APACRS
ASIA-PACIFIC ASSOCIATION OF CATARACT & REFRACTIVE SURGEONS
30th Anniversary - 1987 - 2017

Principles of Preferred Practice

Management of the Ocular Surface in Cataract & Refractive Surgery

APACRS

ASIA-PACIFIC ASSOCIATION OF CATARACT & REFRACTIVE SURGEONS

30th Anniversary - 1987 - 2017

The Asia-Pacific Association of Cataract and Refractive Surgeons (APACRS) was founded in 1987 to facilitate the dissemination of the rapidly accumulating knowledge in the fields of cataract and refractive surgery in the Asia-Pacific.

Thirty years on, through annual meetings held in conjunction with other regional organizations and through publications such as *EyeWorld Asia-Pacific* news magazine, the APACRS continues to be the leading forum for the region, serving the cataract and refractive surgery needs of over half the world's population.

APACRS SECRETARIAT
11 Third Hospital Avenue | Singapore 168751
apacrs@apacrs.org www.apacrs.org

FOREWORD

To commemorate the 30th anniversary of the APACRS, we have updated the Principles of Preferred Practice for Cataract Surgery and we have also produced this completely new Principles of Preferred Practice for the Management of the Ocular Surface in Cataract & Refractive Surgery.

As cataract surgeons, it is all too easy for us to be indifferent to the cornea, dry eye, and tear film, concentrating only on biometry, IOL choices, and surgical techniques. But if ever there was a truism, it is that keratometry and aberrometry are really investigations of the tear film and the accuracy of these tests is hugely affected by the quality of the tear film. Furthermore, in this age of ever increasing implantation of advanced technology lens implants, dry eye and other corneal problems significantly affect image quality.

It is timely therefore that Dr. Lim Li and her colleagues have put together this comprehensive guide to the management of the ocular surface as it affects all of us cataract and refractive surgeons.

Our grateful thanks to them and to Santen for their education grant that made this publication possible.

Ronald Yeoh
President, APACRS

EDITORS

Chief Editor

Adjunct Associate Professor Lim Li
Senior Consultant
Corneal and External Eye Disease Department
Singapore National Eye Centre

Co-Editor

Associate Professor Louis Tong
Senior Consultant, Singapore National Eye Centre
Principal Clinician Scientist & Head, Ocular Surface Research Group
Singapore Eye Research Institute

Contributing Editor

Professor Kyung Chul Yoon
Department of Ophthalmology
Chonnam National University Hospital, Gwangju, South Korea

STATEMENT OF INTENT

The Principles of Preferred Practice (PPP) guide was developed for ophthalmologists to provide up-to-date and evidence-based information on the management of the ocular surface in cataract and refractive surgery.

Ophthalmologists are ultimately responsible for the management of their unique patients on the basis of the clinical data and the diagnostic and treatment options available.

CONTENTS

1 INTRODUCTION

1.1 Methodology

The Principles of Preferred Practice (PPP) for the Management of the Ocular Surface in Cataract and Refractive Surgery was developed by an expert workgroup appointed by the Asia-Pacific Association of Cataract and Refractive Surgeons (APACRS). The workgroup conducted a systematic review of current medical literature, discussed and reviewed successive drafts of the document. The final version was agreed upon by the workgroup and provided guidelines according to the levels of evidence and grades of recommendation.

1.2 Target Group

These guidelines are developed for general ophthalmologists in their care of cataract and refractive surgery patients.

LEVELS OF EVIDENCE AND GRADES OF RECOMMENDATION

2

Levels of Evidence

Level	Type of Evidence
Ia	Evidence obtained from meta-analysis of randomized controlled trials.
Ib	Evidence obtained from at least one randomized controlled trial.
IIa	Evidence obtained from at least one well-designed controlled study without randomization.
IIb	Evidence obtained from at least one other type of well-designed quasi-experimental study.
III	Evidence obtained from well-designed non-experimental descriptive studies, such as comparative studies, correlation studies, and case studies.
IV	Evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities.

Grades of Recommendation

Level	Type of Evidence
A (evidence levels Ia, Ib)	Requires at least one randomized controlled trial as part of the body of literature of overall good quality and consistency addressing the specific recommendation.
B (evidence levels IIa, IIb, III)	Requires availability of well-conducted clinical studies but no randomized clinical trials on the topic of recommendation.
C (evidence level IV)	Requires evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities. Indicates absence of directly applicable clinical studies of good quality.
GPP (good practice points)	Recommended best practice based on the clinical experience of the guideline development group.

