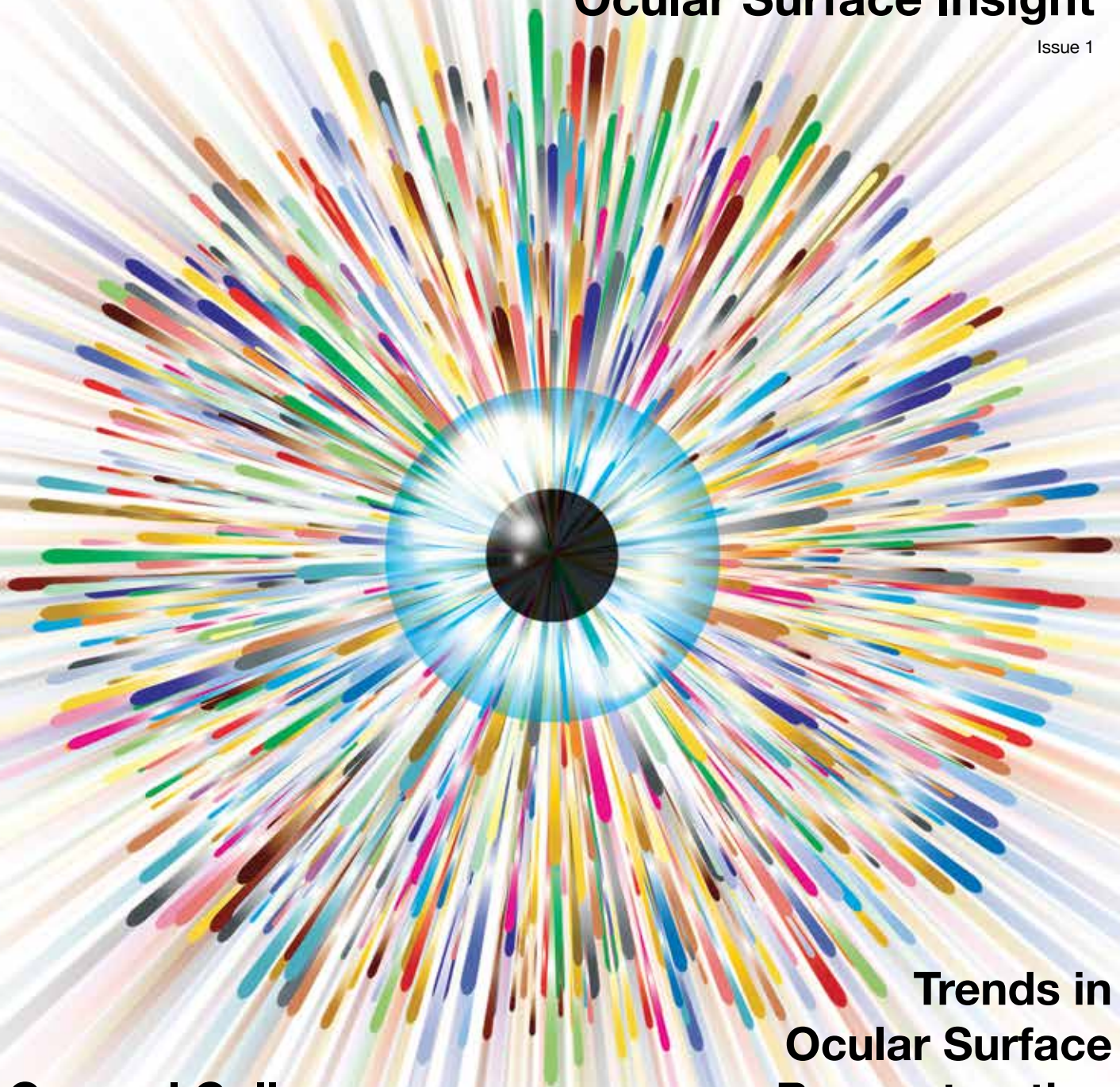
MIDDLE EAST EDITION

OSI

Ocular Surface Insight

Issue 1



Trends in Ocular Surface Reconstruction

Corneal Collagen Cross-Linking in Children with Keratoconus

The importance of dry eye assessments

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Ocular Surface Insight

"Be brave enough to live the life of your dreams according to your vision and purpose instead of the expectations and opinions of others."

Roy Bennett

Welcome to the first Ocular Surface Insight – Middle East Edition

Ocular Surface Insight is a publication focusing on cornea and ocular surface disease and its impact on all areas of medical and surgical ophthalmology.
We present pioneering medical therapies and surgical techniques to ophthalmologists and eye health professionals.

