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Clinical Editor, *Pharma*

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December 2015

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Coloured scanning electron micrograph (SEM) of *Demodex folliculorum* or eyelash mites protruding from a human hair follicle. Magnification x760 at 21 cm wide. Science Photo Library

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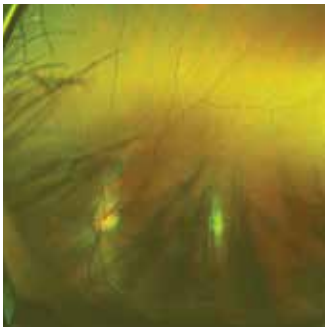

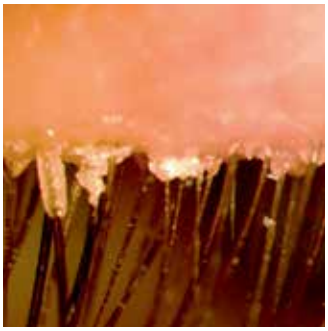

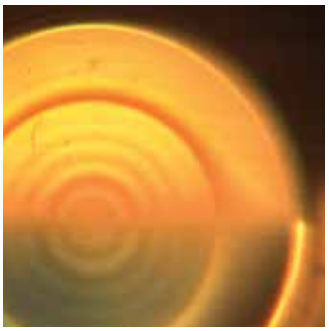

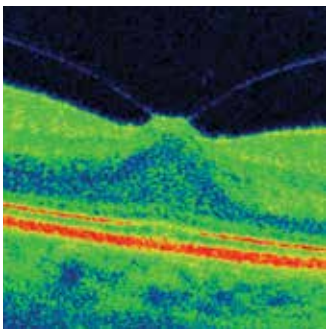

Contact lens prescribing trends 2015

The Efron, Morgan and Woods 16th annual survey of Australian contact lens prescribing habits

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THE 16TH ANNUAL survey of Australian contact lens prescribing was conducted from January to April 2015. The same format as in previous years was employed. An e-mail was sent to all members of Optometry Australia with a link to a downloadable questionnaire, and a request that this be accessed, printed and completed to provide details of the first 10 patients fitted with contact lenses after receipt of the questionnaire.

The survey was specifically designed to be straightforward to complete while capturing key information about their patients. Practitioners were asked general questions about themselves. For each contact lens fitting, they were requested to complete the following details: date of fitting, new fitting or refitting, age and sex of patient, lens material, lens design, frequency of replacement, times per week of wear, modality (daily or extended wear) and care system. Practitioners were asked to return the questionnaire by fax, post or e-mail.

Completed questionnaires relating to 353 contact lens fittings were returned, which provides a sound basis for a meaningful analysis. Each fitting was given a weighting based on the number of lenses fitted per year by the practitioner, based on the date information on the form. This means that data generated by practitioners who have a higher frequency of fitting contact lenses were afforded a higher weighting than those taking longer to fit the 10 patients with lenses.

This discussion concentrates primarily on data relating to new lens fittings as opposed to refittings. We believe that new fittings are a more sensitive barometer of current patterns and future trends, whereas refittings are more indicative of previous fitting behaviours.

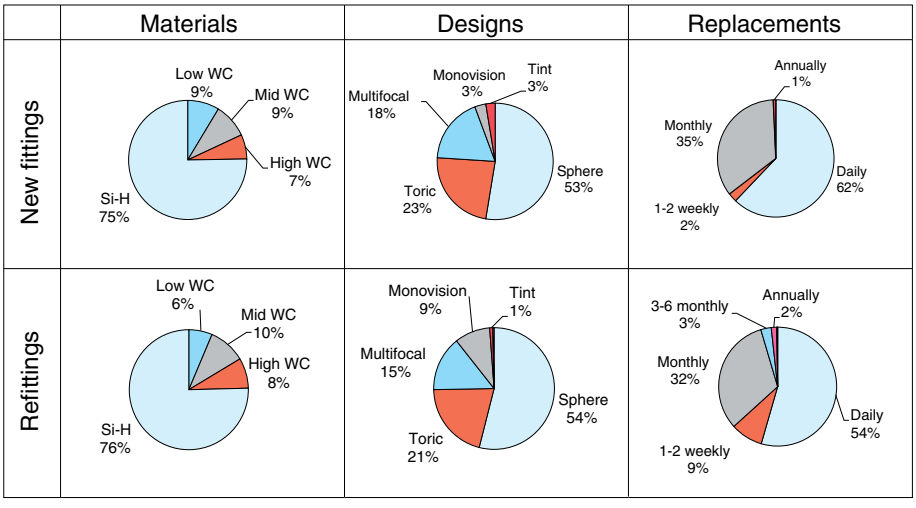
In keeping with other markets around the world,[1] the majority of lenses (62 per cent) were fitted to females. The average age of contact lens wearers at the time of fitting was 32.2 ± 16.5 years. The age at fitting ranged from eight to 75 years.

Soft lens materials and designs

Soft lenses are still the main type of contact lens fitted, accounting for 95 per cent of new fittings. Figure 1 is a composite of pie charts detailing the key findings of the 2015 survey in relation to soft lenses. Silicone hydrogels are still the dominant material, representing 75 and 76 per cent of materials prescribed as new fittings and refittings, respectively, which is broadly consistent with 2014 data[2] (79 and 76 per cent). The balance is more or less evenly split between low-water, mid-water and high-water content hydrogel materials.

A surprise in this year's survey is the apparent increase in the use of low-water content hydrogels (nine per cent of new fittings and refittings), which were prescribed for zero per cent of new fittings and only two per cent of refittings in 2014.[2] The reason for this is unclear.

The major categories of lens designs are spherical, toric, multifocal, monovision, coloured (tinted) and



▲ Figure 1. Detailed results for soft contact lens prescribing in the 2015 Australian survey
Si-H = silicone hydrogel, WC = water content

The number of patients with soft multifocal lenses continues to grow in an essentially two-modality market dominated by daily and monthly lenses

anti-myopia. Spherical designs represent a small majority of new fittings (53 per cent). About one quarter of soft lenses prescribed are in toric form (23 per cent of new fittings and 21 per cent of refittings).

Continuing improvements in soft multifocal lens designs over the past decade have resulted in strong prescribing figures for these lenses. This year, multifocal lenses represent 18 per cent and 15 per cent of new fittings and refittings, compared with 11 per cent and eight per cent, respectively, in 2014.[2]

It is evident that multifocals are preferred over monovision lens wear for correcting presbyopia. This year, there have been six times more presbyopic new fittings with multifocal lenses (18 per cent) compared with monovision lenses (three per cent).

Coloured (tinted) lenses represented three per cent of new fittings and one per cent of refittings, which is up on last year's result[2] where there were no recorded fittings with these lenses.

This may be attributed to the recent emergence of coloured soft lenses made from silicone hydrogel materials in the market.

Anti-myopia lenses incorporate special designs for arresting the rate of progression of myopia.[3] No anti-myopia lens fittings were recorded, which perhaps is not surprising because these lenses are still in the experimental/development phase, and the single product now on the market (MiSight, CooperVision) is not yet commercially available in Australia.

Soft lens replacement and wearing modality

The proportion of soft lenses prescribed for daily replacement continues to rise relentlessly in the Australian market (Figure 2). This lens category is now the overwhelming majority of fittings by replacement frequency, accounting for 62 per cent of new fittings. The balance of new fittings comprises largely monthly replacement lenses (35 per cent), with the fitting with one to two weeks replacement lenses having declined in recent years, from 21 per cent in 2012[4] to only two per cent this year. Only one per cent of lenses were being replaced less frequently than monthly.

Multi-purpose solutions remain the lens care option of choice for those wearing reusable lenses, representing 91 per cent of prescribed care regimens. The balance is made up almost exclusively of peroxide systems.

Extended wear lenses represented four per cent of new soft lens fittings in 2015, so single use lenses (in other words, extended wear and daily disposable lenses combined) represented 66 per cent of new soft lens fittings this year. As we have noted previously, the increasing dominance of single-use lenses does not augur well for the soft contact lens solutions industry.

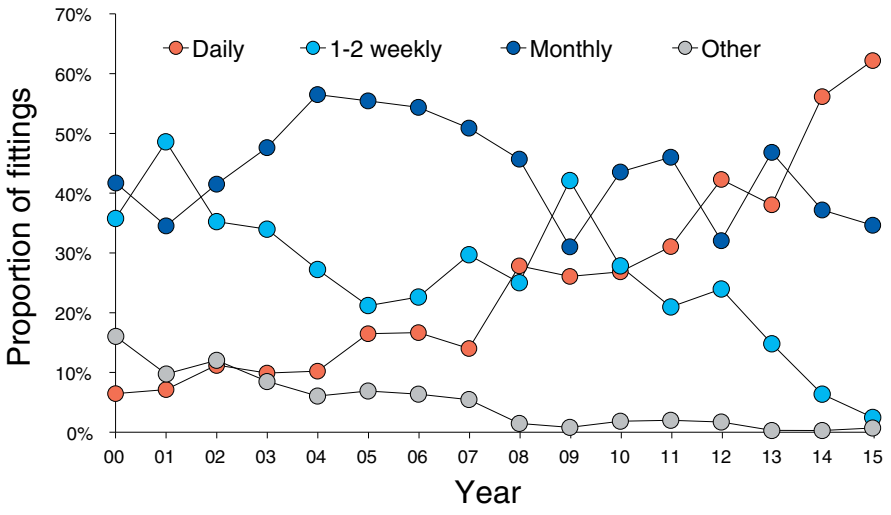
Rigid lenses

Conventional and orthokeratology rigid contact lenses represented four per cent and two per cent of all contact lens fittings, respectively. Because of the low level of rigid lens fitting in Australia at present, a valid statistical analysis of sub-categories of materials, designs and replacement frequencies cannot be undertaken. The limited extent of orthokeratology fitting in Australia is probably due the specialist nature and complexities of this fitting activity.

Australia versus the world

We currently survey contact lens fitting in about 40 countries annually.[1] This provides an opportunity to benchmark Australian trends against international colleagues. This year we compared contact lens prescribing with that of the world average.

The current pattern of contact lens



▲ Figure 2. Percentage of soft lens new fittings prescribed according to replacement frequency in Australia between 2000 and 2015

Continued page 4

Prescribing trends 2015

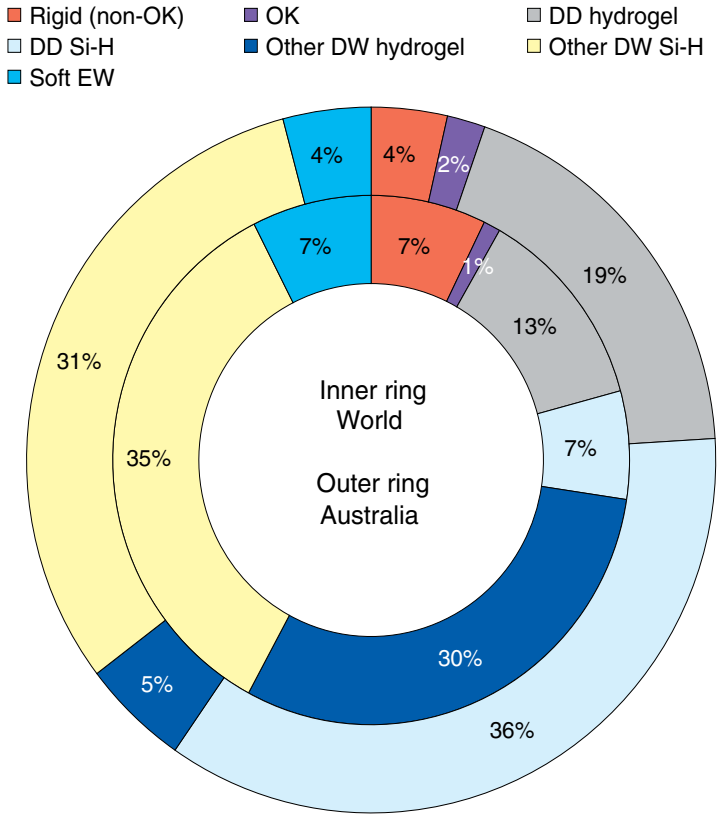
From page 3

fitting in Australia versus the rest of the world is shown in Figure 3. Six key categories of lens type are represented. The outer and inner rings display the Australian and world data,[1] respectively.

Overall, Figure 3 reveals some differences in contact lens prescribing patterns between Australia and the rest of the world. Perhaps the starkest difference is seen in the prescribing of daily disposable lenses, which are represented by the combined grey (daily disposable hydrogel) and light blue (daily disposable silicone hydrogel) arcs. The extensive prescribing of daily disposable lenses in silicone hydrogel materials appears to be the main reason for this outstanding performance.

Rigid contact lenses have been losing ground in Australia for many years as a lens of first choice and are largely prescribed as a speciality lens for solving difficult cases. Although new information on orthokeratology continues to be published and discussed at conferences, this apparent interest has not translated into clinical practice, with this modality representing only one per cent of contact lens prescribing around the world[1] and two per cent in Australia.

Extended wear lenses represent four per cent of contact lens fittings in Australia and seven per cent in the rest of the world.[1] This indicates small but on-going interest in this modality, but perhaps not enough to warrant sufficient industry investment in research directed at further reducing the risk of microbial keratitis during overnight lens wear.



▲ Figure 3. Percentage of all contact lenses prescribed in Australia (outer ring) compared with the rest of the world (inner ring). DD = daily disposable, DW = daily wear, EW = extended wear, OK = orthokeratology, Si-H = silicone hydrogel

Conclusions

The highlight of our 2015 survey is the relentless rise in the prescribing of daily disposable lenses, at the expense of one to two weekly lens replacement. The market is now essentially polarised into a two-modality market: daily and monthly lens replacement. Silicone hydrogels remain the material of choice, representing three-quarters of all soft lens fittings. Taking these two factors together leads to the inescapable conclusion that daily disposable silicone hydrogel contact lenses are likely to continue to dominate the contact lens market in Australia and probably the world for the foreseeable future.

The emerging presbyopes of 'Generation X' (now aged early-30s to mid-40s) are hot on the heels of the already-presbyopic 'Baby boomers' (aged roughly 47 to 65), and it has been a struggle for the contact lens industry to properly cater for the vision needs of these growing demographic cohorts. The high rate of prescribing multifocal lenses recorded in the 2015 survey is perhaps an indication that as a profession and as an industry, we are rising to the challenge.

