Cataract surgery in the face of ocular surface disease

Asadolah Movahedan and Ali R. Djalilian

Purpose of review
This article reviews the importance of ocular surface management in patients undergoing cataract surgery. The current strategies for the diagnosis and management of ocular surface disease in cataract surgery patients are discussed.

Recent findings
The current trend is to diagnose and treat ocular surface disease before cataract surgery using a stepwise regimen tailored to the individual patient and disease severity.

Summary
Maintaining a healthy ocular surface is essential for achieving the best visual outcome in cataract patients. Ocular surface preparation is beneficial not only in patients with established ocular surface disease, but also in those with minimal signs or symptoms of surface disease.

Keywords
blepharitis, cataract surgery, dry eye, lid margin disease, ocular surface disease

INTRODUCTION
Ocular surface disease, particularly dry eye syndrome, is one of the most common conditions in the elderly [1,2]. As age-related cataract constitutes most of patients undergoing phacoemulsification, the diagnosis and management of ocular surface disease is therefore indispensable in majority of these patients. In a recent multicenter study, presented at the American Society of Cataract and Refractive Surgery, more than half of all patients who underwent cataract surgery were found to have significant dry eye disease based on objective testing (W.B. Trattler et al., unpublished data). This is important, as the incidence and severity of dry eye symptoms increase even further after cataract surgery [3,4]. In particular, phacoemulsification has been shown to reduce tear meniscus height and tear breakup time (TBUT) [5,6] and increase squamous metaplasia on conjunctival impression cytology [7]. The mechanism for the exacerbation of surface disease after cataract surgery likely includes several factors: increased inflammatory mediators due to postoperative inflammation, toxicity from the use of benzalkonium chloride containing eye drops, and damage to the corneal nerves from limbal incisions. The presence and exacerbation of ocular surface disease may have special importance in patients receiving presbyopic intraocular lenses, as disturbances in the tear film can significantly impact the visual quality and patient satisfaction postoperatively. In addition to having delayed visual recovery after cataract surgery, patients with moderate-to-severe ocular surface disease are also at higher risk of postoperative complications, namely infections and corneal melts. Therefore, aggressive management of the ocular surface disease is imperative in all cataract surgery patients. This review summarizes the latest approaches to the diagnosis and management of ocular surface disease in the setting of cataract surgery.

DIAGNOSIS
Preoperative recognition of patients with ocular surface disease provides an opportunity to optimize the surface before proceeding with surgery. The patient history is often one of the most important elements...
in the diagnosis of patients with dry eyes or ‘dysfunctional tear syndrome’ [8,9]. In addition to the usual symptoms of grittiness or discomfort, blurry vision that is worsened by visual activity, can sometimes be overlooked as a symptom of dry eye and could be mistakenly attributed to the patient’s cataract [10]. As noted by others, fluctuating vision either before or after cataract surgery is almost always a sign of tear film insufficiency [11]. Likewise, history of a systemic collagen vascular disease or associated manifestations such as arthritis or dry mouth provides important clues for the possibility of concomitant ocular surface disease.

Clinical examination and diagnostic testing
The clinical examination of the cataract surgery patient can provide additional clues that suggest tear film insufficiency. These include findings such as debris in the tear film, a low tear meniscus height, evidence of lid margin disease, and conjunctival inflammation.

Diagnostic testing is greatly valuable both for the detection of early changes due to dry eyes and also to grade the severity of surface disease. The most commonly performed tests include the Schirmer test, TBUT, and ocular surface staining. It is noteworthy that clinical findings and diagnostic tests are only weakly associated with patient symptoms in ocular surface disease [12,13].

There is an ongoing debate about the reproducibility and sensitivity of the Schirmer test as it measures reflex tearing and the stimulus is not standardized. Serin et al. [14] have suggested that performing the test without anesthesia with the eyes closed produces less variable results and increases the repeatability of the test. The two-minute Schirmer test has been proposed as an acceptable alternative for 5-min test both for the patient and examiner; overall, the Schirmer test may be less useful in mild cases and instead more applicable for detecting patients with moderate-to-severe aqueous tear deficiency.

A TBUT of less than 10 s is likewise highly suggestive of an inadequate tear film and is a valuable diagnostic test when looking for the evidence of ocular surface disease preoperatively.