3 BACKGROUND

3.1 Definitions

3.1.1 Laser refractive surgery

Laser refractive surgery in this PPP refers to laser-assisted in-situ keratomileusis (LASIK), photorefractive keratectomy (PRK), laser epithelial keratomileusis (LASEK), and small incision lenticule extraction (SMILE).

3.1.2 Cataract surgery

Cataract surgery refers to planned surgical excision of the crystalline lens using phacoemulsification or the extracapsular cataract extraction technique. Many of the mechanisms of dry eye discussed below also apply to newer cataract surgery techniques such as femtosecond laser-assisted cataract extraction.

3.1.3 Dry eye after laser refractive surgery

Dry eye is defined as a multifactorial disease of the tear film and ocular surface due to abnormal homeostasis of the tear film, resulting in symptoms of tear instability, visual disturbance, and potential damage of the ocular surface. Although dry eye may have various etiologies, hyperosmolarity of the tear and inflammation of the ocular surface are final common pathways in the pathogenesis of dry eye. Clinically, common tests used to detect dry eye include a reduced tear breakup time (TBUT), reduced Schirmer's test, and increased dye staining of the ocular surface.

It is important to realize that the normal tear film consists of different components secreted by different glands. The lacrimal and accessory lacrimal glands secrete the aqueous tear and its proteins, the conjunctival epithelial cells and goblet cells secrete the mucin component of tears, and the meibomian glands produce the lipid layer of the tear film. In iatrogenic dry eye due to surgical procedures, different glandular disturbances contribute to the formation of dry eye through mechanisms described below.

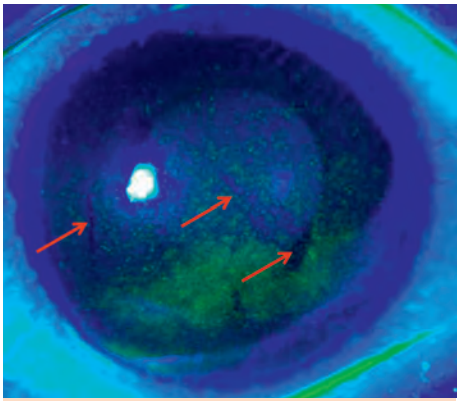

Fig. 1. Slit lamp photography showing tear film instability with spot-like tear break pattern after LASIK

The incidence of post-LASIK dry eye ranged from 8.3 to 48% based on symptoms or signs assessed at least 6 months post-surgery.[1-6] **Level IIa**

The incidence of dry eye (at day 7) after uncomplicated phacoemulsification (92 cases) has been found to be 9.8%, but clinical signs of dry eye tend to improve over a few months.[7] Cataract surgery involves corneal or limbal incisions and the procedure is also associated with worsening of dry eye.[8] In a prospective observational study, it was found that meibum expressibility was reduced even at 3 months after cataract surgery.[9] After cataract surgery, TBUT is reduced but not Schirmer's test readings; however, TBUT returned to normal about 1 month after surgery. On the other hand, the goblet cell dysfunction after cataract surgery did not recover even at 3 months after surgery.[10] The tear film lipid thickness is reduced up to 1 month after cataract surgery.[11] **Level III**

Compared to patients with no preexisting dry eye, dry eye patients who had cataract surgery developed significantly worse dry eye symptom scores, lower TBUT, more lid margin abnormalities, worse meibum quality and reduced expressibility of meibomian glands after cataract surgery.[12] **Level IIa**

In a non-randomized prospective study, both femtosecond laser-assisted cataract surgery and standard phacoemulsification resulted in worsening of dry eye after surgery.[13] **Level IIa**

3.2 Mechanisms

3.2.1 Disruption of corneal sensory nerves

A normal lacrimal functional unit is required for normal tear secretion. Disruption of corneal afferent input to the lacrimal unit due to corneal incisions will result in reduction of the production of tears by efferent glands. This occurs in both laser refractive and cataract surgeries. When lacrimal glands are involved, there is reduced aqueous tear production. Decreased blink frequency and increases in the inter-blink interval can also result from a reduced afferent stimulation of the lacrimal functional unit. This increases exposure time of the ocular surface and reduces the delivery of meibum lipids to the tear film. In addition, since the efferent arm of the lacrimal functional unit also supplies the meibomian glands, there may be reduced meibum production.[14]