Other noteworthy market trends in summary are:

- On-going high rates of toric contact lens prescribing, indicating continuing practitioner confidence in this modality
- Hints of a possible re-emergence of interest in coloured lenses
- Apparent industry and practitioner caution in relation to purposeful prescribing for arresting the progression of myopia
- General lack of clinical interest in orthokeratology fitting. ▲

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Patient compliance and dry eye

Improved outcomes start with a willingness to engage

Margaret Lam BOptom

NSW president, Cornea and Contact Lens Society of Australia

Visiting lecturer, School of Optometry, UNSW

Director, theeyecarecompany Sydney NSW

A TRANSITION is underway from the commonly used term 'compliance', meaning submitting to the authority and directions from a medical professional, to 'adherence', implying greater ownership by the patient of their own care and an emphasis on shared decision-making in a patient's management plan.

Semantic dispute aside, non-compliance is a major obstacle to the effective delivery of health care. True rates of non-compliance are hard to measure but the best estimates find that irrespective of disease, prognosis or settings, about 30-50 per cent of patients are non-compliant.[1,2,3,4,5]

When it comes to dry eye management, Swanson has shown that patients with dry eye disease will have a natural tendency to *not* adhere to a prescribed management plan from their eye-care practitioner, but will largely self-medicate according to their symptoms.[6]

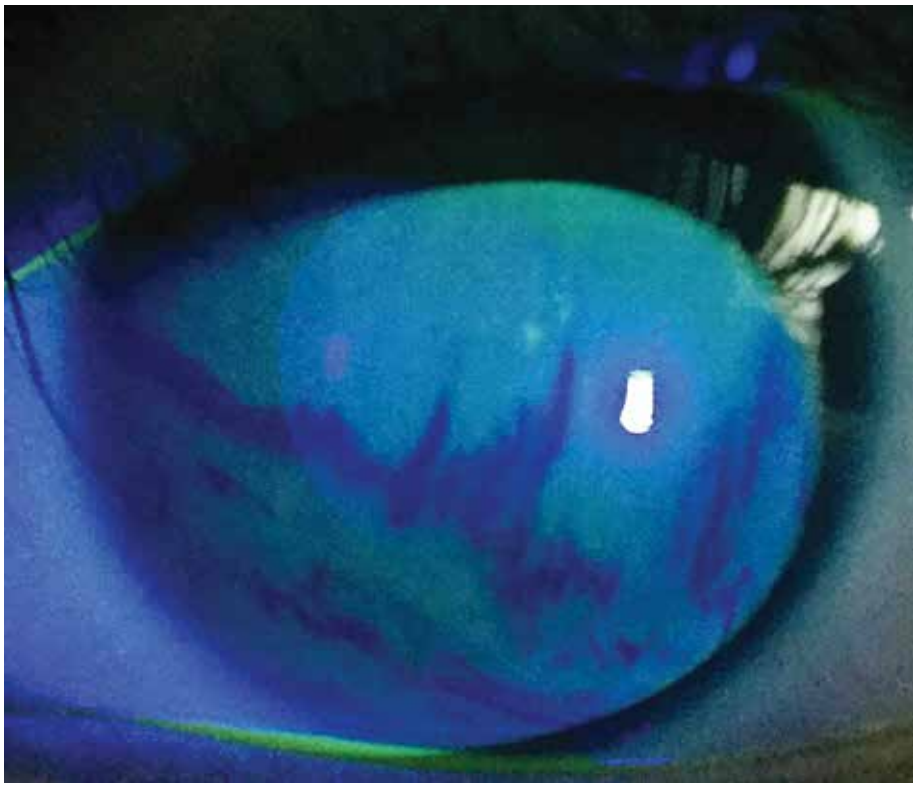
Patients believe that non-compliance does not cause life or death consequences, yet we know that their non-compliance can exacerbate dry eye symptoms, which can lead to a debilitating, painful and severe condition.

Effective communication

It has been shown that lower compliance can be expected in many situations: when a health condition is chronic, if the course of symptoms varies or when symptoms are not always apparent, if a regimen requires complex instructions, and when a treatment regimen requires lifestyle changes.[7]

Any one of these factors can produce a considerable challenge in disease management. In dry eye disease management, all of these are factors. Compounding this, the patient may sometimes simply have difficulty with fundamentally understanding their dry eye condition.

Engaging a patient with a relatable analogy is one of the keys to a successful take-home message and adherence. Having had no time to repair my car's windscreen wiper's pump and lubricating system for more than a year, I was often subjected to the god-awful screech of the dry windscreen wiper. I have found that is an effective analogy for dry eye.



▲ Vertical breaks in the tear film are indicative of evaporative dry eye and therefore, it is worthwhile emphasising the necessity of the use of ocular lubricants

Prescribe preservative-free ocular lubricants

It is well established that the use of ocular lubricants is useful in reducing both symptoms and clinical signs of dry eye;[8] however, there is also considerable evidence on the disruptive and damaging effects on the corneal epithelium and ocular tear film of preservatives in ocular lubricants, particularly benzalkonium chloride (BAK).[9,10]

Newer preservatives have a slightly better safety profile but do not entirely prevent damage to the corneal epithelium.[11]

It has been recommended that because preservative effects disrupt the corneal epithelium at higher concentrations, use of eye-drops containing preservatives should be limited to no more than 4-6 times a day.[12]

Although we know preservative-free ocular lubricants represent best practice prescribing, continual use of preservative-free ocular lubricants for patients can be a considerable hindrance due to the increased cost—especially for patients who require multiple treatment types to address the causes of their dry eye syndrome.

This is where preservative-free ocular lubricants such as Hylo-Fresh (0.1% sodium hyaluronate w/v, 10 mL), and Hylo-Forte (0.2% sodium hyaluronate w/v, 10 mL) play an essential role in the management plan for dry eye patients.

Sodium hyaluronate is the active ingredient in Hylo-Fresh, which is perceived by patients to be 'lighter', and Hylo-Forte, which is four times more viscous and lasts longer but potentially causes blurriness on instillation. It is a naturally-occurring lubricant that is normally synthesised in the body for joint lubrication.

The continuous mono-dose (COMOD) application system, which can be challenging for patients to master initially, is innovative in that it ensures no 'backwash' on application and so can provide a preservative-free lubricant for up to six months from first application.

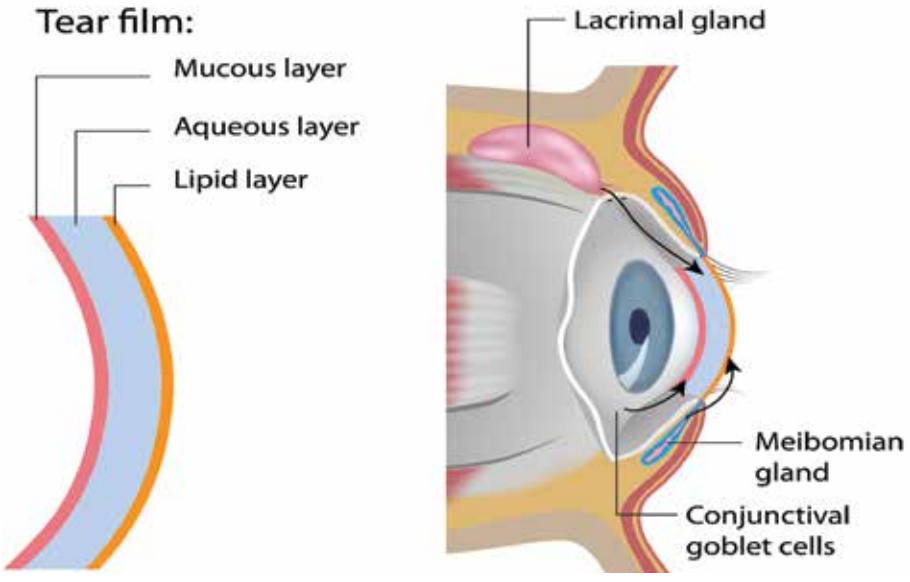
It is important to note that it is best prescribed to patients by demonstrating the COMOD pump, with its one-way delivery valve applied much like an asthma puffer. Each bottle contains 300 applications, or 150 for each eye.

Conclusion

This medical care model is evolving for optometry. I encourage optometrists to engage more frequently with patients in a dynamic, responsive way, which will allow for more open discussions on the importance of adherence and how it can be improved.

When patients and optometrists work with agreed management guidelines, it allows for the implementation of new treatments that can make better outcomes possible, such as preservative-free ocular lubricants.

The first step towards improved patient outcomes for those with dry eye disease is willingness on the part of the optometrist to engage and educate their patient, and a patient willing to adhere to the agreed management plan. ▲



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Osmolarity testing for dry eye

Dr Jim Kokkinakis

BOptom FAAO ISCLS

The Eyepractice, Sydney

FOR THE MOST PART, optometrists treat dry eye as a symptomatic disease, yet research has shown that relying on symptoms alone may lead to misdiagnosing 40 per cent of patients.[1]

I liken dry eye management to piecing together a very large jigsaw puzzle. Like any puzzle, the more assumptions you can test by gathering data points along the way, the more complete the picture will begin to look.

Analysing my patients' tears for their level of osmolarity gives me another data point that allows me to build a better picture of a patient's ocular surface and their level of dry eye disease.

When we look at the other diagnostic tools for screening dry eye disease, the research indicates that measuring osmolarity is a superior predictor of dry eye.[2,3] Tests like TBUT or corneal staining, although very useful, diagnose later-stage signs after the disease has progressed.

As the DEWS 2007 report pointed out, hyperosmolarity is a leading indicator for dry eye.[4] The challenge in measuring osmolarity is that it cannot be seen, it can only be measured through a lab-on-chip device. Currently, the best and only way to test for hyperosmolarity in a practice setting is the TearLab system.

The osmolarity test indicates whether a patient's tears have a higher than normal salt content; when the aqueous declines, the concentration of salt in the tear will increase. The higher the measurement, the 'drier' the eye.

This concentration level is measured in milliosmoles per litre (mOsmol/L), where a reading of > 308 mOsmol/L requires further investigation. A low reading with an inter-eye difference of +/-8 mOsmol/L is also deemed abnormal and also requires further investigation.

Knowing my patient's osmolarity level helps me navigate through the different treatment options available, even to the point of deciding which artificial tear I will prescribe for a particular patient based on their osmolarity level. For example, patients with elevated osmolarity (> 308) are going to respond better to an artificial tear that has a lower osmolarity level such as Hylo-Fresh (AFT), Blink (AMO) or TheraTears (Akom).[5-7]

CASE REPORT 1

Dry eye symptoms with low osmolarity

MD, a 28-year-old female, presented with dry and irritated eyes. She had been suffering from these symptoms for 12 years and had seen many ophthalmologists and optometrists.

Our normal preliminary work-up includes tear film osmolarity, LipiView, OSDI questionnaire, eye-drop list, dry eye history, medication list and medical history.

▲ Figure 1. The TearLab osmolarity test for tear film

Often symptoms that can mimic dry eye disease, such as recurrent corneal erosions, floppy eyelid syndrome, blepharitis, meibomian gland dysfunction, filamentary keratitis, Salzmann's nodular degeneration and mucous fishing syndrome, can become quicker to isolate after first conducting an osmolarity test.[8] Patients with these symptoms will measure a low osmolarity level, which allows me to narrow my diagnostic focus.

Her preliminary work-up results were:

TearLab: OD 285 mOsmol/L; OS 291 mOsmol/L (> 308 is suspicious of dry eye).

LipiView: R 65 microns; 62 microns (> 80 is considered normal). Blinking frequency and quality were normal.

Ocular surface disease index (OSDI): 24 (on a scale from 0 to 100). In our clinic, where we deal with the worst cases, a score > 60 is the norm; > 33 is considered significant.

Current eye-drops: Systane Ultra (four times per day); Visine Clear (twice a day).

This is not the typical dry eye profile. Very few eye clinics have the LipiView, so if we take these results away, it still will make the clinician aware that they are possibly not dealing with dry eye. Chronic dry eye, especially with such a long time-frame should have an elevated osmolarity.

These results immediately direct us to a different line of questioning.

Q: What bothers you more about your eyes, the irritation or the redness?
A: The redness

Q: When are your eyes at their worst, in the morning when you wake up or as the day progresses?
A: On waking irritation is worst.

Q: Describe the irritation in more detail.
A: Continually have a pus-like discharge with a mild to moderate grittiness.

Continued page 10

Osmolarity testing for dry eye

From page 9

▲ Figure 2. Tear Osmolarity data (mOsm/L) quantifies ocular surface health

The answers to these questions lead us away from the typical evaporative and aqueous-deficient dry eye. There is little doubt that we have an ocular surface disturbance, which is supported by the following observations:

- Significant palpebral papillary response
- Lid eversion revealed very floppy lids
- Significant conjunctival staining, especially inferiorly, which was suggestive of fishing syndrome
- A mild superficial punctate keratitis

The likely compounded diagnosis is:

- Floppy eyelid syndrome
- Fishing syndrome
- Rebound hyperaemia with corneal toxicity from the tetrahydrozoline hydrochloride decongestant and the benzalkonium chloride preservative in the Visine Clear eye-drops.

Treatment of this dilemma is a huge challenge but the following need mentioning.

Floppy eyelid syndrome can be managed conservatively with non-irritating ointments and lid-taping overnight. In resistant cases, lid surgery might help. This condition is often associated with both sleep apnoea and keratoconus.[9]

Fishing syndrome is a rebound mucous discharge that occurs from the continual irritation to the conjunctival surface from trying to digitally 'fish out' the overflow of mucous. Treatment can be successful with preservative-free topical steroids and the strict resistance of digitally removing the mucous.[10]

Rebound conjunctival hyperaemia and the often associated preservative toxicity can be treated again with a tapering dose of preservative-free topical steroid and strictly refraining from using the decongestants.

Ultimately, education, encouragement and patient compliance are paramount to long term success.

High osmolarity with no dry eye symptoms

CASE REPORT 2

A 62-year-old male returned for a routine eye examination. His previous eye examination had been with our clinic about three years prior. When asked if there were any eye issues that were bothering him, he admitted to intermittent reading blur.

Refraction revealed a reading add increase of about +0.25 D in each eye. Intermittent reading blur in this age bracket can be associated with evaporative dry eye, so we also performed a TearLab osmolarity measurement and a fluorescein assessment of the ocular surface.

The following measurements and observations were made:

TearLab: OD 325 mOsmol/L; OS 321 mOsmol/L. This elevated reading indicates some type of dry eye.

Fluorescein assessment: tear film was unstable with virtually every blink. Invasive tear break up time was two seconds, at best. Thumb expression of the meibomian glands revealed a stagnant and viscous meibum.

Treatment of this type of case is usually simple. We chose to supplement the tear film with a hypo-osmotic lubricant (Hylo-Fresh) four times per day for a month and combined this with daily hot compresses and lid massage.

At review three months later, the patient was not using any drops but had continued the compresses and massage once per day.

