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Management of dry eye disease to optimize cataract surgery outcomes: two tables  
for daily clinical practice

*Prise en charge de l'œil sec pour optimiser les résultats de la chirurgie de la cataracte :  
deux tableaux pour une utilisation quotidienne*

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**Titre anglais cours:** Management of dry eye disease to optimize cataract surgery

## **Abstract**

The increase in life expectancy has resulted in a greater number of patients presenting for cataract surgery as well as an increasing prevalence of dry eye disease (DED) symptoms or signs noted in these patients. Low grade and/or non-symptomatic DED is common and can be exacerbated after surgery. DED can induce errors in IOL power calculation. DED can impair the visual prognosis and patient comfort after cataract surgery, leading to dissatisfaction of both the patient and the surgeon. Hence, preoperative evaluation for DED for all cataract candidates is crucial to mitigate these risks. To optimize clinical efficiency during the screening examination, we propose a strategy of three levels of DED screening, according to a patient's risk of DED given his or her history. We also propose a summary of the main clinical points before, during and after cataract surgery in eyes with DED.

**Key-Words:** Dry eye disease, sicca syndrome, cataract, surgery, ocular surface, outcomes, patient satisfaction

## **Résumé**

L'augmentation de l'espérance de vie a induit une croissance importante du nombre de patients devant être opérés de la cataracte, et dans le même temps une recrudescence de la prévalence des symptômes ou des signes de la maladie de l'œil sec (OS) chez ces patients. L'OS de grade modéré, voire non symptomatique, est courant et peut même exacerbé après la chirurgie. En outre, l'OS peut induire des erreurs dans le calcul de la puissance du cristallin artificiel, et en postopératoire, il peut altérer le pronostic visuel et le confort, pour conduire à une insatisfaction à la fois du patient et du chirurgien. Par conséquent, un dépistage préopératoire de l'OS pour tous les candidats à la cataracte est légitime pour atténuer ces risques de complications. Afin d'optimiser l'efficacité clinique de ce dépistage, nous proposons une stratégie en trois niveaux d'examen clinique, en fonction du risque d'OS pour le patient en question, compte tenu de ses antécédents. Nous proposons également un résumé des principaux points cliniques avant, pendant et après la chirurgie de la cataracte pour les yeux secs.

Mots-clefs : œil sec, syndrome sicca, cataracte, chirurgie, surface oculaire, résultats, satisfaction du patient

## **Assessing DED before cataract surgery: why, who, and how ?**

Increasing lifespan and growing elderly population in many countries are leading to increased cataract surgical volumes. In France (population: 67.2 million), cataract surgery procedures have increased from 300,000 in 1991 [1] to more than 800,000 in 2016 [2]. During the same period, life expectancy increased from 76.6 to 82.1 years [3]. As the majority of cataract patients who underwent surgery in 2016 were born prior to 1946, i.e. in periods when the number of births were around 700,000 per year, we estimate that at least 60% of an age group undergoes cataract surgery in at least one eye.

In many countries, cataract surgery is the most common procedure in medicine. Hence, factors that contribute to improve outcomes must be proactively addressed. Dry eye disease (DED) can significantly affect vision and refractive outcomes [4], and quality of life after cataract surgery [5-8] due to the risk of postoperative exacerbation of the signs and symptoms [9-11].

This is even more important given that the prevalence of DED ranges from 5% to 50% of the general population, and increases with age [12]. When assessed preoperatively, 50% of cataract patients present with central corneal fluorescein staining and 63% of patients present with reduced tear break-up-time [13]. Furthermore, 52% of these patients have clinical signs of meibomian gland dysfunction (MGD) [14]. Surprisingly the prevalence of signs of DED is higher than that of symptoms [12]. For example, asymptomatic MGD has been suggested to be twice as prevalent as symptomatic MGD [15]. Hence, assessment for DED should be included in the standard preoperative evaluation for cataract surgery.

However, there is a perception that the evaluation for DED disease may be cumbersome, increasing work-up time for the surgeon. Our experience indicates that implementation of ocular surface disease (OSD) diagnostics in the refractive cataract practice has little appreciable effect on patient turnover in the clinic. In about 80-90% of the cases, which correspond to the part of the general population who do not present with obvious signs of, or are not at risk of significant DED [12], less than 2 minutes are required to assess the ocular surface. For the remaining 10-20% of patients who are either already diagnosed, or

at risk for significant DED, an additional 5 minutes of work-up should be sufficient. Lastly, at most 1% of the patients evaluated at primary care centers require an extensive ocular surface assessment, because of an uncontrolled and severe DED.