This publication was founded 4 years ago in the UK and we are now proud to introduce our dedicated Middle East edition.

We present articles written by key opinion leaders and those with special expertise and experience.
They will be disseminating their in- practice pearls of wisdom, that are both practical and have immediate clinical relevance. We will publish article submissions, new research and treatments for ocular surface disease.
This journal aims to help you strengthen your practice and improve the outcomes for your patients.
Our goal is to become one of the major sources of knowledge in the field.

We have many distinguished contributors, providing innovative and cutting-edge content. We aim to show the patients point of view via a series of articles focusing on patients own stories. We present articles relating to lifestyle choices and their effects on the patients.
We will be exploring the effects of chronic disease on the patients' emotional and psychological wellbeing.

This publication is free of charge to all ophthalmologist.
We encourage you to get in touch with us for article submissions and with suggestions for content.
This magazine is for your benefit and we want it to become a forum for discussion, so your suggestions are very important to us. We hope you will find this publication helpful and we await your feedback.
I hope you enjoy the magazine.

Samer Hamada

Samer Hamada,
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Media No. 0001

Published November 2020

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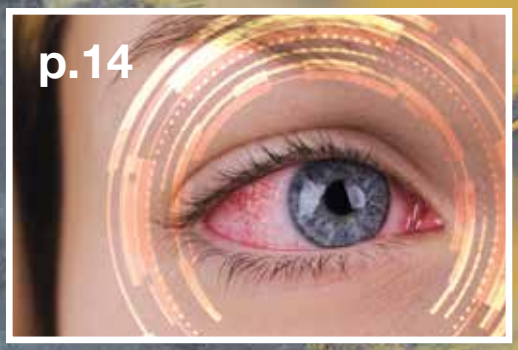


New Insights into Corneal Biomechanics

by **Dr. Zisis Gatzioufas** & **Mr. Samer Hamada.**

Corneal biomechanical properties are essential for the early detection of corneal ectatic disease such as keratoconus, as well as for predicting and evaluating the visual outcome in corneal refractive surgery, the risk for corneal ectasia, and the response to corneal collagen crosslinking (CXL). Advances in measurement of corneal biomechanical properties have the potential to enhance early keratoconus diagnosis, enable personalized, procedure- specific ectasia risk assessment, and optimize cross-linking treatment for stopping progression of corneal ectatic disease.

Current corneal imaging technology provides an accurate anatomical and topographical analysis of the cornea, which is the “gold standard” for the diagnosis of corneal ectatic disease and the preoperative screening in refractive surgery. Until recently, evaluation of corneal biomechanics was feasible only in vitro, since the technology required for in vivo analysis was not available. However, in the recent years, there have been developed methods which enable an accurate in vivo analysis of corneal biomechanics, thereby introducing a new era in corneal diagnostics and corneal-refractive surgery.

In the terminology of material science, the cornea is a complex anisotropic composite with nonlinear elastic and viscoelastic properties. It is a composite because its properties are determined by the interaction of disparate materials like collagen and a polyanionic ground substance. It is anisotropic because its properties are not directionally uniform. The cornea is also highly structurally heterogeneous when the center is compared to the periphery and the anterior cornea is compared to posterior surface. Viscoelastic properties arise from the time- dependent nature of biomechanical responses and are a feature of all biological soft tissues. These properties can be represented by the phenomena of hysteresis, stress relaxation, and creep. As opposed to the symmetric loading and unloading behaviour of purely elastic materials, viscoelastic materials return to their pre-stress configuration via different stress-strain pathways that depend on loading rates. This discordance between loading and unloading behaviour can be partially characterized by hysteresis. Viscoelastic creep is a time-dependent elongation that occurs under a sustained stress (such as intraocular pressure) or repeated stress (such as the ocular pulse amplitude) and may be an important contributor to the biomechanics of corneal ectasia.

Shear strength describes the corneal stromal resistance to sublayer sliding. Corneal shear strength is very low relative to its tensile strength, but provides a mechanism for load transfer between lamellae that may contribute to hyperopic shift after photoablation. The shear resistance provided by collagen interweaving and other extracellular matrix forces may be reflected in metrics such as the interlamellar cohesive strength, which is greatest near Bowman’s layer and decreases by more than 40% in the posterior stroma. Interlamellar cohesive strength appears to increase as a function of age, depends on the meridian, is greater in the corneal periphery than in its center, and is lower in the inferior periphery than in other corneal quadrants. These regional differences in corneal properties help define the biomechanical equilibrium of a certain cornea and are likely to be important in the pathogenesis of corneal ectasia.