Subjectively, vision was perceived as normal and TearLab results were back into the normal range of < 300 mOsmol/L in each eye.

Although vital, osmolarity testing should not be used on its own. As with any diagnosis, it provides a data point that can be combined with other findings—such as corneal staining, symptoms, meibomian gland expression and so on—to help you piece together the dry-eye puzzle. The sum total of these findings will improve your disease diagnosis and help you to tailor a management plan that will add value to your patients' visual outcomes and health.[11] ▲

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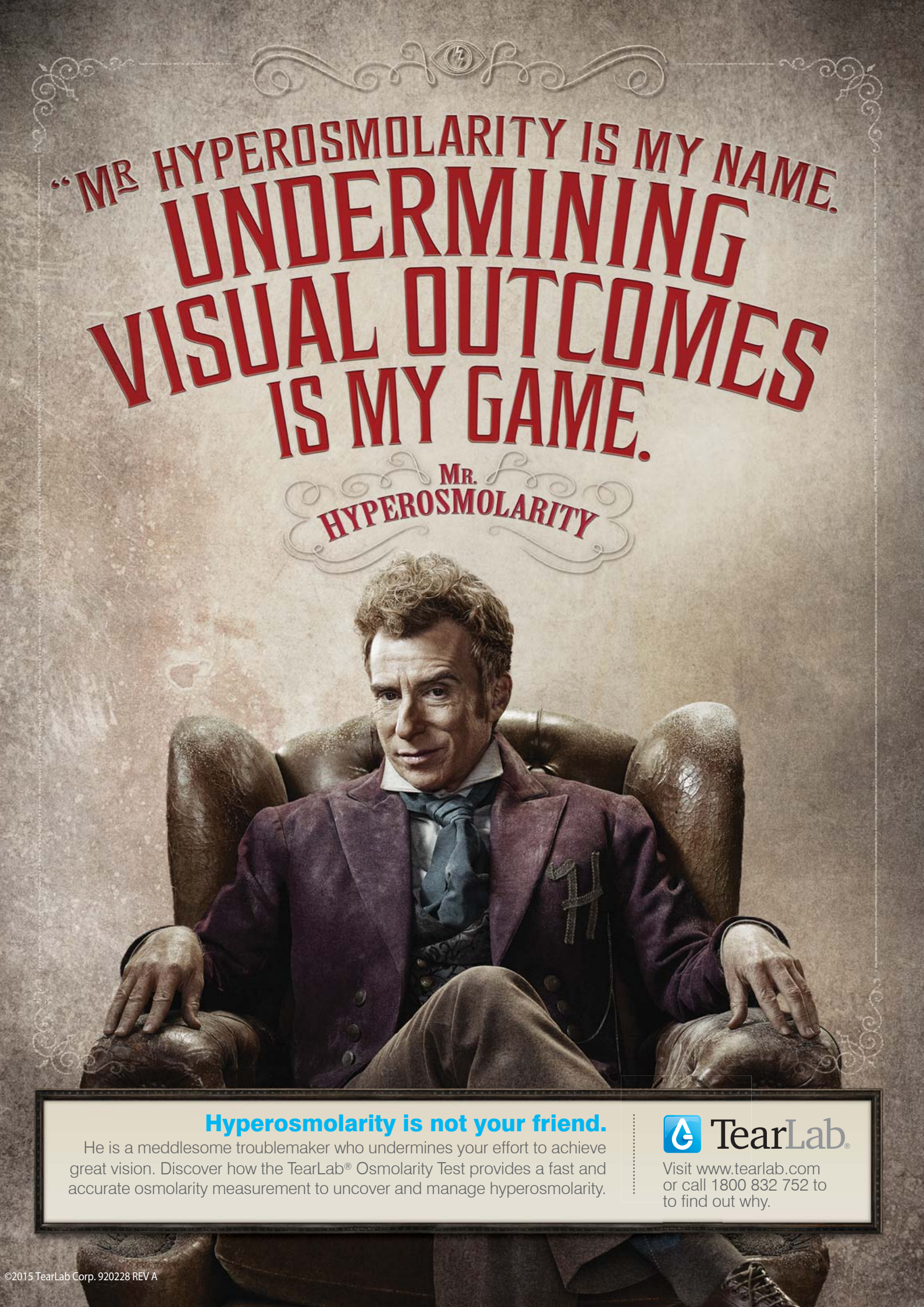
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Demodex blepharitis in a clinical practice

Dr William Trinh

BOptom BSc OD

DEMODEX BLEPHARITIS is frequently encountered in ophthalmic practices and often associated with other ocular surface diseases.[1] As this case report shows, it can be easily and effectively managed in any optometry practice.

CASE REPORT

A 74-year-old male presented to the practice, reporting that his eyes had often been itchy and irritated in the past few months, despite using Genteal eye-drops three or four times daily. The patient had an unremarkable medical history and did not take any systemic medications. His ocular history included mild bilateral cataracts and right eye posterior vitreous detachment.

On examination, his best corrected visual acuity was 6/12 R and 6/9 L, and intraocular pressures were 14 R and 13 L. Anterior examinations revealed numerous collarettes, which had the appearance of clear yellow cylindrical dandruff attaching to the eyelid margin and encircling the eyelashes (Figures 1 and 2). The condition was worse in the upper eyelid in both eyes, with moderately injected eyelid margins. Bulbar and tarsal conjunctivas were quiet and there was no superficial corneal erosion observed. There were moderate anterior cataracts, worse in the right eye.

Diagnosis

The patient was diagnosed with Demodex blepharitis and was given information regarding the treatment, which involved tea tree oil in office. The patient's consent was provided. Treatment of Demodex blepharitis was initiated with one drop of proparacaine into the conjunctiva fornix to reduce the irritation and burning sensation prior to applying tea tree oil (TTO) to the roots of upper and lower eyelashes with a cotton bud. The patient was instructed to close his eyes for five minutes.

After this period of time, the patient's eyelids were then re-examined and all the melted collarettes were wiped off with a fresh cotton bud. One drop of Prednefrin Forte 1% was instilled into the conjunctiva fornix to reduce the hyperaemia and the patient was prescribed hydrocortisone 1% ointment applied to the lid margins at night time and advised to continue Genteal eye-drops. At one week follow up, the patient no longer reported any symptoms of itchy or irritated eyes. On examination, there were no visible collarettes detected and the eyelids and conjunctiva were quiet (Figures 3 and 4).

Discussion

Demodex blepharitis is one of most common ocular conditions seen in eye-care practices. Most literature reviews show about 30 per cent[2,3] of all patients who come to see eye care practitioners have Demodex blepharitis and they are often associated with meibomian gland dysfunction (MGD), anterior blepharitis, vulgaris acne and rosacea.[4] Demodex blepharitis is found more commonly in the older population[5] and in nursing home environments.

Demodex blepharitis is caused by Demodex mites infecting the eyelid. Demodex mites are eight-legged ectoparasites that can live inside the lash of sebaceous glands and meibomian glands. Studies have shown that Demodex mites usually

▲ Figure 1. Right eye, day 1

▲ Figure 2. Left eye, day 1

migrate from a patient's face to the eyelid margins due to the increased sebum secretion from the meibomian glands.[6]

If Demodex blepharitis is left untreated, it can cause symptomatic blepharokerotoconjuntivitis such as chronic dry, itchy, irritated, gritty, stinging, burning, watery and red eyes. Therefore, to provide effective treatment it is important for eye-care practitioners to be familiar with Demodex blepharitis and associated conditions in order to provide accurate differential diagnosis and effective treatment

Demodex blepharitis can be easily and differentially diagnosed from other types of blepharitis on clinical examination by the appearance of cylindrical collarettes, which are made up of oil, eggs and dead skin. It is possible to extract the mites for slide microscopic examination, but this is generally regarded as unnecessary and time-consuming in the clinical setting.

To eliminate or improve Demodex blepharitis, it is required to eliminate or reduce the Demodex mite population on eyelids by physical removal, chemical killing or oxygen deprivation while also improving the skin condition on the eyelids by lid hygiene and anti-inflammatory medications.

In mild cases of Demodex blepharitis without symptoms, daily routine eyelid hygiene and warm compress are sufficient. In mild cases of symptomatic Demodex blepharitis, chloramphenicol ointment or hydrocortisone ointment should be added, depending on the associated other anterior or posterior blepharitis. In moderate to severe cases of Demodex blepharitis, TTO should be applied to eliminate the Demodex mites effectively.[7]

The exact mechanism of TTO on killing demodex is unclear; however, it is believed TTO compromises the mites cytoplasmic membrane, has an anti-inflammatory property and anti-cholinesterase activities.[8]

One hundred per cent TTO concentrated can be obtained from a local pharmacy and can be used in the practice as one-time treatment for patients. Commercially prepared TTO wipes (Cliradex terpinen 4-ol or Blephadex) can be prescribed for patients, especially for children, to use twice daily at home for one month. However, moderate-to-severe cases of demodex may require the TTO to be at full strength to be an effective agent as described in this case. The killing effect of TTO demodex mites is dose-dependent; 100 per cent, 50 per cent, 25 per cent and 10 per cent of TTO completely kills demodex mites in 3.7 minutes, 14.8, 34.7 and 150 minutes, respectively.[9]

The incidence of toxicity keratitis from 100 per cent concentrated TTO is generally not encountered as the TTO is applied only to the outer eyelid margins. Mild lid allergic reactions can occur in some patients and can be treated easily with topical steroids. The possibility of chemical irritation of TTO can be further reduced by the use of a disposable bandage contact lenses during the in-office procedure.

As with most chronic conditions, the recurrence of Demodex blepharitis is almost inevitable so regularly-scheduled eye examinations are very important.

Conclusion

Demodex blepharitis is a common yet easily-overlooked ocular condition encountered in ophthalmic practices. Optometrists' awareness and sound knowledge of Demodex blepharitis are important. A simple but effective treatment can be applied to manage the condition and improve our patients' quality of life. ▲

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▲ Figure 3. Right eye, post 7 days

▲ Figure 4. Left eye, post 7 days

Demodex blepharitis: new understanding, novel approach

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Evergreen Optical Carnegie

DEMODEX BLEPHARITIS is a common condition that is often overlooked, misdiagnosed and poorly treated. While Demodex mites can exist in the skin of asymptomatic patients, ocular infestation usually results in disorders of eyelashes, lid margin inflammation, meibomian gland dysfunction and blepharoconjunctivitis. In chronic, untreated cases, Demodex infestation can manifest as corneal disease, resulting in ocular pain, photophobia and vision loss.

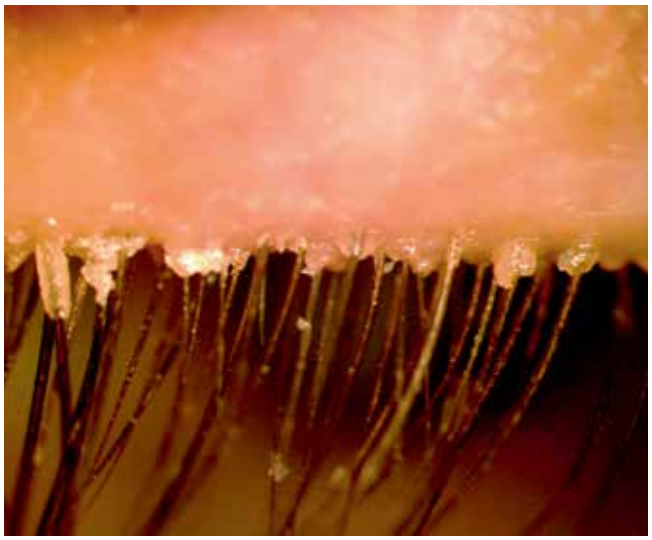
Two Demodex species have been identified to exist in humans: *D folliculorum* and *D brevis*. *D folliculorum* can be found in the eyelash follicle whereas *D brevis* live in the sebaceous glands and meibomian glands. Our current understanding is that these mites exist parasitically in human. Demodex mites can cause blepharitis by introducing bacteria including *Streptococci* and *Staphylococci*.[1] Bacterium living inside Demodex can also trigger a host immune reaction and even the dying mites can release bacterial antigens that can trigger a cascade of host inflammatory responses.

The main symptoms include itching, grittiness, crusty eyelashes, redness and irritation. While cylindrical dandruff around eyelashes is a sign of Demodex infestation, eyelash extraction and high-magnification microscope examination should be performed to confirm a diagnosis.

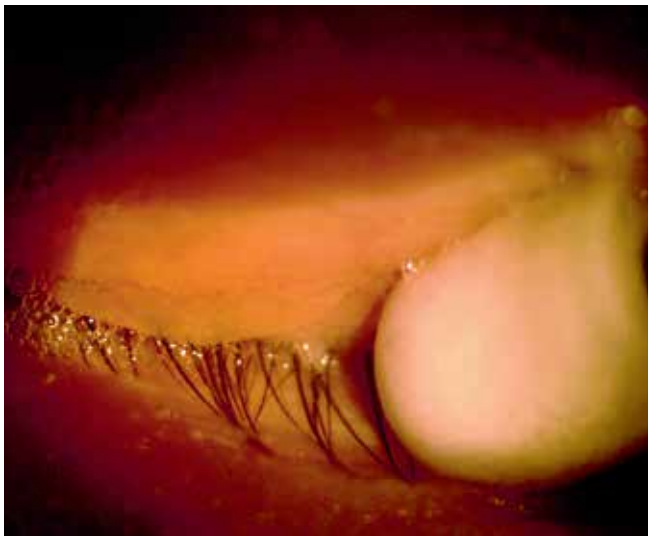
Conventional treatments involving baby shampoo can be effective in removing eyelash dandruff but have no miticidal effect. Antibiotics are important in reducing the bacterial load but have no direct effect on the Demodex mites. Tea tree oil treatment is currently the best way to kill Demodex *in vivo*.[2] Commercially available preparations are available for ocular use and these are essential for any practice-based or take-home treatment plan.

Take-home treatments can often be very effective with the right patient but without a practitioner-driven program and a practice-based strategy, even the most compliant patient can struggle to manage the condition.