Corneal sub-basal nerves undergo morphological changes in post-LASIK corneas at 6 months. After LASIK, corneal sensory threshold rises many times at 2 weeks, but returns to normal by approximately 6 months.[15,16] **Level III**

LASIK-induced neurotrophic epitheliopathy results in the poor healing of the corneal epithelium after LASIK surgery. This may be related to the reduced delivery of certain proteins such as substance P, insulin-like growth factor-1, and lacritin to the ocular surface, which are related to either corneal neuronal dysfunction, or associated with aqueous tear hyposecretion.[17,18] **Level III**

3.2.2 Increase in ocular surface inflammation

There is reduced tear clearance rate after LASIK.[19] **Level III**

This may in part explain the increase in tear osmolarity, which induces stress signaling in the epithelium and drives expression of inflammatory mediators. Cytokines such as IL-1, IL-6 and IL-8, and MCP-1 are expressed by corneal fibroblasts when exposed to the excimer laser.

However, some studies have found the level of tear cytokines to be normal after LASIK.[20-22] **Level III**

As a result of LASIK, pro-inflammatory mediators neuropeptide Y, substance P, and calcitonin gene-related peptide are released in the cornea from damaged nerves, at the ablation interface as well as boundaries of the flap. They result in mast cell degranulation and infiltration of neutrophils and mononuclear inflammatory cells to the ocular surface, thereby irritating and damaging ocular surface structures. This is called neurogenic inflammation. The neuropeptides have been known to lower sensory thresholds, allowing patients to perceive dry eye symptoms more readily.[23,24] **Level III**

3.2.3 Alteration of ocular surface anatomy

There is reduced tear lipid thickness and lipid abnormalities in the tear film from 3 months up to a year or more after LASIK.[25,26] **Level III**

Immobilization of the eye via a suction ring performed for LASIK has been known to cause conjunctival hyperemia, infiltration of immune cells, and reduction of conjunctival goblet cell density.[27] **Level III**

It has also been postulated that corneal microstriae results in surface irregularity which can impair tear spreading, resulting in tear instability and dry eye.[28] **Level III**

3.2.4 Other mechanisms

The use of preserved eyedrops as well as topical aminoglycosides in conjunction with any surgery may contribute to epitheliopathy or corneal toxicity that is indistinguishable from dry eye (systematic review of literature).[29] **Level Ib**

The use of povidone iodine solution preoperatively may contribute to compromised ocular surface. However, this may be unavoidable so the adverse effects may be minimized by diluting the iodine solution.[30] **Level III**

C For cataract surgery, 5% povidine iodine solution is applied on the eyelids but usually not in the conjunctival sac (Fig. 2). **Grade C, Level IV**

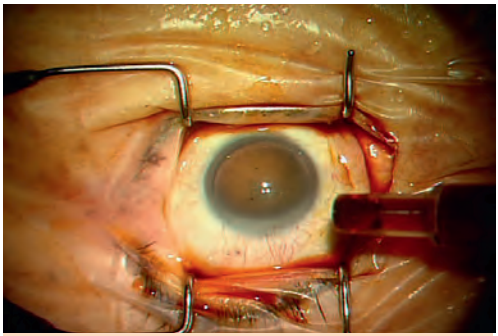

Fig. 2. Use of 5% povidone iodine solution in the conjunctival sac in cataract surgery

Meibomian gland function is influenced by cataract surgery and is accompanied by structural changes and these can be correlated with ocular symptoms.[12]

B Patients with preexisting meibomian gland dysfunction may have worsening of dry eye symptoms after any ocular surgery (Figs. 3 & 4). This may be because patients discontinue the eyelid warming and cleaning of the eyelids which are necessary to control the eyelid disease. It is recommended that after the first 3 days post-surgery, patients should carefully restore these therapies with the eyelids gently closed. **Grade B, Level III**

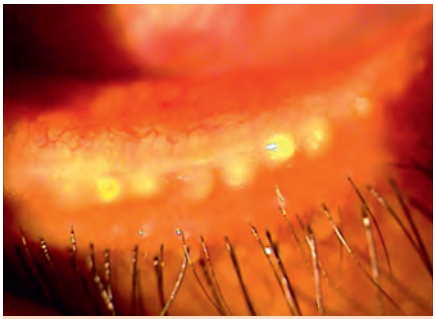

Fig. 3. Slit lamp photography showing exudates on the meibomian gland orifices

Fig. 4. Obstructive meibomian gland disease with anterior blepharitis following penetrating keratoplasty

