/OPTH.S139894)
15. Liu R, Rong B, Tu P, et al. Analysis of Cytokine levels in tears and clinical correlations after intense pulsed light treating meibomian gland dysfunction. *Am J Ophthalmol*. 2017; pii: S0002-9394(17)30375-6. doi: [10.1016/j.ajo.2017.08.021](https://doi.org/10.1016/j.ajo.2017.08.021)
16. Toyos R, McGill W, Briscoe D. Intensified pulsed light treatment for dry eye disease. *Photomed Laser Surg*. 2015; 33(1): 41-46. doi: [10.1089/pho.2014.3819](https://doi.org/10.1089/pho.2014.3819)