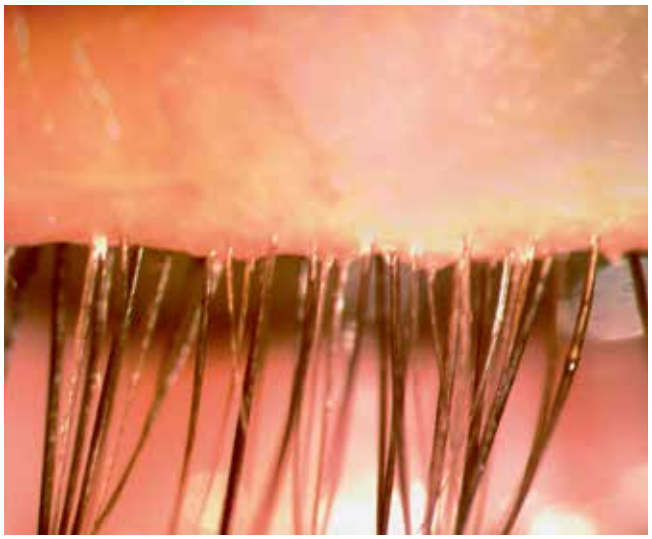
As an optometrist who has actively treated Demodex blepharitis for 13 years, one of my key challenges has been to effectively remove the mites from the eyelids and eyelashes. BlephEx is a hand-held electrical tool that drives a disposable micro-sponge to exfoliate the eyelid and eyelashes. Used in conjunction with a tea tree eye wash, great results can be achieved and should be central to any practice-based treatment.



▲ Figure 1. Before treatment



▲ Figure 2. Treatment with BlephEx



▲ Figure 3. After treatment

▲ Figure 4. Extraction of *D folliculorum*

CASE REPORT

A 42-year-old Caucasian female presented with a two-year history of irritated dry eyes. She noted that her discomfort had gradually worsened over the past two years, which she attributed to being tired.

Refraction revealed mild myopia and astigmatism. She was corrected to RE 6/4.8 LE 6/4.8 in the distance and N4 at near. Reading glasses were prescribed.

Slitlamp examination revealed inflamed lid margins with cylindrical eyelash dandruff. Tear break up time was RE 5s LE 4s and fluorescein staining showed mild superficial punctate keratitis. Infrared meibography revealed some meibomian gland atrophy, and eyelash examination with high-magnification microscopy confirmed Demodex.

This patient was diagnosed with Demodex blepharitis and meibomian gland dysfunction. A treatment plan involving practice-based treatments and a take-home regimen was prescribed.

Active tea tree cleaning was performed with BlephEx exfoliation, followed by a passive tea tree gel treatment, warm compression and meibomian gland expression. The patient was given instructions on lid hygiene with eyelid wipes with tea tree oil. At her four-week review, there were no signs of Demodex blepharitis. Tear break up time had improved to RE 12s LE 10s and there were no signs of superficial punctate keratitis. ▲

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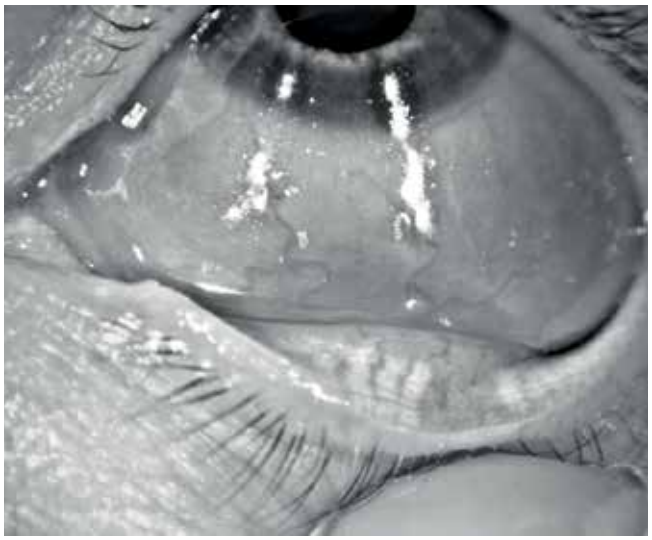

▲ Figure 5. Meibography

▲ Figure 6. *D folliculorum* pathology

Dry eye and contact lenses

Margaret Lam BOptom

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AT THE CLINICAL coal face, the presence of dry eye signs or symptoms in a contact lens wearer presents a chicken or egg conundrum. Did the dry eye signs and symptoms exist without the contact lens or were they induced by the contact lens?

Dry eye is a multifactorial ocular surface disease that can exist alone without the presence of a contact lens and as per the findings of the Dry Eye Workshop (DEWS) Report, contact lenses induce dry eye symptoms in as many as 50 per cent of wearers.[1] Then, in a confusing twist, when patients suffer from severe ocular dryness, the condition can be relieved by the prescription of bandage and scleral contact lenses.

This article highlights a few findings from key landmark papers in this field that can be useful to guide dry eye and contact lens management in clinical practice.

Interaction between contact lenses and the tear film

The 'dry eye' associated with contact lens wear consists of many tear film alterations and dysfunctions that are created when the thickness of a contact lens is interspersed into the much thinner tear film system. These changes can add to what is termed contact lens discomfort (CLD).

The DEWS Report found that, parallel to dry eye in general, in the non-contact lens wearing population, a hormonal association is suggested for dry eyes, with female wearers reporting symptoms at a rate roughly 50 per cent higher than in men.[2] Other associated factors include loss of corneal sensitivity, increased tear osmolarity, trigeminal denervation, shortened blink intervals and higher water content contact lenses.[2] In addition, the presence of the contact lens causes pre-lens lipid layer thinning of the tear film to mimic an evaporative dry eye.[2]

The International Workshop on Meibomian Gland Dysfunction (MGD Workshop) is also an important landmark paper about dry eye.[3] From this, we know to recognise that differences in lipid attraction among the different groups of contact lens polymers influence contact lens-related dry eye, and that non-ionic, low-water content contact lens materials minimise CLD.

In contact lens wearers, the rate of evaporation of the tear film is 1.2 to 2.6 times faster than the non-lens wearing eye.[4,5,6] As a result of these changes, a tear film dysfunction that mimics an evaporative dry eye can result from contact lens wear.

The MGD Workshop also reconfirmed that the presence of the contact lens causes an increased instability of the tear film, and this leads to evaporative dryness, which then leads to higher rates of contact lens discomfort or intolerance.[3,7,8,9]

Contact lenses and how to minimise dry eye

Appropriate dry eye interventions for either dry eye or contact lens related dry eye sufferers should include the following findings from Workshop on Contact Lens Discomfort from the Tear Film and Ocular Surface Society (TFOS).[10]

Appropriate interventions

Patients with contact lens discomfort require intervention similar to that for dry eye patients. In other words, the interventions for traditional evaporative dry eye would also be appropriate management for contact lens related dry eye sufferers. Dietary supplements, like omega-3 and omega-6, are appropriate to consider for this group. An examination of any medications that may induce dry eye symptoms would be appropriate.

However, although the role of topical anti-inflammatory medications, such as cyclosporin A 0.05% emulsion (or compounded solution), steroids and/or NSAIDs, may be useful, concerns about their use include preservative binding to the contact lens medium, opportunistic infection with topical steroid use and a lack of studies documenting their use in contact lens wearers.

Studies by Ramamoorthy and Nichols have found that switching to daily disposables can minimise dry eye symptoms.[11]

Improve the cleaning regimen

Optimise the combination of the contact lens and lens care solution combinations to minimise CLD. The Andrasko corneal staining grid is a useful clinical tool in assisting you with this (Figure 1).[12] The employment of a hydrogen peroxide cleaning system over a multipurpose solution also assists by reducing CLD.

Due diligence at the after-care appointment

Conducting after-care and thoroughly asking about any CLD symptoms allows the practitioner to prescribe changes in polymers to reduce their effects.

Change the lens material

It was well established that there was a considerable improvement in symptoms of contact lens comfort when traditional hydrogel patients were changed in their contact lens material to silicone hydrogels.13-18

However, new developments in contact lens technology have made significant inroads in reducing ocular dryness and reducing CLD further, and there is more exploration of the boundaries of when hydrogels and silicone hydrogels can be employed or even fused to improve CL comfort.

		Branded solutions									
		Unisol 4 Saline	AOSEPT plus Clear Care	OPTI-FREE *EXPRESS*	OPTI-FREE RepleniSH	OPTI-FREE PureMoist	Biotrue	Renu Fresh	Renu Sensitive	Complete MPS	Aquify
Hydrogel	Acuvue 2	1%	1%	2%	5%	1%	1%	1%	1%	1%	1%
	Proclear	1%	1%	1%	2%	1%	28%	57%	23%	6%	12%
	Soflens 66	1%	1%	1%	1%	1%	52%	73%	32%	17%	8%
Silicone hydrogel	Acuvue Advance	1%	1%	1%	1%	1%	9%	13%	4%	12%	2%
	Acuvue Oasys	2%	1%	3%	5%	2%	1%	9%	5%	4%	3%
	Biofinity	2%	2%	3%	2%	1%	17%	4%	2%	2%	2%
	Purevision	2%	1%	4%	7%	3%	46%	73%	43%	15%	21%
	O2 Optix	2%	1%	2%	5%	1%	21%	24%	7%	3%	3%
	Night & Day	2%	1%	2%	3%	1%	17%	24%	11%	1%	3%
Staining zone colour codes			H_2O_2	POLYQUAD/ALDOX			PHMB/ Polyquaternium	BIGUANIDES (PHMB)			

Under 10% 10% to 20% Over 20%

▲ Figure 1. Based on the Andrasko corneal staining grid. Percentage of corneal staining area at two hours

- **Alcon**

Alcon's Dailies Total1 lenses are manufactured from a new material, Delfilcon A, which is the first water gradient contact lens. The material combines the benefits of a silicone hydrogel with high oxygen transmissibility and a hydrogel material with high water content for comfort. At the core of the Dailies Total1 contact lens is a silicone hydrogel material with a water content of 33 per cent. The surface of the lens is designed with a water content approaching 100 per cent at the interface with the tear film. A water gradient is created by cross-linked polymeric wetting agents that form a soft, hydrophilic surface gel, which is embedded into the core. The surface of the lens becomes highly lubricious.

- **Bausch and Lomb**

Bausch and Lomb's new Biotrue ONEday contact lenses are made from 'Hypergel' a 'bio-inspired' material that allows patients to feel hydrogel-like comfort through the material's dehydration resistance that helps the contact lens retain moisture and optical shape while allowing oxygen to flow freely through the lens.

- **CooperVision**

Other material developments include reworking hydrogel materials to have wetting agents that are partially embedded in the contact lens modulus to remain on the lens surface during lens wear. Others, such as CooperVision's MyDay lenses, are made with a structural backbone of a long silicone chain polymer surrounded by smaller molecular chains of non-silicone polymers to envelope the silicone backbone. This reduces the amount of silicone exposed to the ocular surface, which seems to minimise any potential adverse silicone hydrogel responses but retains the advantages of silicone hydrogel properties. MyDay has certain unique combinations of hydrogel and silicone hydrogel properties for their lenses in their modulus and lens behaviour to minimise CLD.

- **Johnson & Johnson**

The new 1-Day Acuvue Moist platform from Johnson & Johnson utilises 'Lacreon Technology', a process that the company says permanently embeds the wetting agent 'polyvinylpyrrolidone (PVP) in the lens material. This PVP creates a cushion of moisture from the lens core to the lens surface to help reduce symptoms of CLD.

Chicken or egg?

Contact lenses and dry eye symptoms can appear to be a chicken or egg conundrum but thoughtful clinical management and diligent after-care should mean dry eye symptoms can be minimised in contact lens wear to prevent contact lens drop-out.

By examining each part of the equation to solve this puzzle, we can optimally manage the needs of our dry eye and contact lens patients to improve their quality of life. ▲

About the CCLSA
The Cornea and Contact Lens Society of Australia was established in 1962 with the goal of providing education in the cornea and contact lens field. The CCLSA encourages collegiality in the eyecare industry through education, hosting conventions and lectures, and generates funds for scientific research.

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Therapeutic NEWS of note

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Warm facecloth offers cold comfort against MGD

An *ex vivo* study to evaluate the heat retention properties of a warm facecloth versus commercially-available masks has found that the new products are superior to the old facecloth.

Meibomian gland dysfunction (MGD) appears to be the most common cause of evaporative dry eye. Eyelid warming masks slowly transfer heat between 40° and 45° C to the inner meibomian glands, in an attempt to melt or soften the stagnant meibum.

Five eyelid-warming masks (MGDRx EyeBag, EyeDoctor, Bruder, Tranquileyes, Thera Pearl) were heated following manufacturers' instructions. Heat retention was assessed at one-minute intervals for 12 minutes on a non-conductive surface. A facecloth warmed with hot tap water was used as comparison.

All masks reached above 40° C within the first two minutes after heating and remained so for five minutes, with the exception of the facecloth, which lasted only three minutes and quickly degraded to 30° C within 10 minutes.

The Bruder and Tranquileyes products reached > 50° C, after heating and the Bruder goggles maintained > 50° C for nearly six minutes. The MGDRx EyeBag and TheraPearl have the most stable heat retention (in targeted ranges) between two and nine minutes.

The study authors concluded that although the heat-retention profiles are different for commercially-available eyelid warming masks, the time-honoured facecloth is poor at retaining the desired heat over a 5-10 minute interval.

Cont Lens Ant Eye 2015; Feb 27. [Epub ahead of print]

Seasonal variations of dry eye

Resarchers have formally quantified a clear seasonal pattern of dry eye, and have shown that a majority of the dry eye cases occur in winter and spring.

All patients seen in a US veteran eye clinic from July 5 2006, to July 4 2011, were included in this retrospective analysis. To further evaluate the link between allergens and seasons, the study authors obtained information from www.pollen.com, which provides a monthly allergy index, based on pollen concentrations, for various locations throughout the USA.

In total, 17.4 per cent of veterans were diagnosed with dry eye. When looking at the distribution of cases, researchers observed a clear seasonal pattern. Specifically, the prevalence of dry eye was highest in April, which corresponded with pollen counts in the USA.

In a multivariable analysis considering meteorological conditions, season and allergy index on dry eye prevalence, seasonality showed the strongest association with dry eye, with dry eye prevalence during peak seasons (winter–spring) being 3.7 per cent higher compared with summer–fall.

'Our study supports the general clinical impression that dry eye has a seasonal pattern and suggests that different mechanisms may underlie dry eye in winter vs spring months,' the authors concluded.

The authors went on to point out the importance of this distinction, because the treatment approaches to dry eye may differ based on whether an allergy is a component of disease.

Understanding which indoor and outdoor environmental conditions, across different seasons, most closely align with dry eye can open new treatment algorithms that include environmental manipulation, such as air filters and humidifiers for indoor use or goggles for outdoor use.

Ophthalmology 2015; 122: 8: 1727-1729. doi: 10.1016

Sjögren's syndrome may be underdiagnosed in men

Although primary Sjögren's syndrome (SS) is typically considered a disease of middle-aged women, a recent study has found that it may be underdiagnosed, and consequentially more severe, in men.

In a retrospective cohort study, a total of 163 consecutive primary Sjögren's syndrome (SS) patients were evaluated between January 2007 and March 2013 to measure the frequency of extraglandular ocular and systemic manifestations and serologic results in men compared to women.