Keratoconus and iatrogenic keratectasia after corneal refactive procedures represent the most common clinical entities of corneal ectatic disease. The current 'gold standard' for the diagnosis of keratoconus is computer-assisted corneal topography. Placido- based modalities or Scheimpflug camera-based systems facilitate an accurate analysis of the anterior and posterior corneal surface, thereby providing valuable topographic and pachymetric data, which are important for the diagnosis of keratoconus. However, the major diagnostic challenge is the diagnosis of subclinical form of keratoconus, which is not diagnosed by computer-assisted corneal topography and tomography and is a ssociated with certain alterations in the corneal biomechanical profile. On the other hand, diagnosis of forme fruste keratoconus, which is an extremely mild form of keratoconus occurring anytime throughout life and showing no progression, poses sometimes diagnostic dilemmas.
Nowadays, modern diagnostic modalities are being employed in routine clinical practice, such as the Ocular Response Analyzer (ORA) and the Corvis ST, in order to investigate the corneal biomechanical properties in vivo, thereby improving our diagnostic capacity in the early diagnosis of keratoconus.

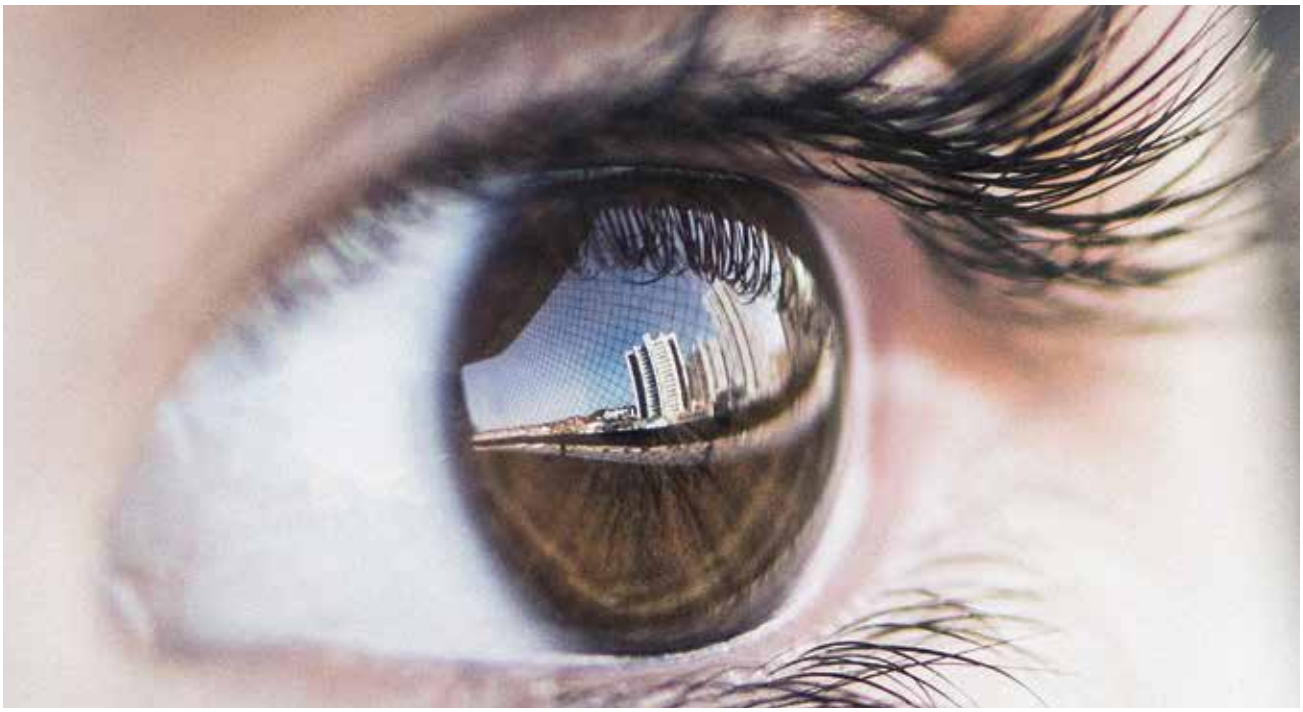
"The current 'gold standard' for the diagnosis of keratoconus is computer-assisted corneal topography..."