Other surgical factors including prolonged microscopic light exposure, use of an aspirating speculum and thermal energy generated from phacoemulsification devices can also play an indirect role in postoperative dry eye, decreasing tear film breakup time.[31,32] **Level II**

PREOPERATIVE ASSESSMENT AND MANAGEMENT

4

It is important to perform sufficient preoperative assessment for patients undergoing refractive or cataract surgery. This allows proper counseling of patients concerning postoperative dry eye and avoidance of unrealistic expectations of surgical outcome. Importantly, at-risk patients can postpone the surgery and institute measures to stabilize the tear and ocular surface prior to surgery.[33-36]

It has been shown in a retrospective study that patients who underwent preoperative treatment of dry eye had reduced postoperative dry eye symptoms and achieved higher goblet cell densities compared to patients who did not optimize the ocular surface prior to LASIK.[37] **Level II**

B It is recommended that preoperative LASIK patients who show signs of inflammation (including conjunctival hyperemia and meibomian gland dysfunction) be given topical cyclosporine A.[38,39] **Grade B, Level III**

B Some patients will be found to have significant meibomian gland dysfunction before cataract surgery. Use of eyelid wipes for 5 days reduces microbial load. It is therefore recommended that patients with eyelid disease perform eyelid measures before cataract surgery.[40] **Grade B, Level IIb**

4.1 Demographic and Lifestyle Predisposition

Older age, female gender, and East Asian ethnicity were potentially predisposing factors for dry eye development. History of contact lens wear and contact lens intolerance also predispose to dry eye that persists beyond 6 months post LASIK surgery.[41,42] In Shoja's study, patients who developed dry eye were significantly older (mean 35±8 years) compared to those who did not develop dry eye (31±6 years) ($p<0.001$).[3] In Michaeli's study,[43] female gender was found to have significantly greater decrease in corneal sensitivity in the short period after LASIK, which returned to normal at 3 months. **Level III**

B Although there is no evidence that cessation of smoking improves tear outcomes after LASIK, smoking should be discouraged as chronic smoking is known to correlate with higher levels of TGF-B1 and VEGF in tears, and with delay in corneal epithelial wound healing.[44] **Grade B, Level III**

Cataract surgery patients tend to be post-menopausal, which is a risk factor.[45] **Level III**

4.2 Medical and Surgical History

High myopia requires a greater extent of laser ablation and may be linked to higher risk of dry eye post-surgery.[4] **Level III**

B The incidence of dry eye after LASIK is increased in patients with a history of allergy. This was concluded from a study of 572 patients, with conditions such as asthma, atopic dermatitis and rhinitis. It is recommended that ocular allergies be stabilized prior to surgery.[46,47] **Grade B, Level IIa**

B The presence of collagen vascular disease. The FDA has named Sjögren's syndrome, rheumatoid arthritis, systemic lupus erythematosis and seronegative spondyloarthropathies to be contraindications for LASIK (Fig. 5). However, a study concluded that provided there is stringent selection of these patients with mild, stable, and well-controlled systemic conditions, LASIK can be safe. Nevertheless, Sjögren's syndrome patients are best avoided, although good functional outcomes can still be achieved postoperatively when measures such as artificial tears, punctal occlusion, and autologous serum are used.[48] **Grade B, Level IIa**

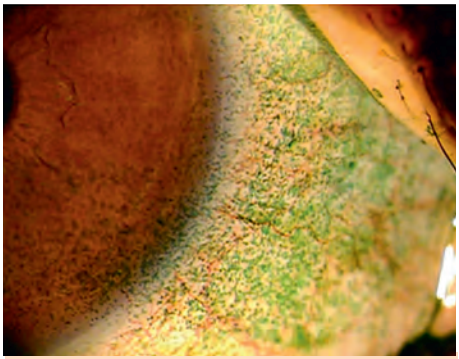

Fig. 5. Slit lamp finding in a Sjögren's syndrome patient showing positive staining with lissamine green in the corneal and conjunctival epithelium