Ocular surface staining
Corneal staining with fluorescein is a widely used diagnostic modality to assess the severity of the dry eyes (Fig. 1). Lisamine green and Rose Bengal stain the epithelial cells that have lost their mucin covering; both are more sensitive than fluorescein in detecting the early signs of tear film insufficiency by looking for staining in the nasal and temporal conjunctiva.

Hardten [15] has suggested using a test he calls ‘ocular surface stress test’ to identify high-risk patients for developing dry eye signs and symptoms after phacoemulsification. ‘After the dilating drops and anesthetic, the patient is directed to sit in the waiting room for 30–60 min and is then reexamined. If irregular epithelium or punctate keratopathy is observed during this follow-up examination, that patient probably has problems maintaining a healthy epithelial surface after surgery.’ (p. 855).

Corneal sensation
Neurotrophic corneal disease is relatively common and especially in diabetic patients is a frequent cause of chronic surface disease [16]. The use of cotton wisp to measure sensation can identify such
patients. Although neurotrophic patients are less likely to complain of the typical dry eye symptoms (other than fluctuating or decreased vision), they are at particularly higher risk for ocular surface complications such as persistent epithelial defects following cataract surgery.

**MANAGEMENT**

Given the elective nature of cataract surgery, once a patient has been identified as having poorly controlled ocular surface disease, surgery is typically postponed until the surface can be optimized.

**Preoperative care**

Management of ocular surface disease may be done most effectively by following established treatment guidelines [17]. In this stepwise approach, treatment begins with artificial tears which have been shown to diminish ocular symptoms and improve vision-related function and dry eye signs (TBUT) in the majority of cataract surgery patients [18].

Anti-inflammatory agents play a major role in the treatment of moderate-to-severe dry eye because of the critical role of inflammation in pathogenesis of the ocular surface disease. Topical corticosteroids and immunomodulatory agents constitute the main therapies currently in use. Several studies have noted the efficacy of topical corticosteroids in treatment of dry eye [19]. Steroids have a rapid onset of action and therefore are helpful in circumstances that immediate response is needed. In a randomized, double-masked, placebo-controlled study in keratoconjunctivitis sicca patients, a significant difference between the loteprednol etabonate ophthalmic suspension 0.5%-treated group and vehicle-treated group was found in patients with moderate clinical inflammation after 2 weeks of therapy. In addition, steroid-treated patients retained their improvement compared with control group [20].

Cyclosporine has gained popularity because its long-term use is devoid of steroid-induced side-effects. Although, it may take several weeks of treatment in order to get a therapeutic effect. The mechanism of action of cyclosporine in increasing tear production is not fully understood, but the drug seems to have immunomodulatory effects that reduce inflammation. Pflugfelder et al. [21] showed a significant increase in goblet cell density in the bulbar conjunctiva in patients with dry eye with 0.05% cyclosporine emulsion therapy twice a day for 12 weeks comparing the same treatment with artificial tears. Sahli et al. [22] reported the beneficial effects of topical cyclosporine therapy twice daily in increasing Schirmer test values and TBUT scores and improvement of cytological grade of dry eye comparing the patients before and 6 months after treatment. Donnenfeld et al. [23] found that cyclosporine 0.05% therapy improves visual quality after multifocal intraocular lens implantation suggesting its beneficial effect on tear-film quality. A recent study showed that decreasing therapy to once daily for patients controlled with topical 0.05% cyclosporine twice daily for at least 1 year, still may allow suppression of the dry eye disease [24]. An important consideration in patients with cataract surgery is to maximally suppress inflammation preoperatively, given that inflammation increases significantly after surgery.

In patients with significant aqueous deficiency, consideration should be given to punctual occlusion. Punctal plugs have been shown to improve vision in dry eye patients by stabilizing tear film through decreasing its osmolarity [25]. Combining punctal plugs with 0.05% cyclosporine is shown to result in the best Schirmer test scores, Rose Bengal staining, and reduction in overall artificial tear use compared to either treatments alone [26]. Punctal occlusion is best done after controlling the ocular surface inflammation.