Several studies have documented that keratoconus is associated with significant reduction of corneal rigidity and damping capacity of the cornea. The modified viscoelastic profile of the cornea in keratoconus is reflected in the reduction of corneal hysteresis (CH)- and corneal resistance factor (CRF)- values by the ORA measurement, where an air-puff system is employed for inducing dynamic corneal deformation.

The biomechanical detection of subclinical form of keratoconus is extremely challenging, because there is no validated corneal topographical and tomographical diagnosis for this clinical entity and, thus, it is difficult to interpret the comparative correlations between biomechanical and topographical/tomographical changes. It has been reported that certain variables of the ORA-waveform have an increased capacity of discriminating forme fruste keratoconus from normal cornea. However, ORA signal analysis requires high expertise and display only moderate reproducibility, sensitivity and specificity.
The Corvis ST employs a similar air puff perturbation like the ORA, but does not vary the air puff pressure from measurement to measurement and captures a 2-dimensional cross-section of the deforming horizontal meridian with a high-speed Scheimpflug camera. The new software programme introduced by the manufacturing company enables accurate quantification of the corneal biomechanical properties in vivo, and promises high diagnostic capacity for the diagnosis of forme fruste keratoconus. However further studies are required for validating its efficacy in the diagnosis of forme fruste keratoconus.

Other emerging techniques with the potential for clinical application include interferometric determinations of apical displacement during IOP changes, corneal optical coherence elastography, brillouin microscopy and supersonic shear imaging. To varying degrees, these approaches offer the potential for more comprehensive spatial characterisation of properties, a feature that may be helpful in differentiating early keratoconus.

In conclusion, nowadays there is modern technology for precise in vivo evaluation of the corneal biomechanics. Computer-assisted corneal topography and tomography remain the 'gold standard' for the diagnosis of corneal ectasia, but consideration of the corneal biomechanical properties could increase the input of information which is necessary for the detection of subclinical form of keratoconus, thereby improving the safety for corneal-refractive procedures such as LASIK. The future of corneal ectasia screening promises the development of hybridic diagnostic modalities, which will incorporate biomechanical and topographical data, introducing a new era in corneal diagnostics.



What's in the news?

Symptoms of Ocular Surface Disease in Construction Workers: Comparative Study with Office Workers

The authors set out to investigate and contrast the prevalence of dry eye symptoms in construction workers and office workers using the OSDI questionnaire.

A cross-sectional, observational study was conducted using the OSDI questionnaire to evaluate dry eye symptoms and associated risk factors. Sampled size calculation with a power of 80% and a 95% degree of confidence suggested the inclusion of 298 participants.

They studied 304 subjects (149 construction workers and 155 office workers). More than half (55%) of the participants presented dry eye symptoms (OSDI > 12). The average OSDI score was 21.30 ± 22.20 points, being lower in the group of construction workers (12.45 ± 17.50) than in-office workers (28.51 ± 22.99) ($p < 0.001$). Considering participants who had moderate and severe symptoms (23 to 100 points in OSDI), office workers presented dry eye symptoms 4.15 times more frequently than construction workers (OR 4.15, 95% CI 2.52, 6.85). Women presented statistical evidence of higher OSDI scores than men (32.47 ± 23.72 vs. 14.87 ± 18.48, respectively).

The conclusion from the study was that construction workers have four times less risk of presenting dry eye symptoms than people working in the average office space. This highlights the pernicious effects on the ocular surface of the office environment, which poses a significant risk for the development or worsening of dry eye symptoms.

BMC Ophthalmol2020 Jul 9;20(1):272.doi: 10.1186/s12886-020-01548-0.
Authors: Sergio Hernandez-Llamas, Ana Karen Paz-Ramos, Patricio Marcos-Gonzalez, Francisco Amparo, Manuel Garza-Leon.

Cataract Surgery and Dry Eye Disease: A Review

The aim was for the authors to review published literature concerning cataract surgery and dry eye disease (DED).

A search was undertaken using the following: PubMed (all years), Web of Science (all years), Ovid MEDLINE(R) (1946 to 12 December 2019), Ovid MEDLINE(R) Daily Update 10 December 2019, MEDLINE and MEDLINE non-indexed items, Embase (1974-2019, week 49), Ovid MEDLINE (R) and Epub Ahead of Print, In-Process and Other Non-Indexed Citations and Daily (1946 to 12 December 2019), CENTRAL (including Cochrane Eyes and Vision Trials Register; Cochrane Library: Issue 12 of 12
December 2019), metaRegister of Controlled Trials (mRCT) (www.controlled-trials.com), ClinicalTrials.gov (www.clinicaltrial.gov)

and WHO International Clinical Trials Registry Platform (www.who.int/ictrp/search/en). Search terms included 'cataract surgery', 'phacoemulsification' and 'cataract extraction', combined with 'dry eyes' and 'ocular surface'. Relevant in-article references not returned in our searches were also considered.