B Caution should be exercised when performing refractive surgery on patients with diabetes mellitus as some of these patients have keratopathy and corneal neuropathy which manifest with symptoms similar to dry eye. Any epithelial problems that develop postoperatively may also take longer to heal in diabetic patients.[49] **Grade B, Level IIa**

Similarly, in diabetic people, a prospective comparative study has shown that tear dysfunction after cataract surgery may take up to 3 months to recover, whereas this can be accomplished in 1 month in non-diabetic patients.[50] **Level IIb**

B Look out for a history of bone marrow transplantation, as patients with chronic graft versus host disease may have no health problems other than severe dry eye, and may require aggressive treatment for dry eye before cataract surgery.[51] **Grade B, Level III**

B There have been reports of intractable dry eye in patients who had anti-depressant therapies post LASIK.[52,53] Although there is no specific evidence, it is recommended that cataract surgery be performed with caution in such patients. **Grade B, Level III**

B As the extent of post-cataract surgery tear lipid thinning and meibum dysfunction are related to severity of MGD, it is recommended that an eyelid examination for MGD be performed prior to any cataract surgery, and lid function optimized preoperatively if significant MGD is present.[11] **Grade B, Level IIa**

B A history of blepharoplasty should be noted prior to LASIK since these patients may have poor blinks or even mild lagophthalmos that may not be evident until the patient lies down.[54] **Grade B, Level III**

B Neuropathic pain after LASIK and other ocular surgeries is a well-described phenomenon. Patients with previous episodes of migraines, trigeminal neuralgia, fibromyalgias, allodynia, and herpes zoster may be at greater risk of developing neuropathic pain. The symptoms of neuropathic pain may be indistinguishable from dry eye after surgery and may persist

long after the resolution of tear-related problems. It is recommended that refractive surgery be avoided unless there can be co-management with neurologists and appropriate precautions (such as prophylactic gabapentin) have been implemented.[55] **Grade B, Level III**

4.3 Assessment of Preoperative Tears and Corneal Function

Traditional tests of dry eye such as Schirmer's test, TBUT, and fluorescein dye staining have been demonstrated to be effective in detecting preoperative dry eye as a risk factor in the development of chronic dry eye post LASIK. Pre-LASIK Schirmer's test scores are correlated with postoperative TBUT (r=0.502) for up to 9 months. Also, a Schirmer I score of <10 mm (at 5 minutes) has 1.6 (95% CI 1.1–2.3) times risk of developing dry eye at 1 month after LASIK.[56] There is insufficient evidence to recommend Rose Bengal dye staining for preoperative assessment. **Level III**

Corneal sensitivity may be performed if the surgeon suspects any reason for reduced corneal sensation. This may be performed with a Cochet-Bonnet esthesiometer, but there has been no study indicating a correlation between preoperative corneal sensitivity and postoperative tear function (Fig.6).[14] **Level III**

Fig. 6. Corneal sensitivity test with Cochet-Bonnet esthesiometer

B In the context of pre-LASIK assessment, a point-of-care device for tear matrix metalloproteinase-9 levels may be used if available. Patients who test positive should receive ocular surface therapy and anti-inflammatory treatment for dry eye even if the other clinical signs are subtle.[57] **Grade B, Level III**

B The performance of tear osmolarity tests prior to refractive surgery has been found to be useful, and can be used to detect patients who need tear and ocular surface treatment pre-surgery.[58] **Grade B, Level III**

B In cases with raised tear osmolarity, where keratometry readings for cataract planning may be highly variable and not accurate, it is recommended that assessment be repeated when tear status has returned to normal.[59] Patients with tear osmolarity above 316 mOsm/L in at least one eye were compared to those with osmolarity below 308 mOsm/L in both eyes.[59] **Grade B, Level II**

5 SURGICAL CONSIDERATIONS

5.1 Laser Refractive Surgery

Comparison of LASIK, SMILE, and surface ablation

Compared to SMILE, femtosecond LASIK is associated with significantly more dry eye symptoms and lower corneal sensitivity at 6 months post-surgery (meta-analysis).[60] **Level Ia**

Comparison of PRK (photorefractive keratectomy) and LASIK

Patients have better postoperative tear function in terms of higher Schirmer's test score and TBUT, but suffer more severe dry eye symptoms and poorer wound healing.[22] The reason for this discrepancy between signs and symptoms can be explained by the finding that corneal sensitivity was more significantly impaired in LASIK patients.[61] Hence, while patients have poorer tear function after LASIK, their corneas are less sensitive and they suffer fewer symptoms. **Level III**