Fourteen of the 163 primary Sjögren's syndrome patients (nine per cent) were men. On initial presentation, men were a decade older (61 vs 50 years, $p < 0.01$) and less likely than women to have a prior diagnosis of Sjögren's syndrome (43 per cent vs 65 per cent, $p = 0.09$).

A majority of men reported dry eye on presentation (92 per cent), albeit less chronic compared to women (5.9 vs 10.8 years, $p = 0.07$). Men were more likely to present with serious ocular complications than women (43 per cent vs 11 per cent, $p = 0.001$). Extra glandular systemic complications of Sjögren's syndrome, for example: vasculitis, interstitial nephritis, were also more common in men (64 per cent vs 40 per cent, $p = 0.07$). Men were more likely to be negative for anti-SSA/Ro, anti-SSB/La, and antinuclear

antibodies than women (36 per cent men vs 11 per cent women, p = 0.01).

Researchers concluded that men with primary Sjögren's syndrome have a higher frequency of serious ocular and systemic manifestations.

The researchers proposed that there should be a lower threshold to test for Sjögren's syndrome in men with dry eye.

AJO 2015; 160: 3: 447–452.

Corneal topography in children with vernal keratoconjunctivitis

A high prevalence of keratoconus-like topography was observed in patients with vernal keratoconjunctivitis (VKC).

A study was conducted in Kathmandu, Nepal, to determine corneal topographic characteristics of children with VKC. Corneal topographic indices in VKC subjects were then compared with those of normal subjects.

In the hospital-based comparative study, 115 consecutive subjects with VKC and 102 age and sex matched normal subjects were selected for videokeratography with the NIDEK ophthalmic operating system.

Other assessments included visual acuity testing with LogMAR chart, slitlamp biomicroscopy, dilated fundus examination, measurement of central corneal thickness and intraocular pressure. Topographic indices were analysed and compared using unpaired t-test among different groups. Sensitivity and specificity was estimated by the ROC curve.

Among the 115 subjects with VKC, males comprised 86 subjects (66.1 per cent of the total) and the mean age of presentation was 10.9 (SD 4.9) years with mixed VKC in 56.5 per cent. Keratoconus-like topography was present in 13 subjects (11.3 per cent). The keratoconus predictive index (sensitivity 92.3 per cent, specificity 98.5 per cent), the opposite sectoral index (sensitivity 84.6 per cent; specificity 93.2 per cent) and the differential sectoral index (sensitivity 92.3 per cent; specificity 90.8 per cent) were found to be significantly associated with VKC subjects having keratoconus-like topography.

Cont Lens Ant Eye 2015; June 9 (Epub ahead of print). ▲

SKQ1? How a molecule you've never heard of could prove effective against dry eye syndrome

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IN THE QUEST for human immortality, some notable contributions are well documented. Of particular interest is the free radical theory of ageing proposed by physicist Denham Harman in 1956.[1] Harmon's theory was that cumulative cell damage leads to cell death and the ageing of an organism, due to unstable free-radical molecules.

At a molecular level, free radicals are atoms or molecules with unpaired valence electrons. Consequently, they are unstable and reactive. In cells, free radicals are produced primarily by the enzyme-mediated conversion of O2 to superoxide (O2-) and hydrogen peroxide (H2O2).[2] The effects of their instability can be observed by these reactive substances 'stealing' electrons from other chemical entities. While this can be harmless, damage will occur if the 'theft' is from a chemical entity that cannot function without its stolen electron.[3]

Free radicals are sometimes referred to as reactive oxygen species (ROS) and their consequences on biological systems are now well-documented in numerous disease states. Oxidative stress describes the extent to which a biological system can withstand the effects of ROS with antioxidative measures.

Mitochondrial theory of ageing

In modified form, Harman's theory further proposes that critical destructive effects of ROS occur within mitochondria. The mitochondrial theory of ageing proposes that ROS mutation of mDNA and protein and lipid damage leads to further ROS accumulation, increased oxidative stress and eventual destruction of the mitochondrial unit.[4]

Critics of the theory point out that ROS are also involved in positive effects on mitochondria, such as signal transduction/processing functions critical for maintaining cellular health.[5,6] Therefore, this aspect of cell homeostasis can be somewhat oversimplified as a balance between toxic and beneficial effects of oxidative stress and the cell's ability to recover from any damage sustained.

Studies of mitochondrial-delivered antioxidants have shown mixed but overall positive effects on tissue and organ structures from various species of animal models and humans. While the effects of supplementing our diets with foods and pills that might increase our lifespans continues to be explored, a more specific target of ROS research—dry eye—is also now showing promise.

SKQ1

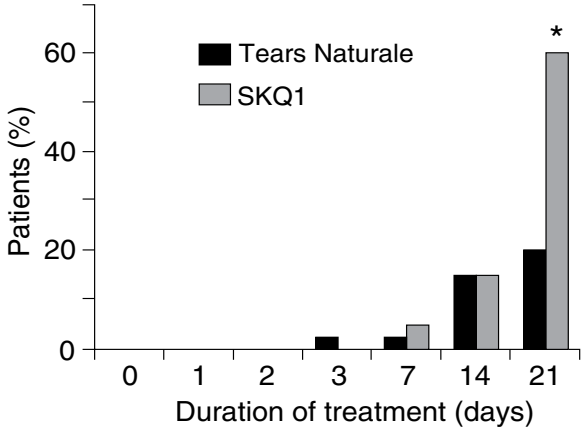
Depending on one's reading of the existing literature on the topic, the SKQ1 molecule is everything from a potential cure of various ailments to the elixir of immortality. Before the reader switches off and moves to the next article, it may be worth paying some serious attention to SKQ1.

SK, short for 'Skulachev', is a patented organic cation containing a phosphorus atom, with three hydrophobic phenyl residues that can penetrate the lipid bilayer of the mitochondrial membrane. Given the negatively-charged state of the mitochondrial interior, the cation concentration readily accumulates up to 1,000-fold higher than in the extracellular space. Attached to the SK molecule is an augmented plastoquinone (an electron carrying antioxidant): plastoquinonyl-decyl-triphenyl-phosphonium, designated 'Q'. The combined molecule is called SKQ1 and was invented by Skulachev and colleagues.[7]

The scientists behind the compound have produced volumes of peer-reviewed studies supportive of the remissive and life-prolonging effects of their molecule. Vladamir Skulachev, who is credited with the invention of SKQ1, is a scientific icon in Eastern Europe and has a significant following elsewhere.

Dry eye and SKQ1

Notable diseases of SKQ1 inquiry with promising results include Alzheimer's, Parkinson's and other neuro-degenerative diseases, thymus disease, dermal wound healing, acute pyelonephritis and kidney disease,



▲ Figure 1. Comparison of efficacy of SKQ1-based eye drops Visomitin and Tears Naturale (Alcon) in clinical trials on patients suffering from dry eye syndrome. Percentage of successful cases is indicated $p < 0.001$. A case was considered successful if the dry eye symptoms disappeared completely.

ischaemia-induced heart arrhythmia and tissue damage in myocardial infarction and stroke.[8,9] However, perhaps the most interesting area of inquiry is the role of SKQ1 in dry eye disease.

Dry eye specialists know all too well the refractory nature of the condition. Skulachev and colleagues chose to investigate the effects of SKQ1 on dry eye for this reason.

Investigation of SKQ1 in dry eye has progressed remarkably quickly in Russia, from a novel chemical entity to a registered topical treatment in just a few years. The ophthalmic formulation of SKQ1 is called 'Visomitin.' Preclinical studies found the drug to be safe at the likely therapeutic dosages.[10]

In the initial human clinical trial, SKQ1 was compared with Tears Naturale (Alcon) in a group of dry eye patients over 21 days. SKQ1 produced a significantly greater reduction in conjunctival hyperaemia and oedema, corneal micro-erosions and improved vision compared with Tears Naturale. In most cases, the ocular signs of dry eye almost completely resolved in the SKQ1 group (Figure 1).[10,11]

Visomitin

As mentioned, the Anglicised name for the topical SKQ1 eye-drop now marketed in Russia is Visomitin. A Luxemberg-based pharmaceutical company, Mitotech, has the US rights for Visomitin and is also now conducting clinical trials for the US Food and Drug Administration. Mitotech presented data of the Phase 1 safety and Phase 2 safety and efficacy studies at ARVO in Denver, USA earlier this year. A conjunctival cell culture model was used to investigate whether SKQ1 could down-regulate an inflammatory response of surface epithelial cells. SKQ1 proved effective and non-toxic at therapeutic dose levels below 300 nM.[12]

In the Phase 2 single-centre randomised, double-masked, placebo-controlled study, a controlled adverse environment (CAE) was created for 91 dry eye subjects. Key eligibility criteria included scores of ≥ 2, ≥ 0.5 and ≥ 2 for fluorescein corneal staining (FCS), inferior region FCS, and one symptom from a four-symptom questionnaire, respectively. A positive response to CAE exposure on two visits with exacerbation of FCS and ocular discomfort were also required. Eligible subjects were dosed bid with 1.55 µg/mL SKQ1, 0.155 µg/mL SKQ1 or placebo for 28 days and recorded their symptoms in diaries. Efficacy was assessed as the amount of inferior region FCS pre-CAE and at day 28 as well as diary data for the 28-day period.

Differences were observed for total FCS scores in the intention-to-treat group when compared pre and post CAE at day 28 ($p = 0.0452$). Differences in dry eye symptom scores were also observed for 'ocular discomfort' when day 28 and baseline scores were compared ($p = 0.0068$). SKQ1 was also safe and well tolerated with no significant differences in adverse events between treatment groups and controls.[13]

Further studies

Ocular SKQ1 studies are not limited to dry eye disease. In 2008, a series of laboratory and veterinary animal based experiments were published involving SKQ1 treatment in a range of ocular conditions. Notably, SKQ1 reversed cataract and retinopathies in 3-12-month-old, but not in 24-month-old, OXYS (senescence accelerated) rats.

Laboratory-induced uveitis and glaucoma were found to be prevented or reversed by instillation of SKQ1 drops in rabbits. In 271 veterinary based animals (dogs, cats, and horses) with retinopathies, uveitis, conjunctivitis and corneal diseases, the ocular health of 242 animals improved with SKQ1. Of the 89 animals blind on presentation, vision returned to 67 after treatment. *Ex vivo* studies of cultivated posterior retina sector showed a reduction of macrophage transformation of the retinal pigmented epithelial following 20 nM SKQ1[14] Studies now continue in earnest in glaucoma, light-induced retinal degeneration, non-exudative macular disease, cataract and uveitis.

Hope for dry eye?

This article is intended to provide a snapshot rather than a comprehensive review of mitochondrial antioxidants. As the evidence mounts, researchers are moving away from early claims of SKQ1's anti-ageing benefits. According to the data currently available, SKQ1 does at least appear to hold the promise of symptom remission for many dry eye patients.

SKQ1's potential role in various other ocular and systemic diseases is also of great interest. Of course, eye-care professionals and dry-eye patients know all about false hope. While it is important to keep perspective, it is hard not to get just a little excited about the possibilities for SKQ1. ▲

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Presbyopia correction with Options for

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PRESBYOPIA is an inevitable part of ageing, becoming noticeable around the age of 40 years, and characterised by a loss of accommodation and a concomitant diminished ability to focus at near.

In the United States alone, more than 40 per cent of the population is aged over 45 years.

This target group grew by over 45 per cent from 2000 to 2010[1] and in the next few years the number of presbyopes is expected to exceed 135 million.[2]

As the population of the developed world continues to age, the need for presbyopia vision correction is exploding with a six per cent increase since 2010 in the target population (now estimated at 560 million people 45 years and older) and with a further five per cent increase predicted by 2020.[3]

Usually by the age of 52, there is no objective accommodation remaining.[4-6] Globally, an estimated two billion people have presbyopia[7] and with an ageing global population, this is set to increase exponentially. Although this age group makes up almost 45 per cent of the population, it represents only 22 per cent of the contact lens market.[8-12]

In 1874 Benjamin Franklin developed the first version of bifocal spectacles by combining half lenses from his different spectacles so that he could see 'near and far'.[13] In addressing his presbyopia, he was following a tradition starting around 5000 BC when transparent semiprecious stones were used to help with reading.[13] From Franklin's bifocals to today's progressive lenses, using lenses to give clear focus for presbyopes has never been completely satisfactory due to limits in the direction and distances for which clear vision can be maintained.

Strategies for presbyopia correction

At the onset of presbyopia, monovision correction is acceptable as low reading correction is usually all that is needed.[14,15,16] As accommodation diminishes further, the increased disparity between eyes that is required for monovision correction leads to decreased binocular acuity,[17] stereoacuity[14-18] and contrast sensitivity, which can all contribute to increased risk of accidents in the elderly.[19]

Various strategies for presbyopia correction have been trialed over the years with three systems of correction most often prescribed: spectacle lenses only, contact lenses only, and spectacle/contact lens combinations. Refractive surgery can also be used but is less common.

For those wishing to remain in contact lenses as they age, earlier reports suggested that monovision lenses were the correction often advocated by practitioners,[20,21] in part due to practitioner bias related to the perception that multifocals are harder to fit, require more chair time, and the understanding that 'consulting room' preferences of wearers might not translate to 'real world' efficacy.[22]

Popularity of multifocal modality

However, in 2011 Efron, Morgan and Woods reported from their survey of prescribing habits in 38 countries that the majority (63 per cent) of presbyopes were fitted with non-presbyopic lenses, while 29 per cent wore multifocals and only eight per cent used monovision correction.[23] From 2005 to 2009, about one-third of presbyopic contact lens wearers were prescribed multifocals[23] and this proportion increased between 2010 and 2014 to almost half, representing about 12.5 per cent of all soft contact lens fittings.[23] The increasing popularity of the multifocal modality is also represented in statistics showing that between 2000 and 2009 in Australia, the multifocal designs offered increased from six to 21.[23]

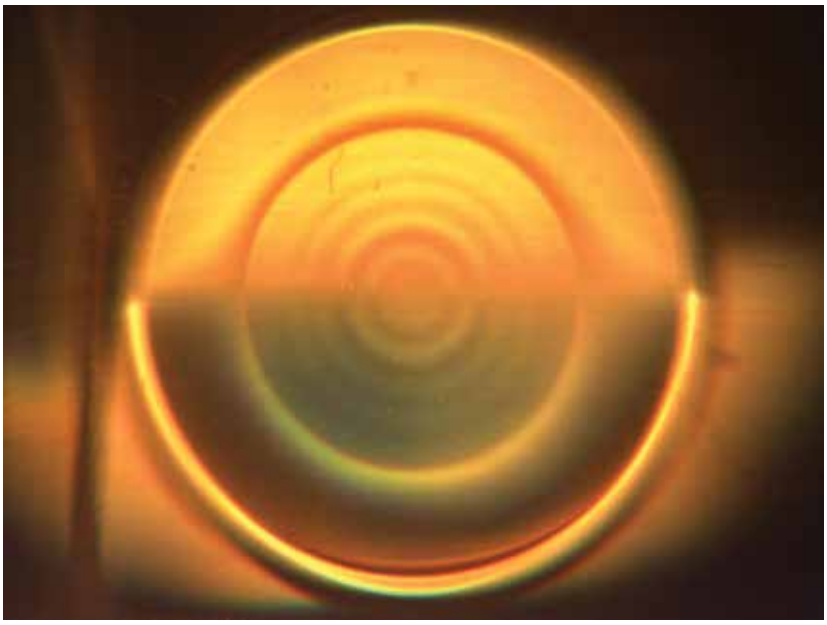
Presbyopia correction can become more challenging in the presence of additional attendant ocular aberrations. Contemporary simultaneous image-design multifocal contact lens designs are suboptimal because in attempting to correct refractive errors they compromise the quality of vision at both distance and near,[24,25] introducing a degree of ghosting and/or distortion,[26] which can sometimes result in unsatisfactory quality of vision with decreased contrast sensitivity.[27] Fluctuating vision can also arise due to change of pupil size.[24] Thus there is need for contact lenses that can address presbyopia without inducing distortions of vision.