Management of lid disease is likewise essential for optimization of surgical outcomes. In one series, blepharitis was the number one reason for cancellation of cataract surgery [27], as it is thought to be a primary risk factor for endophthalmitis [28]. Preoperative treatment begins with a prolonged commitment to eyelid hygiene. Topical antibiotics are used to control staphylococcal growth on the eyelids. Recent antibiotics such as topical azithromycin are promising in unresponsive patients and have been shown to effectively reduce signs and symptoms of blepharitis [29]. If severe inflammation or complications like phlyctenules or severe conjunctivitis are present, topical antibiotic-steroid combinations can be used for short periods of time [30]. Oral antibiotics, commonly doxycycline or minocycline, are reserved for refractory cases most of whom have significant meibomian gland disease or ocular rosacea [31]. Tetracycline drugs improve the symptoms [32], boost TBUT [33], and also decrease eyelid flora. These are typically started at least 1 month before cataract surgery. Increasing intake of omega-3 fatty acids from fish oil and flax seed oil may also have anti-inflammatory effects which are beneficial in the management of lid disease.

**Intraoperative care**

Intraoperatively, the ocular surface is prone to damage from preservative containing anesthetics and
more importantly from desiccation. Frequent irrigation with balanced salt solution or more viscous eye lubricants or viscoelastics [34] can minimize the desiccating stress to the surface. In a randomized, controlled, double-masked study, hydroxypropyl methylcellulose (HPMC) 2% gel provided significantly better optical clarity and less frequent need for irrigation compared with Balanced Salt Solution during cataract surgery. One-hour after surgery, there was no difference in the corneal staining between the two groups [35*].

The surgical incision may potentially impact the ocular surface after cataract surgery. Historically, large incision from extracapsular cataract extractions induced significant damage to the corneal nerves [36]. However, small incision cataract wounds [37,38] as well as limbal relaxing incisions seem to induce localized damage to the corneal nerves with subsequent reduced corneal sensation [39]. However, the effect of decreased corneal sensation on ocular surface and tear film has not been studied.

**Postoperative care**

After cataract surgery, the signs and/or symptoms of ocular surface disease typically get worse. Prolonged use of postoperative medications may be one of the contributing factors. Therefore, in patients with surface disease, it is best to stop or taper medications when no longer needed. One particular type of medication commonly used after cataract surgery that deserves special attention is topical nonsteroidal anti-inflammatory drug (NSAID). Topical NSAIDs such as nepafenac, ketorolac, and diclofenac have been reported to cause corneal melting mainly in the presence of epithelial breakdown [40–42]. These complications may be more likely in patients with significant ocular surface disease and dry eye such as Sjogren’s syndrome. There is a suggestion that concomitant use of topical steroids with NSAIDs may reduce this complication; however, it does not completely prevent it. Therefore, in patients with significant ocular surface disease, it is prudent to minimize or even avoid the use of topical NSAIDs especially as a single agent.

**CATARACT SURGERY IN SEVERE OCULAR SURFACE DISEASE**

As mentioned in the last section, patients with severe ocular surface disease are at significantly greater risk of complication after cataract surgery. One noteworthy complication is sterile corneal melts which has been reported in patients with immune-mediated ocular surface diseases such as Sjogren’s syndrome, graft versus host disease, and Stevens–Johnson syndrome [42–47]. Optimization of the ocular surface prior to cataract surgery is imperative in these patients. Although topical steroids are cautiously used in patients with an unstable surface, systemic immunosuppression may be indicated to suppress inflammation in the setting of systemic disease [48]. Cataract surgery in patients with ocular cicatricial pemphigoid (OCP) requires the disease to be controlled for a minimum of 1 year, while perioperative use of systemic steroids is highly recommended.

**CONCLUSION**

Given that cataract surgery is a surface-damaging event, it is important to consider ocular surface in patients preoperatively. Ocular surface preparation is beneficial not only in patients with established ocular surface disease, but also in those with minimal signs or symptoms of surface disease. Currently, there is more interest among the cataract surgeons to further improve the outcomes of surgery by aggressively treating the ocular surface before and after operation.

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**Conflicts of interest**

There are no conflicts of interest.

**REFERENCES AND RECOMMENDED READING**

Papers of particular interest, published within the annual period of review, have been highlighted as:
- **of special interest**
- **of outstanding interest**

Additional references related to this topic can also be found in the Current World Literature section in this issue (p. 77).

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Cataract surgery and ocular surface disease

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