LASEK and epiLASIK

Compared with LASIK, LASEK and epiLASIK showed better postoperative tear secretion in patients.[62,63] **Level III**

LASIK

LASIK flap hinge position (horizontal/vertical) has minimal effect on the severity of dry eyes in the postoperative period.[64] **Level Ib**

There is no significant difference in either symptoms or tear function between microkeratome and femtosecond laser procedures.[65] **Level Ib**

5.2 Cataract Surgery

Transection of corneal nerve fibers during cataract surgery results in decrease in corneal sensitivity and aqueous tear-deficient dry eye.[66] Corneal sensitivity can recover to preoperative levels with time with larger incisions taking a longer time than smaller incisions.[66,67] **Level Ib**

The location of the incision does not significantly affect dry eye markers.[31] **Level III**

Prolonged microscopic light exposure has been correlated with reduced TBUT and worsening symptoms.[31] Exposure time is negatively correlated to TBUT (R=–0.496) and symptoms of dry eye (R=0.459) at 1 day after surgery, particularly for patients with dry eye symptoms and poorer Schirmer's test before cataract surgery. Unfortunately, the range of operative exposure time was not provided in the paper.[10] **Level III**

Inflammation plays a key role in the pathogenesis of dry eye disease.[68] Cataract surgery has been shown to increase inflammatory cytokines in lacrimal tears.[69] **Level Ib; Level III**

Topical anesthetics and preservative-containing eyedrops contribute to the inflammatory reaction and dry eyes.[70,71] **Level Ib**

Studies show that there is a reduction of goblet cells after cataract surgery.[67] **Level Ib**

Studies show that cataract surgery can alter meibomian gland function despite a lack of structural changes.[9] **Level III**

6 POSTOPERATIVE MANAGEMENT OF DRY EYES

6.1 Artificial Tears

GPP The first-line treatment for dry eye symptoms after cataract and refractive surgery is the use of artificial tears. Artificial tear preparations containing various polymers such as cellulose derivatives, hyaluronic acid, and polyvinyl alcohol have been effective in alleviating symptoms of dry eyes after cataract surgery.

6.2 Preservative-free Artificial Tears

The most common complication of LASIK is dry eyes, and virtually all patients develop some degree of dryness in the immediate postoperative period.

GPP Preservative-free artificial tears are recommended in the postoperative management of dry eyes after LASIK/refractive surgery.

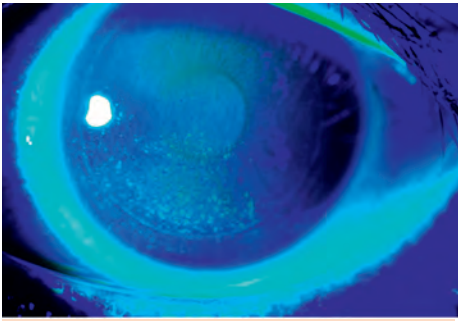

Fig. 7. Post LASIK dry eye with punctate epithelial erosions staining with fluorescein dye. The edge of the LASIK flap can be seen.

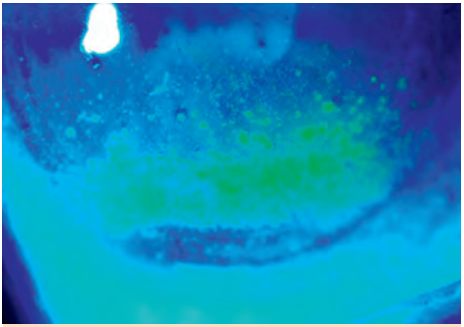

Fig. 8. This is a 55-year-old Chinese woman who had LASIK done 10 years ago in her right eye. After the procedure, she was diagnosed with rheumatoid arthritis and secondary Sjögren's syndrome, and LASIK was not done in the other eye.

A The use of carboxymethylcellulose (CMC) artificial tears demonstrated better early postoperative tear film stability than and less ocular surface staining than hydroxypropyl methylcellulose (HPMC) artificial tears.[72] **Grade A, Level Ib**

C If MGD is present, lid hygiene, warm compress, nutritional supplements, topical azithromycin, and oral doxycycline have been found effective for post-LASIK patients.[33,73,74] **Grade C, Level IV**

6.3 Oral Antibiotics

GPP Tetracyclines and macrolides have anti-inflammatory properties and are effective in the treatment of MGD and blepharitis cases that do not respond to lid hygiene practices.