EDOF lenses

Fourier optics simulations suggest that interactions of higher order spherical aberration terms with Zernike defocus can improve depth of focus.[2] Modelling the wavefront aberration profiles for eyes permits the manufacture of lenses that can provide images that are focused on the retina over all focal lengths.

The Brien Holden Vision Institute has developed an extended depth of focus (EDOF) lens for presbyopia that deliberately manipulates higher order aberrations of the ocular wavefront to optimise retinal vision quality over near, intermediate and far distances. This depth of acuity is achieved by treating aberrations and desired visual outcomes as variable parameters in a non-linear optimisation routine that can be manipulated to determine the best metrics for 'compromise free' vision through focus over a selected range of distances.

contact lenses a growing demographic



▲ Contact Lens Optical Quality Analyser image of Brien Holden Vision EDOF lens in -3.00 D distance power

Conclusion

In the quest to supply satisfactory options in contact lens wear for the ageing population, novel lenses were designed that deliberately manipulate higher-order spherical aberrations to optimise retinal image quality. Novel EDOF lenses that are relatively independent of patients' natural aberrations offer acceptable intermediate and near vision performance without compromising distance vision performance in low, medium and high presbyopes, and offer great opportunity for successful presbyopic vision correction for the burgeoning consumer market.

In April 2015, Brien Holden Vision Pty Ltd announced that the US Food and Drug Administration had granted clearance for the company's EDOF contact lenses, a world-first for the correction of presbyopia. ▲

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2016 International Dry Eye Workshop

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THE TEAR FILM and Ocular Surface (TFOS) Society, founded in 2000 by Harvard senior scientist and associate professor David Sullivan, is a non-profit organisation with a network that extends to more than 85 countries. It represents a global community with a mission to advance the research, literacy and educational aspects of the scientific field of the tear film and ocular surface.

Since organising the first two successful International Conferences on the Lacrimal Gland, Tear Film and Dry Eye Syndromes in 1992 and 1996 in Bermuda, the incorporated TFOS Society, with David maintaining a leading role, has continued to organise meetings. They were held initially every four years and are now every three years, with the most recent meeting in Taormina, Sicily in 2013.

These meetings provide a forum for critically appraising current knowledge and the latest research on the ocular surface, and promote an international exchange of information and ideas, by basic scientists, academic clinicians and industry representatives dedicated to understanding the field and ultimately to improving ocular health.

Even beyond the conferences, the International Workshops are considered the most celebrated of TFOS Society's achievements. Critical to these workshops is an evidence-based approach and a process of open communication, dialogue and transparency, in order to achieve global consensus.

The original Dry Eye Workshop (DEWS) was published in *The Ocular Surface* in 2007[1] and has become the most significant reference material in the field for clinical researchers and regulatory authorities alike.

Recognition of the significance of lid disease within the dry eye spectrum in the initial DEWS led to the subsequent launch of the Meibomian Gland Dysfunction (MGD) Workshop, with contributions from over 50 experts, and resulting publication in *Investigative Ophthalmology and Visual Science* (*IOVS*) in 2011.[2]

The MGD Workshop was followed by the Contact Lens Discomfort Workshop, which was published in 2013,[3] also in *IOVS*. Both reports in *IOVS* recorded top rankings for downloads, reflecting their impact within the academic community, and summaries of these workshops, translated into multiple languages, have been distributed to more than 400,000 clinicians worldwide.

Looking forward to Montpellier

Ten years since the launch of the first DEWS and in recognition of the exponential volume of research that has since been published in the field, it is both timely and exciting to see the launch of the second Dry Eye Workshop, 'DEWS II'. TFOS DEWS II will update the definition, classification and diagnosis of dry eye disease, critically assess the aetiology, mechanism, distribution and global impact of this disorder, and address its management and therapy.

To this end, the steering committee met in San Francisco in March 2015 to agree on workshop topics and to select subcommittee chairs and participants. The workshop comprises about 150 participants forming 10 subcommittees, each devoted to a specific topic: definition and classification; epidemiology; sex, hormones and gender; tear film; pain and sensation; pathophysiology; iatrogenic dry eye disease; diagnosis; management and therapy; and clinical trial design. There is also an industry liaison subcommittee and for the first time, a public awareness subcommittee, tasked with ensuring broad dissemination of the workshop results.

Subcommittee meetings to develop outlines for the 10 individual reports are underway and detailed researching and writing will follow over the next year. The preliminary presentation of the report is expected to take place at the next TFOS conference on 8-10 September 2016 in Montpellier, France.

Associate Professor Jennifer Craig has served as a subcommittee member on the MGD Workshop, and a steering committee member and subcommittee chair on the Contact Lens Discomfort Workshop. She has been appointed by the TFOS Society board to serve on the steering committee and as vice-chair of DEWS II. ▲

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Sometimes the best treatment is no treatment at all

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PHOTO CLINIC

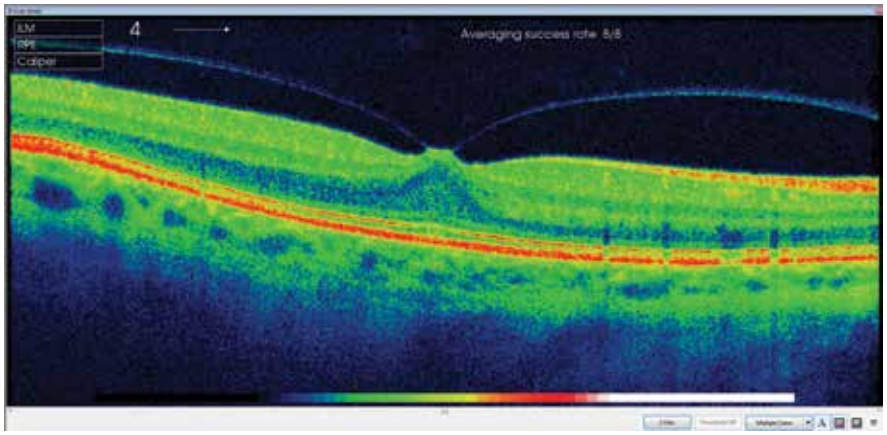
PATIENT JM presented with symptoms of right metamorphosia in April 2014. Her best corrected visual accuracy with a low hypermetropic correction was R 6/9 and L 6/6.

Following a complete ophthalmic work-up, including an OCT examination, a diagnosis of right vitreomacular traction (VMT) was made.

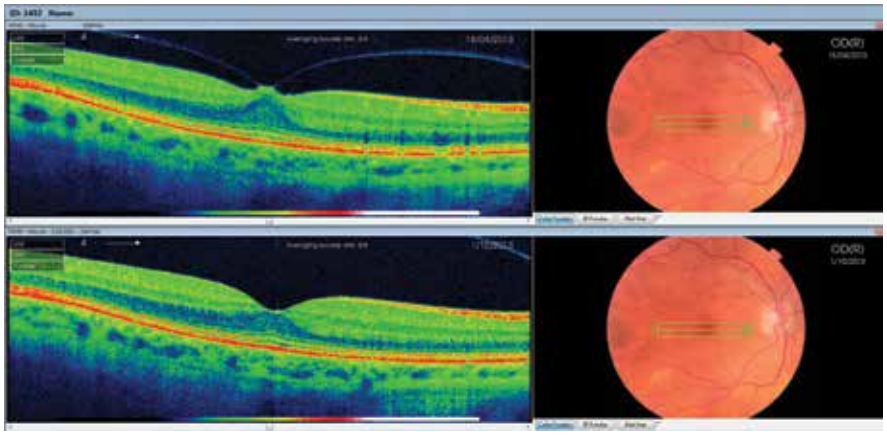
The patient was appropriately counselled and a further review was scheduled for six months unless the patient noticed a change in symptoms.

In this case, a repeated OCT examination was all that was indicated for the patient. At her follow-up review six months later, her symptoms had completely resolved with best corrected vision returning back to 6/6 in each eye.

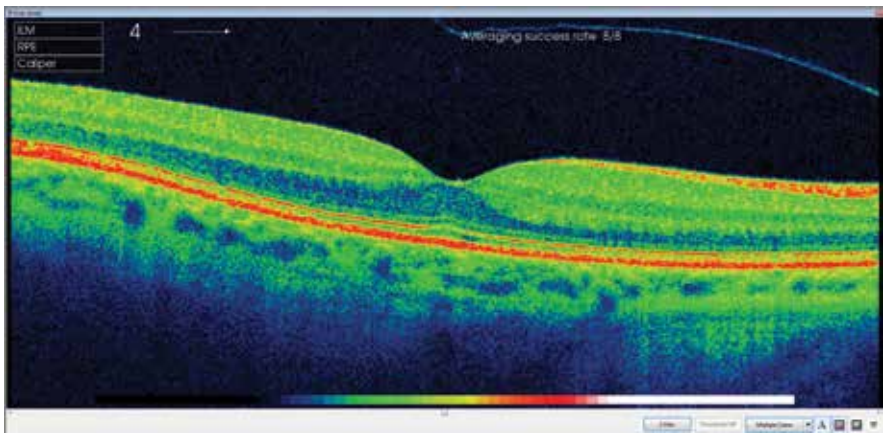
The OCT images show the initial VMT followed by a natural resolution. ▲



▲ Figure 1. Vitreomacular traction



▲ Figure 2. OCT of patient with colour fundus images



▲ Figure 3. Vitreomacular traction resolved

Variable clinical presentations of white without pressure

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THE TERM 'white without pressure' (WWOP) refers to focal or circumferential semi-translucent greyish-white retinal areas with smooth or scalloped margins and a deep red posterior border, most often located between the equator and ora serrata.[1,2] They resemble the appearance of 'white with pressure' (WWP) but are visible without external pressure applied to the eye with scleral indentation. There has been some suggestion that WWOP may represent an advanced form of WWP.[2]

WWOP is most frequently bilateral[2] and found in the temporal retina,[2,3] but it can be more extensive and involve the entire retinal periphery,[3] occur as far posteriorly as the peri-macular region,[1] contain islands of normal tissue making distinction from retinal holes difficult,[1] and change location over time.[4] Cases of dark-without-pressure fundus lesions have also been reported, albeit limitedly, and present in similar locations.[5]

The reported prevalence of WWOP varies greatly in the literature, from as low as three per cent for the general population to up to 75 per cent for high myopes.[2,6,7] Generally the prevalence increases with axial length[2,6] and high myopia.[2,6] Frequency of WWOP declines with age[2,6,8] and it does not show a consistent predilection for gender.[1,7]

Some variation with ethnicity has been reported, with the lowest prevalence reported for Caucasian populations and higher prevalence reported for individuals with darker-pigmented skin.[1,2] Higher prevalence reported for individuals of Asian background[7] are confounded by higher degrees of refractive error and axial length. Prevalence variation can also be attributed in part to differences in fundus pigmentation[5] and retinal examination techniques.

Although the pathological basis of WWOP remains uncertain, the retinal appearance is speculated to arise from mild vitreal traction and/or vitreo-retinal adhesions.[2,3,6] Spectral domain optical coherence tomography (SD-OCT) has demonstrated hyper-reflectance of the outer retina in eyes with WWOP.[5,9]

Case	Age at 1st prescription (years)	Gender	Eye	RE (D)	BCVA	CC (mm)	Vitreous detachment	WWOP	Floaters	Photopsia
1	10	Male	Right	-5.7	6/4.8^{-2}	7.7	AVD	All sectors (Figure 1)	Reported	Absent
			Left	-5.3	6/4.8^{-}	7.7	AVD and PVD	All sectors	Reported	Absent
2	8	Female	Right	-6.7	6/3.8^{-2}	7.8	AVD and PVD	All sectors (Figure 2)	Reported	Absent
			Left	-6.5	6/3^{-}	7.7	AVD	All sectors	Reported	Reported
3	No Rx	Male	Right	+0.4	6/6^{-}	8.1	None	None	Laterality uncertain	Absent
			Left	-0.4	6/6^{-2}	8.4	None	All sectors (Figure 3)	Laterality uncertain	Absent
4	13	Female	Right	-4.2	6/6^{-2}	7.5	None	None	Reported	Reported
			Left	-4.5	6/7.5^{+2}	7.6	None	Temporal	Reported	Reported
5	11	Male	Right	-4.7	6/6	7.8	None	Temporal	Reported	Absent
			Left	-4.9	6/6	7.8	None	Temporal	Reported	Absent

▲ Table 1. Clinical characteristics of five individuals with WWOP

These structural changes may result from ocular enlargement and/or vitreous base tractional forces.[8] Structural change to the photoreceptors has been postulated for both WWOP and dark without pressure,[5] but functional changes are yet to be identified. Altered peripheral vascular perfusion has also been demonstrated in eyes with WWOP by fluorescein angiography but it is unknown if this finding is causal.[10]

The association between WWOP and retinal tears and rhegmatogenous retinal detachment (RRD) is not clearly demonstrated in the literature. However, the risk of RRD must be considered given the association between WWOP and axial length[2,6] and peripheral degenerations such as lattice,[1,2] the proposed role of vitreous traction in the development of WWOP[9] and the reported link between WWP and giant tears.[11] Here we report the clinical observations for five optometry students in whom WWOP was detected during ocular fundus examination training sessions using a variety of examination techniques.