Determining the level of DED work-up required for individual patients before cataract surgery remains ambiguous due to the lack of literature providing a clear consensus on the subject. In this article, we propose guidance on determining the level of risk for DED and level of examination required for patients who present for cataract surgery. The usual (and minimal) preoperative work-up for DED for a cataract surgery candidate involves: patient history and general assessment of the symptoms of DED, fluorescein staining to approximate tear break-up time and examination of the eyelids for inflammation (telangectasia around meibomian gland orifices, plugging, crusting, irregular border). If required, namely in patients at risk of DED or with a known but controlled DED, a variety of additional tests can be performed including (but not limited to), a questionnaire to quantify symptoms (Ocular Surface Disease index -OSDI- or Dry Eye Questionnaire 5 -DEQ 5-), according to the DEWS II report [16], grading the ocular surface fluorescein staining with a standardized scale (eg. the Oxford scheme), tear meniscus and break-up time measurement, and meibum expression testing. More invasive or time-consuming tests (e.g. Schirmer I, meibography, etc...) are required in patients with uncontrolled DED or those with specific medical histories (eg. refractive surgery, Sjögren disease, rheumatoid arthritis, graft versus host disease or systemic lupus).

Table 1 presents the type of examination warranted for patients with different risk levels for DED. For example, a patient with DED that is recalcitrant to treatment has an important risk for exacerbating the disease postoperatively and requires a comprehensive examination (Table 1). Inversely, a 60-year old male patient, with no disorder or complaint other than cataract, i.e. no clues for risk of dry eye disease, needs only a brief DED work-up.

**According to the results of DED assessment, how to prepare the patient's eye and when to plan cataract surgery?**

Cataract surgeons must be cognizant that the risk of DED increases postoperatively due to a number of factors including pupillary dilation and antiseptic procedures, type and duration of anesthesia, incision length and location, phacoemulsification machine settings, duration of procedure and intraoperative exposure to light [17]. Suction procedures such as those used in femtolasers-assisted cataract surgery, may increase the risk of DED, compared to conventional phacoemulsification [18]. Phacoemulsification modifies meibomian gland function [11]. Hence MGD may be exacerbated postoperatively [9, 10] with a magnitude that is correlated to the severity of preoperative MGD status [10]. The resulting abnormalities usually persist up to 3 months postoperatively [9], or longer in some cases [11]. Similarly, recovery of DED symptoms after cataract surgery (tested by OSDI) may take 3 months or even longer [7, 10]. Based on these observations, cataract surgery should be delayed in patients at risk of significant postoperative DED flare-ups until the ocular surface has been successfully managed.

Preoperative management of DED is determined by the severity of the disease, according to the currently available classification scales [19, 20]. As a function of the stage of severity, treatments must be pursued or modified, or initiated if DED has not been previously diagnosed before considering cataract surgery. As the management of DED is more often guided by clinical experience than strict therapeutic algorithms, [20], clinicians are encouraged to use their clinical judgment in managing these patients and in determining the optimal treatment. Artificial tears remain the initial therapy for all forms of DED, but eventually, they may not be sufficient, depending on the underlying mechanisms of DED. In case of MGD, eyelid hygiene is another cornerstone of therapy, and options such as topical or systemic antibiotics, fatty acid intake, androgen use possibly in the future should be discussed. In cases where inflammation is not sufficiently reduced by the usual regimen, short-term regimen of non-preserved low-level steroids, cyclosporine A and lifitegrast have consistently produced encouraging outcomes [21, 22], and may be proposed as an adjunctive therapy for highly moderate to severe cases [23, 24].

The level of DED may also influence the timing of the cataract procedure. If the ocular surface is significantly impaired, postponing surgery may be the right option, until

conditions have sufficiently improved. The patient must be informed of the reasons for delay, including that the ocular surface is a key factor for good visual outcomes. Notably, DED may lead to incorrect intraocular lens power calculations [4], and persistent blur after surgery despite the absence of technical issues preoperatively or intraoperatively, just as a consequence of the potential exacerbation of DED postoperatively.

It is especially important to delay surgery in patients with uncontrolled and severe DED. Additionally, patients with Sjögren's syndrome, rheumatoid arthritis or lupus require greater attention [25-28], especially if serum antineutrophil cytoplasmic antibodies (ANCA) and cryoglobulin levels are abnormal (greater risk of corneal melts or ulceration).

### **Managing DED patients before, during and after the cataract surgery procedure: what clues?**

To further decrease the chances of aggravating DED postoperatively, some simple precautions in the days preceding surgery can mitigate the risk of drug induced corneal epithelial toxicity (**Table 2**). These include avoiding nonsteroidal anti-inflammatory drugs (NSAIDs) that may lead to corneal melting in patients with DED [29], especially in case of Sjögren's syndrome [27]. All eyedrops containing benzalkonium chloride (BAK) may also aggravate, or even induce DED [30]. Additionally, is it more appropriate to use antiseptics in place of antibiotics. Antiseptics are significantly less toxic to the corneal epithelium and preoperative antibiotics have no significant advantages on the incidence of bacterial cleaning if the povidone-iodine cleansing procedures are performed correctly [31].