B Azithromycin is able to normalize the lipid profile and relieve meibomian gland orifice plugging.[75] **Grade B, Level III**

6.4 Punctal Plugs

B In aqueous deficiency dry eye, post-LASIK punctal plug treatment improved tear film stability, symptoms and visual acuity (Fig. 9).[76] **Grade B, Level III**

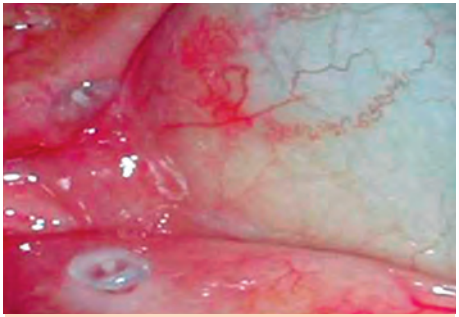

Fig. 9. Permanent punctal plugs inserted into the upper and lower puncta

A Patients with punctal plugs may benefit from adjunctive topical cyclosporine A due to prolonged retention of the medication on the ocular surface.[77] **Grade A, Level Ib**

6.5 Topical Autologous Serum

Topical autologous serum has been shown to reduce corneal epithelial erosions and improve post-LASIK tear film stability more effectively than artificial tears.[78] **Level Ib**

6.6 Topical Cyclosporine A

B Topical cyclosporine A improved tear breakup time and Schirmer's test score after cataract sugery.[79] **Grade B, Level IIa**

Cyclosporine A therapy not only reduced dry eye signs including ocular surface staining but also improved visual quality such as visual acuity and contrast sensitivity after multifocal intraocular lens implantation.[80] **Level IIb**

Topical cyclosporine A has been shown to improve tear secretion in post-LASIK patients compared with artificial tears.[39] **Level Ib**

Perioperative cyclosporine 0.05% treatment provided greater refractive predictability 3 and 6 months after LASIK than artificial tears and was effective for reducing the time needed for visual recovery after LASIK.[39,81] **Level Ib; Level III**

After LASEK, topical cyclosporine A 0.05% can also improve ocular discomfort and increase tear film breakup time during the early postoperative period, especially in patients with preoperative dry eye.[82] **Level III**

Clinical trials using topical cyclosporine A for dry eye disease show improvements in dry eye indicators such as symptoms, corneal staining, Schirmer's test values,[83] reduction in inflammatory cells[84] and markers[85] as well as an increase in the number of conjunctival goblet cells.[86] **Level Ib; Level III**

6.7 Topical Steroids and Nonsteroidal Anti-Inflammatory Eyedrops

A Topical steroids and nonsteroidal anti-inflammatory eyedrops are common anti-inflammatory medications prescribed after cataract surgery. They are usually tapered after 1 month. Long-term steroid use is not recommended due to side effects such as elevated intraocular pressure.[87] With persistent dry eye symptoms, another short-term course (2–4 weeks) is effective in relieving the symptoms.[87] **Grade A, Level Ib**

Nonsteroidal anti-inflammatory eyedrops may cause corneal melting especially in patients with severe ocular surface disease.[88] **Level IV**

6.8 Eyelid Warming Therapy

B Eyelid warming treatment (warm towel, lid warming devices) is effective in reducing dry eye symptoms. A particular lid warming device was shown to improve postoperative symptoms Ocular Surface Disease Index (OSDI), tear film stability (TBUT), and tear lipid layer thickness (interferometry)[19] in patients with persistent dry eyes for more than one year after LASIK. **Grade B, Level III**

6.9 Thermal Pulsation Therapy

Thermal pulsation therapy is effective in relieving obstructive meibomian gland disease and restoring meibomian gland function.[89] The effects of a single treatment may last for up to 1 year.[90] **Level Ib; Level IIb**

If thermopulsation treatment is considered, it is prudent to first investigate if there is likely to be marked benefit in view of the costly nature of the thermopulsation. Such investigations can be in the form of meibography as extensive dropout of meibomian glands may limit the expected benefit of thermopulsation.