Methods

All individuals in whom WWOP was identified underwent a standard clinical history, basic screening, subjective refraction with vertex distance measurement to facilitate conversion to the ocular plane, corneal topography, and slitlamp, 90 D fundus lens biomicroscopy and BIO examination through dilated pupils.

The posterior pole, peripheral retina and vitreous were examined in all nine cardinal positions of gaze using both BIO and a 90 D fundus lens. The maculae and optic nerve heads were further screened by OCT (3D macula and disc scans, Topcon 3D OCT-2000, Tokyo, Japan).

Anterior vitreous detachment (AVD) and posterior vitreous detachment (PVD) were detected by inspecting the anterior and posterior vitreous by slitlamp alone (AVD and PVD) and 90 D fundus lens biomicroscopy to identify the Weiss ring (PVD). Areas displaying WWOP were documented and imaged by the Optos Optomap (Optos, Dunfermline, Scotland, UK).

Results

WWOP was identified incidentally in five optometry students by their peers, in a class of 59 students (eight per cent). All individuals were of Asian background and 22 years of age (three males and two females).

Table 1 summarises the clinical characteristics of each individual that relate to their refractive error status and WWOP. All individuals reported longstanding floaters in one (case 3) or both eyes (cases 1, 2, 4 and 5). Only two individuals (cases 2 and 4) reported a previous episode of photopsia that was brief in duration and suggestive of vitreo-retinal traction.[12]

No individuals reported any other significant personal ocular history including operations, infections and trauma. There was no family history of blindness, retinal detachment, tears or holes. A family history of high myopia was reported by three individuals (cases 2, 4 and 5). Mean refractive error (RE) at the ocular plane of affected eyes was -4.8 ± 2.0 D (mean ± SD) and ranged from emmetropia (-0.4 D, case 3) to high myopia (-6.7 D, case 2), with four myopic individuals who have worn a spectacle correction from 13 years of age or earlier. The only emmetrope (case 3) displayed a flat cornea curvature (CC). Best-corrected visual acuities (BCVA) were 6/7.5++ or better and confrontation was full to finger counting for all individuals. OCT revealed the optic nerve head and macula to be normal in all individuals.

WWOP presented as areas of pale, flat retina with distinct curvilinear or scalloped margins, located between the equator and ora serrata. The demarcating retina often appeared redder than the surrounding normal retina and displayed a band of increased vitreo-retinal reflectance. WWOP occurred bilaterally in three individuals (cases 1, 2 and 5), unilaterally in two (cases 3 and 4), in all sectors for three (cases 1, 2 and 3),

▲ Figure 1. Optos Optomap image of case 1 (right eye). WWOP extended to all sectors of the retina bilaterally. Affected retinal areas appeared pale and flat and the margins were scalloped and redder than the surrounding retina (large arrows).

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White without pressure

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and was limited to the temporal retina for two (cases 4 and 5).

Overall, WWOP was identified in more than one location in five of eight (63 per cent) affected eyes. PVD was noted in two individuals (cases 1 and 2). There was no evidence of additional peripheral retinal pathology, including lattice degeneration, retinal tears and holes. The clinical appearances of WWOP of three representative cases are shown in Figures 1, 2 and 3.

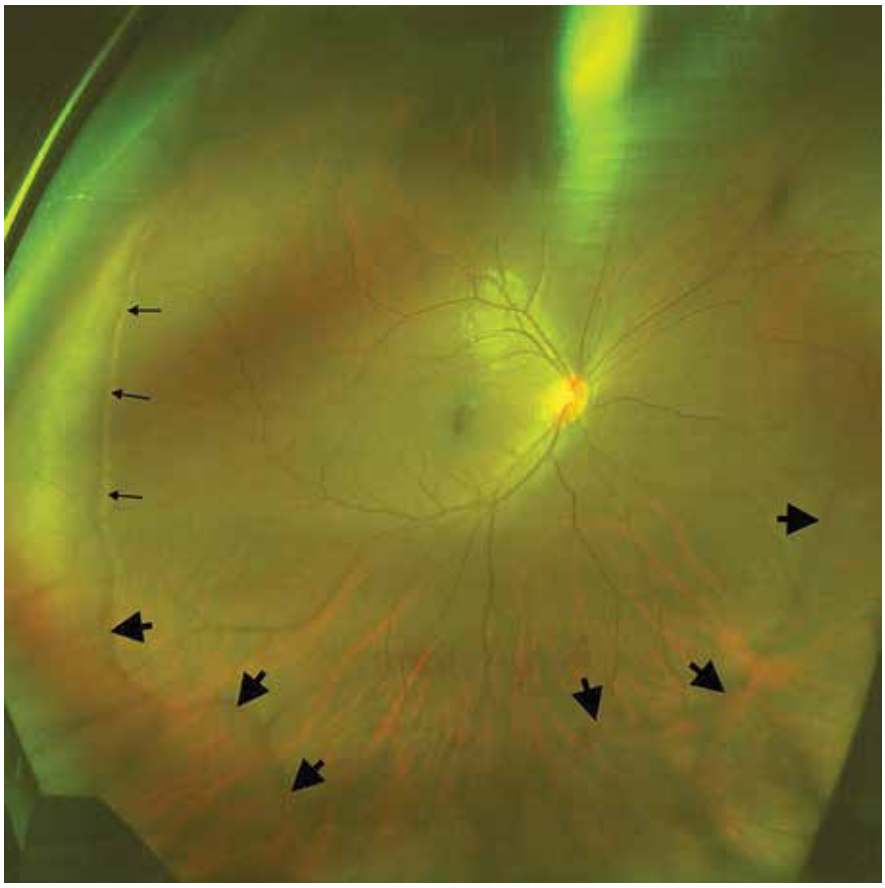
Discussion

WWOP is a relatively common finding in young patients and while this study was not designed to determine the prevalence of WWOP in a student population, our observations have supported the published literature.[2,6]

WWOP occurs more frequently in high myopes but it can be identified in emmetropes and moderate myopes[2,6] (Table 1), presumably as a result of excessive axial elongation. Although axial length was not measured in this study, most affected eyes were myopic (-4.8 ± 2.0 D, Table 1), the flatter cornea noted for the emmetropic case (CC 8.4 mm cf reported mean for emmetropes of 7.8 ± 0.3 mm[13]) suggested that axial length or vitreous chamber elongation may also be implicated in the pathogenesis of WWOP in this individual.

WWOP may vary in appearance, with broad or sharp, curvilinear or scalloped, and dark red or relatively indistinct borders, with or without increased vitreo-retinal reflectance (Figures 1, 2 and 3).[1,2] Its location also varies between individuals but it often occurs bilaterally, in the peripheral retina (particularly temporally)[2,3] and in more than one retinal location (Table 1).

This diversity may reflect variations in the dynamic relationship between the vitreous and the retina.[2,3] Although there was no overt clinical evidence for the role of vitreo-retinal traction in the pathogenesis of WWOP in this study, all individuals reported seeing floaters.



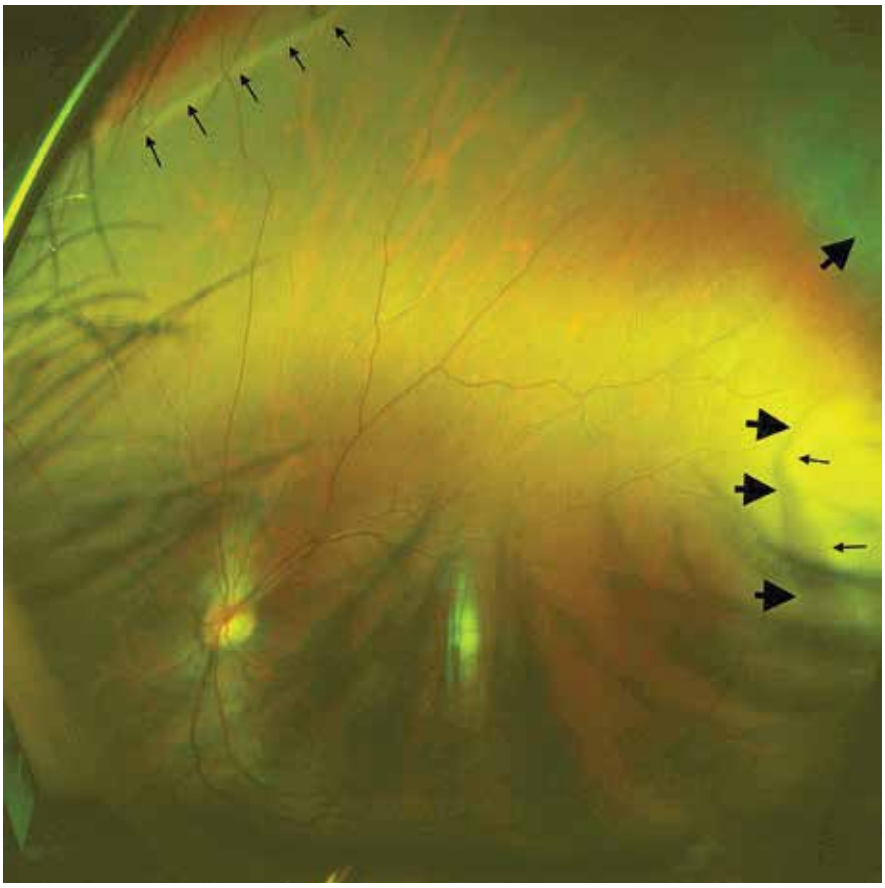
▲ Figure 2. Optos Optomap image of case 2 (right eye). WWOP extended to all sectors of the retina bilaterally. Affected retinal areas appeared pale and flat. Margins were curvilinear or scalloped, redder than surrounding retina (large arrows) and displayed greater vitreo-retinal reflectance in parts (small arrows).

Floaters are commonly reported by patients, particularly by individuals with vitreo-retinal pathology[14] including RRD,[15] but that reported here is higher than that reported for the general community.[16] Variation in the extent of adhesion of the anterior/posterior vitreous face to the lens/retina suggests variable vitreo-retinal forces may be operational in these individuals in the periphery.

Clinicians should familiarise themselves with the diverse clinical presentation of WWOP to assist with distinguishing it from more serious retinal pathologies. Important differentials of WWOP include RRD and non-RRD (for example, exudative) detachment, choroidal detachment (kissing choroidals), retinal holes and tears, retinoschisis, and commotio retinae.

While multiple forms of peripheral retinal pathology can coexist in myopic eyes,[7] WWOP was found in isolation in this sample. Dilated stereoscopic fundus examination is required for the identification and accurate and comprehensive documentation of peripheral lesions, and to establish that the retina is flat, non-oedematous, and devoid of tears, holes and significant vitreo-retinal traction.

To achieve an optimal view when examining the peripheral retina, a combination of 2.5% phenylephrine and 1.0% tropicamide can be used to achieve maximal dilation with scleral indentation. Peripheral fundus imaging can further assist with its identification and documentation, but care must be taken when interpreting the images, due to the variable presentation of WWOP, and although it



▲ Figure 3. Optos Optomap image of case 3 (left eye). WWOP was unilateral, variable in configuration and extended to all sectors. Affected retinal areas appeared paler than the surrounding retina and flat. Margins were largely curvilinear and in parts sharp-edged, redder than surrounding retina (large arrows) and/or displayed greater vitreo-retinal reflectance (small arrows).

can well supplement a dilated fundus examination, it should not replace it.

Although OCT was not performed over areas of WWOP in this study, this technology can be used to help discern if the retina is flat, and to detect changes to the outer retina.[5,8] Once WWOP has been diagnosed, annual review is consistent with many clinical protocols. Patients should also be warned of the symptoms suggestive of acute retinal detachment. ▲

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PBS list of medicines for optometrists

Revised 13 November 2015

By writing a PBS prescription for an antiglaucoma agent, the prescriber is certifying that the criteria set out in the PBS guidelines are satisfied

	Product	Max qty	Repeats
ANTI-GLAUCOMA PREPARATIONS			
Betaxolol eye-drops, suspension, 2.5 mg (as hydrochloride)/mL, 5 mL	Betoptic S	1	5
Betaxolol eye-drops, solution, 5 mg (as hydrochloride)/mL, 5 mL	Betoptic, BetoQuin	1	5
Bimatoprost eye-drops 0.03% eye drops, 3 mL	Lumigan	1	5
Bimatoprost eye-drops 0.03% 30 x 0.4 mL unit doses	Lumigan	1	5
Bimatoprost with timolol eye-drops containing 300 micrograms bimatoprost with timolol 5 mg (as maleate)/mL, 3 mL	Ganfort 0.3/5	1	5
Bimatoprost with timolol eye-drops containing 300 micrograms bimatoprost with timolol 5 mg (as maleate)/mL, 30 x 0.4 mL unit doses	Ganfort PF 0.3/5	1	5
Brimonidine Tartrate eye-drops 1.5 mg per mL (0.15%), 5 mL	Alphagan P 1.5	1	5
Brimonidine eye-drops containing brimonidine tartrate 2mg/mL (0.2%), 5 mL	Alphagan, Enidin	1	5
Brimonidine with timolol eye-drops containing brimonidine tartrate 2 mg with timolol 5 mg (as maleate)/mL, 5 mL	Combigan	1	5
Brinzolamide eye-drops 10 mg/mL, 5 mL	Azopt, BrinzoQuin	1	5
Brinzolamide with timolol eye-drops containing brinzolamide 10mg/mL with timolol 5mg (as maleate)/mL, 5mL	Azarga	1	5
Dorzolamide eye-drops 20 mg (as hydrochloride)/mL, 5 mL	Trusopt, Trusamide	1	5
Dorzolamide with timolol eye-drops containing dorzolamide 20 mg (as hydrochloride) with timolol 5 mg (as maleate)/mL, 5 mL	Cosopt, Cosdor, Dorzolamide/ Timolol Sandoz 20/5	1	5
Latanoprost eye-drops 50 micrograms/mL, 2.5 mL	Latanaprost, Xalaprost, Xalatan	1	5
Latanoprost with timolol eye-drops 50 micrograms latanoprost with timolol 5 mg (as maleate)/mL, 2.5 mL	Xalacom, Latanocom, Xalamol 50/5, Latanaprost/Timolol Sandoz 50/5	1	5
Pilocarpine eye-drops containing pilocarpine hydrochloride 10 mg/mL, 15 mL	Isopto Carpine	1	5
Pilocarpine eye-drops containing pilocarpine hydrochloride 20 mg/mL, 15 mL	Isopto Carpine	1	5
Pilocarpine eye-drops containing pilocarpine hydrochloride 40 mg/mL, 15 mL	Isopto Carpine	1	5
Timolol eye-drops 5 mg (as maleate)/mL, 5 mL	Tenopt, Timoptol	1	5
Timolol eye-drops (gellan gum solution) 2.5 mg (as maleate)/mL, 2.5 mL	Timoptol XE	1	5
Timolol eye-drops (gellan gum solution) 5 mg (as maleate)/mL, 2.5 mL	Timoptol XE	1	5
Timolol eye gel 1 mg (as maleate)/g, 5 g	Nyogel	1	5
Travoprost eye-drops 40 micrograms/mL, 2.5 mL	Travatan	1	5
Travoprost with timolol eye-drops 40 micrograms travoprost with timolol 5 mg (as maleate)/mL, 2.5 mL	Duotrav	1	5

NOTE: Antiglaucoma preparation Tafluprost 0.0015% eye-drops is PBS listed for optometric prescribing; however, at this time it is not included on the Optometry Board of Australia approved list of drugs that optometrists are authorised to prescribe. As a result optometrists cannot currently prescribe Tafluprost eye-drops.