Just prior to surgery, prudent use of anesthetics and mydriatics are encouraged, which can easily be addressed by using an intracameral injection of mydriatics and anesthetics rather than a standard preoperative eye drop regimen. The phase III randomized study evaluating a ready-to-use intracameral combination of mydriatics and anesthetics versus conventional eye drops reported a reduction of symptoms related to ocular surface damage at 8 and 30 days post-op for the intracameral group [32]. Table 2 lists some of the others intraoperative changes that can reduce the risk of corneal epithelial toxicity



such a limiting microscope light exposure/intensity [17, 33], avoiding an aspirating speculum [34], limiting the thermal energy delivered by the phacoemulsification device [33], limiting the size of the incision [35], and applying viscoelastic substance on the cornea during and/or at the end of surgery (in place of immediate steroids + antibiotic ointment) [36, 37]. Considering the risk of refractive error in the calculation of the IOL power and the potential blur due the ocular surface abnormalities, it is also legitimate to use multifocal IOLs with caution in patients with a significant DED [38].

Patients should be instructed to postoperatively continue the preoperative DED regimen. For the same reasons as preoperatively, NSAIDs and BAK containing eye drops should be avoided in DED patients. When possible, the most epitheliotoxic antibiotics should be avoided, or used with caution and/or for a short duration (few days).

Increased frequency of follow-up visits is often required to ensure ocular surface tolerance and to determine if DED therapy needs to be modified. In case of severe exacerbation of inflammation of the ocular surface, some patients may require more aggressive therapeutics, including a short-term regimen of topical (non-preserved) steroid therapy, or even topical immunomodulatory drugs. Some authors have suggested that topical cyclosporine could be useful to decrease DED signs and symptoms in patients newly diagnosed with DED after surgery [39, 40]. This treatment could lead to greater comfort and better visual outcomes after cataract surgery, even in patients without DED [41, 42]. These indications are however not recognized by European health authorities.

In summary, proactive management of DED preoperatively can result in ensuring good visual and refractive outcomes after cataract surgery. We encourage routine assessment of DED for all patients presenting for cataract surgery.

### **Disclosure of interest**

Marc Labetoulle has occasionally acted as a consultant for ALCON, ALLERGAN, BAUSH & LOMB, DOMPE, HORUS, MSD, NOVARTIS, SANTEN, SHIRE, THEA.

**Table 1.****Classification of patients according to their risk of DED and the corresponding of preoperative DED assessment**

<b>Previous history</b>			
Dry Eye Disease (DED)		+ (already treated DED)	+ (recalcitrant DED)
Sjögren's Syndrome, Rheumatoid Arthritis, Lupus, graft versus host disease, cicatrizing conjunctivitis, ocular rosacea		+ (unknown DED)	+ (known DED)
Previous history of refractive surgery		+ (no DED symptoms)	+ (with DED symptoms)
Ongoing anti-depressant drugs		+	
Ocular allergy or anti-glaucoma drugs		+	
Previous history of HSV/VZV		+	
Recent history of adenoviral keratoconjunctivitis		+	
Menopause + suppl. hormones		+	
Diabetes / peripheral nerves disorders		+	
None of the above	+		
<b>Level of risk for DED after Surgery</b>	<b>Minimal</b>	<b>Significant</b>	<b>Maximal</b>
<b>As a result of the previous classification</b>			
<b>Level of DED examination</b>	<b>Minimal</b>	<b>Complete</b>	<b>Comprehensive</b>
Symptoms	Yes / No	+ Visual analogic scale	+ OSDI or DEQ-5

Corneal & Conj. Damage	PSK* after fluorescein?	+ Oxford staining score	+ OSS score
Tear stability	BUT rough assessment	BUT measurement	+ NI-BUT
Tear secretion	TMH** rough assessment	TMH measurement	+ Schirmer 1
Eyelids	Eyelid border assessment	+ Meibum expression	+ Meibography

Abbreviations: BUT = Break-up time, DEQ = Dry Eye Questionnaire, NI-BUT = Non-invasive break-up time, OSDI = Ocular Surface Disease Index questionnaire, OSS: Ocular Surface Score, PSK = Punctuate superficial keratitis, TMH =Tear Meniscus Height

**Table 2:**

**Practical tips and tricks for managing DED patients undergoing cataract surgery**

<b>Days / weeks preceding cataract surgery</b>	Avoid NSAIDs +++
	Avoid any BAK-containing eye drop
	Pursue (or introduce if needed) artificial tears
	Change pre-op antibiotics (if any) for antiseptics

<b>At time of cataract surgery</b>	Do not skip the 2-steps Povidone Iodine pre-op wash of the ocular area
	Limit the amount of anesthetic eye drops just before surgery
	Limit the amount of mydriatic eye drops just before surgery
	Limit the microscope light exposure during surgery
	Avoid large corneal incisions
	Avoid aspirating speculum > Avoid FLACS ?
	Limit the thermal energy delivered by the phacoemulsification device
	Use the remaining viscoelastic on the cornea at the end of the surgery
	Be cautious with the use of multifocal intraocular lens
<b>Days / weeks following cataract surgery</b>	Avoid NSAIDs +++
	Avoid any-BAK containing eye drop
	Limit the use of the most epitheliotoxic antibiotics (eg aminoglycosides)
	Pursue DED treatment
	Increase the frequency & duration of follow-up

Abbreviations: BAK = benzalkonium chloride, NSAIDs = non steroidal anti-inflammatory drugs, PSK = punctate superficial keratitis, TMH = tear meniscus height,

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