6.10 Lipid-Containing Emulsion Eyedrops

Eyedrops containing lipids such as phospholipids, triglycerides, and castor oil are effective in patients with MGD.[91] **Level Ib**

6.11 Mucin Secretagogues

The use of mucin secretagogues showed statistically significant improvement in objective markers of dry eye[92] and these effects are superior to that of artificial tears.[93] **Level IIb; Level Ib**

Diquafosol 3% treatment led to an improvement in tear film stability and subjective symptoms of dry eye after cataract surgery and the diquafosol-treated group showed significantly superior tear film breakup time, corneal fluorescein, and conjunctival staining compared to the sodium hyaluronate-treated group.[94,95] **Level Ib**

Topical diquafosol 3% is effective in treating dry eye disease after cataract surgery with improvement of visual function by decreasing higher-order aberrations.[96] **Level Ib**

Topical diquafosol improves the subjective and objective symptoms of persistent dry eye after LASIK.[97] **Level III**

Hyaluronate and diquafosol combination therapy is beneficial for early stabilization of visual performance and improvement of subjective dry eye symptoms in patients after LASIK.[98] **Level Ib**

6.12 Therapeutic Agents under Research

Eye platelet rich plasma (E-PRP) has been shown to reduce punctate epithelial erosion, increase tear film stability, and improve visual acuity following surgery.[99,100] **Level Ib**

Ophthalmic gels consisting of protein-free calf blood extract and recombinant bovine basic fibroblast growth factor (r-bFGF) have shown clinical efficacy in the treatment of LASIK-induced dry eye although the long-term safety profile has not been reported.[101,102] **Level Ib**

CONCLUSION 7

Dry eye disease after cataract and refractive surgery is common and may be due to a combination of direct damage due to surgical factors, such as corneal incisions and ocular surface manipulations, and indirect damage from the ensuing inflammation. The dry eye symptoms are worst in the immediate postoperative period and tend to recover over time (usually after a few months). A small percentage of these patients continue to have persistent dry eyes and these tend to have preoperative risk factors.

It is important to manage patients with the appropriate treatment for their dry eye disease. It is also important to identify and treat susceptible patients prior to surgery to achieve an optimal outcome.

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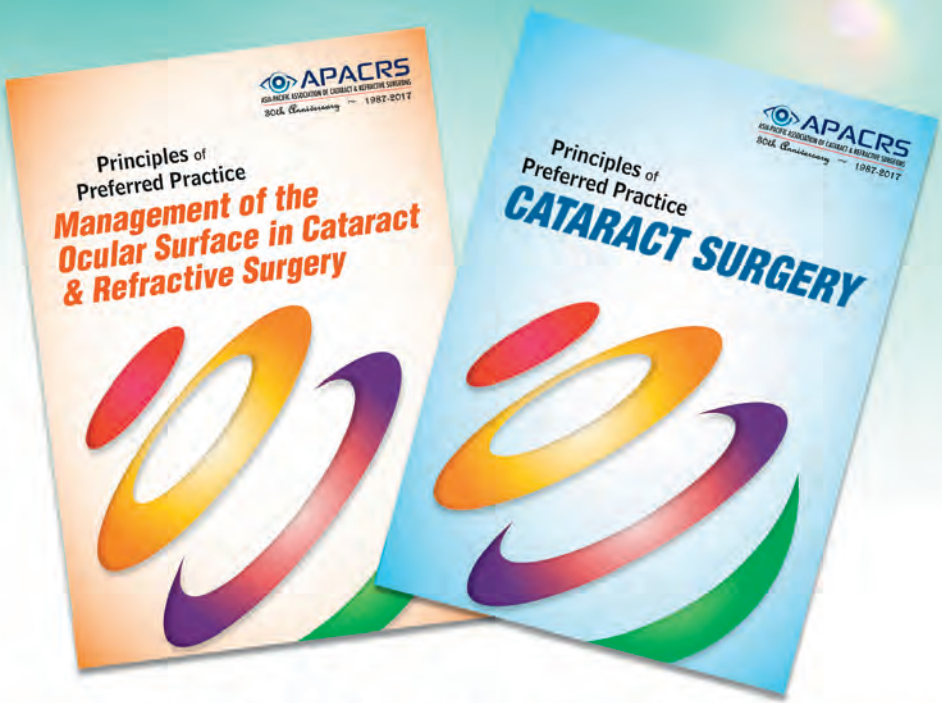

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