	Product	Restriction	Max qty	Repeats
ANTI-VIRAL EYE PREPARATIONS				
		Restricted:		
Aciclovir eye ointment 30 mg per g (3%), 4.5 g	See note	Herpes simplex keratitis	1	0

NOTE: There has been a recall of unsold Zovirax Ophthalmic ointment (3% aciclovir), resulting in a product shortage of this medicine. AciVision 30 mg/g Aciclovir ointment has been granted TGA authorisation to be supplied temporarily in lieu of Zovirax for the treatment of keratitis of the eye caused by herpes simplex virus. AciVision is now available on PBS. Stocks of Zovirax are expected to return in March 2016.

http://www.pbs.gov.au/browse/optometrical

PBS list of medicines for optometrists (continued)

	Product	Restriction	Max qty	Repeats
ANTIBIOTICS		Unrestricted		
Chloramphenicol eye-drops 5 mg/mL (0.5%), 10 mL	Chlorsig		1	2
Chloramphenicol eye ointment 10 mg/g (1%), 4 g	Chlorsig		1	0
Ciprofloxacin eye-drops 3 mg per mL (0.3%), 5 mL	CiloQuin, Ciloxan	Authority required: bacterial keratitis	2	0
Framycetin sulfate eye-drops 5 mg/mL (0.5%), 8 mL	Soframycin		1	2
Gentamicin sulfate eye-drops 3 mg/mL (0.3%), 5 mL	Genoptic	Restricted: Suspected pseudomonal eye infection	1	2
Ofloxacin eye-drops 3 mg per mL (0.3%), 5 mL	Ocuflox	Authority required: bacterial keratitis	2	0
Tobramycin eye-drops 3 mg per mL (0.3%), 5 mL	Tobrex	Restricted: Suspected pseudomonal eye infection	1	2
Tobramycin eye ointment 3 mg per g (0.3%), 3.5 g	Tobrex	Restricted: Suspected pseudomonal eye infection	1	0
ANTI-INFLAMMATORY AGENTS				
Dexamethasone eye-drops 1 mg / mL (0.1%), 5 mL	Maxidex	Applications for increased maximum quantities and/or repeats will not be authorised.	1	0
Fluorometholone eye-drops 1mg/mL (0.1%), 5 mL	Flucon, FML Liquifilm		1	0
Fluorometholone acetate eye-drops 1 mg/mL (0.1%), 5 mL	Flarex		1	0
Hydrocortisone acetate eye ointment 10 mg/g (1%), 5 g	Hycor		1	0
Prednisolone acetate with phenylephrine hydrochloride eye-drops 10 mg-1.2 mg per mL (1%-0.12%), 10 mL	Prednefrin Forte	Restriction: Uveitis. Applications for increased maximum quantities and/or repeats will not be authorised.	1	0
ANTI-ALLERGY AGENTS		Restricted:		
Sodium cromoglycate eye-drops 20 mg/mL (2%), 10 mL	Opticrom	Vernal keratoconjunctivitis	1	5
MYDRIATICS/CYCLOPLEGICS				
Homatropine hydrobromide 2% eye-drops, 15 mL	Isopto Homatropine		1	2
TEAR SUPPLEMENTS		Restricted: Severe dry eye including Sjögren's syndrome		
Carbomer 980 eye gel 2 mg/g (0.2%), 10 g	Optifresh eye gel	As above	1	5
	PAA	As above	1	5
	Viscotears	As above	1	5
Carmellose sodium (0.5%) with glycerol (0.9%) eye-drops 15 mL	Optive	As above	1	3
Carmellose sodium eye-drops 10 mg/mL (1%), 15 mL	Refresh Liquigel	As above	1	5
Carmellose sodium eye-drops 5 mg/mL (0.5%), 15 ml	Refresh Tears plus	As above	1	5
Hypromellose eye-drops 3 mg/mL (0.3%), 15 mL (contains sodium perborate)	In a Wink Moist'ing Genteal	As above	1 1	5 5
Hypromellose eye-drops 5 mg/mL (0.5%), 15 mL	Methopt	As above	1	5
Hypromellose (0.3%) with carbomer 980 (0.2%) ocular lubricating gel, 10 g	HPMC PAA Genteal gel	As above	1 1	5 5

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PBS list of medicines for optometrists (continued)

	Product	Restriction	Max qty	Repeats
TEAR SUPPLEMENTS		Restricted: Severe dry eye including Sjögren's syndrome		
Hypromellose (0.3%) with dextran eye-drops (0.1%) 15 mL	Poly-Tears, Tears Naturale	As above	1	5
Polyethylene glycol 400 (0.4%) with propylene glycol (0.3%) eye-drops 15 mL	Systane	As above	1	5
Polyvinyl alcohol eye-drops 14 mg/mL (1.4%), 15 mL	PVA Tears, Liquifilm Tears	As above	1	5
Polyvinyl alcohol eye-drops 30 mg/mL (3%), 15 mL	PVA Forte, Liquifilm Forte	As above	1	5
Polyvinyl alcohol eye-drops 14 mg/mL (1.4%), 15 mL (contains sodium chorite/hydrogen peroxide as preservative)	Vistil	As above	1	5
Polyvinyl alcohol eye-drops 30 mg/mL (3%), 15 mL (contains sodium chorite/hydrogen peroxide as preservative)	Vistil Forte	As above	1	5
UNPRESERVED TEAR SUPPLEMENTS		Authority required:		
Carbomer 974 ocular lubricating gel 3 mg/g (0.3%), single dose units 0.5 g x 30	Poly Gel	Severe dry eye syndrome in patients sensitive to preservatives in multi-dose eye-drops	3	5
Carbomer 980 eye gel 2 mg per (0.2%) , single dose units 0.6 mL x 30	Viscotears Gel PF	As above	3	5
Carmellose sodium eye-drops 5 mg/mL (0.5%), single dose units 0.4 mL x 30	Cellufresh Optifresh Tears	As above	3	5
Carmellose sodium eye-drops 10 mg/mL (1%) , single dose units 0.4 mL x 30	Celluvisc Optifresh Plus	As above	3	5
Carmellose sodium eye-drops 2.5 mg/mL (0.25%), single dose units, 0.6 mL x 24	TheraTears	As above	4	5
Carmellose sodium ocular lubricating gel 10 mg/mL (1%), single dose units 0.6 mL x 28	TheraTears	As above	3	5
Carmellose Sodium (0.5%) with Glycerol (0.9%) eye-drops, single dose units 0.4 mL x 30	Optive	As above	3	5
Hypromellose with dextran eye-drops 3-1 mg/mL (0.3, 0.1%), single dose units 0.4 mL x 28	Bion Tears	As above	3	5
Polyethylene glycol 400 (0.4%) with propylene glycol (0.3%) eye-drops, single dose units 0.8 mL x 28	Systane	As above	2	5
Sodium Hyaluronate sodium hyaluronate 0.1% (1 mg/mL) eye-drops, 10 mL	Hylo-Fresh	As above	1	5
Sodium Hyaluronate sodium hyaluronate 0.2% (2 mg/mL) eye-drops, 10 mL	Hylo-Forte	As above	1	5
Soy lecithin eye spray 10 mg/mL (1%), 10 mL	Tears again	As above	2	5
TOPICAL OCULAR LUBRICANT OINTMENTS				
Paraffin 1 g/g compound eye ointment 3.5 g	Polyvisc, Duratears		2	5
Paraffin 1 g/g pack containing 2 tubes compound eye ointment 3.5 g	Polyvisc (2 pack), Ircal (2 pack), Refresh Night Time (2 pack)		1	5
Pariffin paraffin + retinyl palmitate 138 microgram/g (equivalent to 250 units/g vitamin A) eye ointment, 5 g	VitA-POS		2	5

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Please review the full Product Information before prescribing.

SINCE LAUNCH, MORE THAN 5.5 MILLION EYLEA® DOSES#

MINIMUM PRODUCT INFORMATION EYLEA® [aflibercept (rch)] INDICATIONS: EYLEA (aflibercept) is indicated in adults for the treatment of neovascular (wet) age-related macular degeneration (wet AMD); visual impairment due to macular oedema secondary to central retinal vein occlusion (CRVO); visual impairment due to macular oedema secondary to branch retinal vein occlusion (BRVO)*; diabetic macular oedema (DME)*. **CONTRAINDICATIONS:** Known hypersensitivity to aflibercept or excipients; ocular or periocular infection; active severe intraocular inflammation. **PRECAUTIONS:** Endophthalmitis, increase in intraocular pressure; immunogenicity*; arterial thromboembolic events; bilateral treatment*; risk factors for retinal pigment epithelial tears*; treatment should be withheld in case of rhegmatogenous retinal detachment, stage 3 or 4 macular holes, retinal break, decrease in best-corrected visual acuity of ≥ 30 letters, subretinal haemorrhage or intraocular surgery*; treatment not recommended in patients with irreversible ischemic visual function loss*; population with limited data (diabetic macular oedema due to type 1 diabetes, diabetic patients with HbA1c > 12%, proliferative diabetic retinopathy, active systemic infections, concurrent eye conditions, uncontrolled hypertension)*; see full PI for effects on fertility, pregnancy, lactation, effects on ability to drive or use machines. **ADVERSE EFFECTS:** Very common: conjunctival haemorrhage, visual acuity reduced*, eye pain. Common: retinal pigment epithelial tear, detachment of retinal pigment epithelium, retinal degeneration*, vitreous haemorrhage*, cataract, cataract cortical*, cataract nuclear, cataract subcapsular, corneal erosion, corneal abrasion, intraocular pressure increased, vision blurred, vitreous floaters, vitreous detachment, injection site pain, foreign body sensation in eyes, lacrimation increased, eyelid oedema, injection site haemorrhage, punctate keratitis*, conjunctival hyperaemia, ocular hyperaemia. Others: see full PI. **DOSAGE AND ADMINISTRATION*:** 2 mg aflibercept (equivalent to injection volume of 50 µL. The interval between doses injected into the same eye should not be shorter than one month. Once optimal visual acuity is achieved and/or there are no signs of disease activity, treatment may then be continued with a treat-and-extend regimen with gradually increased treatment intervals to maintain stable visual and/or anatomic outcomes. If disease activity persists or recurs, the treatment interval may be shortened accordingly. Monitoring should be done at injection visits. There is limited information on the optimal dosing interval and monitoring interval especially for long-term (e.g. >12 months) treatment. The monitoring and treatment schedule should be determined by the treating ophthalmologist based on the individual patient's response. If visual and anatomic outcomes indicate that the patient is not benefiting from continued treatment, EYLEA should be discontinued. *For wet AMD:* Treatment is initiated with one injection per month for three consecutive months, followed by one injection every two months. Long term, it is recommended to continue EYLEA every 2 months. Generally, once optimal visual acuity is achieved and/or there are no signs of disease activity, the treatment interval may be adjusted based on visual and/or anatomic outcomes. The dosing interval can be extended up to every 3 months. *For CRVO:* Treatment is initiated with one injection per month for three consecutive months. After the first three monthly injections, the treatment interval may be adjusted based on visual and/or anatomic outcomes. *For BRVO:* Treatment is initiated with one injection per month for three consecutive months. After the first three monthly injections, the treatment interval may be adjusted based on visual and/or anatomic outcomes. *For DME:* Treatment is initiated with one injection per month for five consecutive months followed by one injection every two months. After the first 12 months, the treatment interval may be adjusted based on visual and/or anatomic outcomes. **DATE OF PREPARATION:** September 2015. Approved PI available at http://www.bayerresources.com.au/resources/uploads/PI/file10294.pdf or upon request from Bayer Australia Ltd, ABN 22 000 138 714, 875 Pacific Highway, Pymble NSW 2073.

**Please note changes in Product Information.*

References: 1. Heier J, et al. Intravitreal aflibercept (VEGF trap-eye) in wet age-related macular degeneration. Ophthalmology 2012; 119: 2537–2548. **2.** Schmidt-Erfurth U, et al. Intravitreal aflibercept injection for neovascular age-related macular degeneration: ninety-six-week results of the VIEW studies. Ophthalmology 2014; 121: 193–201. **3.** Boyer D, et al. Vascular endothelial growth factor Trap-Eye for macular edema secondary to central retinal vein occlusion: six-month results of the phase 3 COPERNICUS study. Ophthalmology. 2012; 119(5):1024–32. **4.** Brown D, et al. Intravitreal aflibercept injection for macular edema secondary to central retinal vein occlusion: 1-year results from the phase 3 COPERNICUS study. Am J Ophthalmol 2013; 155: 429–437. **5.** Heier J, et al. Intravitreal aflibercept injection for macular edema due to central retinal vein occlusion: two-year results from the COPERNICUS study. Ophthalmology 2014; 121: 1414–1420. **6.** Holz FG, et al. VEGF Trap-Eye for macular oedema secondary to central retinal vein occlusion: 6-month results of the phase III GALILEO study. Br J Ophthalmol. 2013; 97(3):278–84. **7.** Korobelnik JF, et al. Intravitreal Aflibercept Injection for Macular Edema Resulting from Central Retinal Vein Occlusion One-Year Results of the Phase 3 GALILEO Study. Ophthalmology. 2014 121(11):202–8. **8.** Ogura Y, et al. Intravitreal aflibercept for macular edema secondary to central retinal vein occlusion: 18-month results of the phase 3 GALILEO study. Am J Ophthalmol. 2014; 158(5):1032–8. **9.** Korobelnik JF, et al. Intravitreal aflibercept for diabetic macular edema. Ophthalmology. 2014 121(11):2247–54. **10.** EYLEA Product Information 23 September 2015 **11.** Davidson JA, et al. How the diabetic eye loses vision. Endocrine 2007; 32(1): 107–116.
#Data on file. Bayer HealthCare.

EYLEA® aflibercept (rch) solution for intravitreal injection