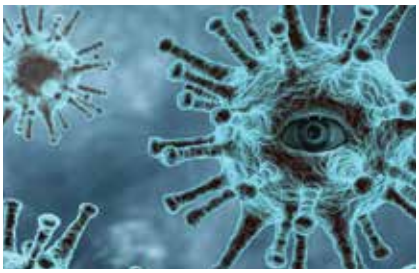
Publications identified included systematic reviews, meta-analysis, randomized controlled trials, cohort studies, case series and laboratory-based studies. Published data highlighting the burden of DED both prior and following cataract surgery were reviewed as well as studies highlighting the effects of cataract surgery on the ocular surface, intra-operative measures to reduce deleterious effects on the ocular surface and current evidence on the management options of post-operative DED.

DED is common and can be exacerbated by cataract surgery. Ophthalmologists need to assess for pre-existing DED and instigate treatment before surgery; be aware of reduced accuracy of measurements for surgical planning in the presence of DED; limit intra-operative surgical factors damaging to the ocular surface; and consider management to reduce DED post-operatively.

Eur J Ophthalmol. 2020 Jun 9;1120672120929958.doi: 10.1177/1120672120929958.
Authors: Khayam Naderi , Jack Gormley, David O'Brart 1

What's in the news?

Propensity and Quantification of Aerosol and Droplet Creation During Phacoemulsification With High-Speed Shadowgraphy Amidst COVID-19 Pandemic



To study propensity of aerosol and droplet generation during phacoemulsification using high-speed shadowgraphy and quantify its spread amidst COVID-19 pandemic.
In an experimental set up, phacoemulsification was performed on enucleated goat eyes and cadaveric human corneo-scleral rims mounted on an artificial anterior chamber. Standard settings for sculpt and quadrant removal mode were used on Visalis 100 (Carl Zeiss Meditec, Germany). Microincision and standard phacoemulsification were done using titanium straight tips (2.2 and 2.8 mm in diameter). The main wound incisions were titrated equal to and larger than the sleeve size.
High speed shadowgraphy technique was used to detect the possible generation of any droplets and aerosols. The visualization and quantification of size of the aerosols and droplets along with calculation of their spread were the main outcome measures.

The results showed that in longitudinal phacoemulsification using a peristaltic pump device with a straight tip, no aerosol generation was seen in a closed chamber. In larger wounds, there was a slow leak at the main wound. The atomization of balanced salt solution was observed only when the phaco tip was completely exposed next to the ocular surface. Under this condition, the nominal size of the droplet was ~ 50 µm and the maximum calculated spread was 1.3 meters.

The conclusion was that there was no visible aerosol generation during microincision or standard phacoemulsification.
Phacoemulsification is safe to perform in the COVID-19 era by taking adequate precautions against other modes of transmission.

The prevalence of keratoconus in children with allergic eye disease in an Egyptian population

A cross-sectional study was conducted on all children presenting with ocular allergic disease from September 2017 to September 2018. All study participants were subjected to history taking (a specially designed questionnaire), routine ophthalmological examination, and corneal tomography.
Results: A total of 79% of the study patients had vernal keratoconjunctivitis (VKC) while the remaining had perennial allergic conjunctivitis (10%), seasonal allergic conjunctivitis (9%) and atopic keratoconjunctivitis (2%). Manifest KC was seen in 7% of cases, suspect KC was found in 27% of cases, and 66% had no evidence of KC. For the manifest KC, 56% had clinical signs, while 44% were diagnosed by tomography. For the purpose of statistical analysis, the cohort was divided into group KC (manifest or suspicious KC) and group non-KC (no KC). The mean age was 11.2 years in group KC, and 9 years in group non-KC ($p < 0.001$). The mean duration of allergic symptoms was 3.75 years in group KC, and 2.5 years in group non-KC ($p = 0.001$). The mean duration of eye rubbing was 2.5 years in group KC, and 0.83 years in group non-KC ($p = 0.02$). Systemic atopy was present in 35.3% of group KC, and in 12.5% in group non-KC ($p = 0.005$).

The overall prevalence of KC was 34%. Risk factors for the development of KC in patients with ocular allergy were age, duration of symptoms specially eye rubbing, systemic atopy and VKC. Tomographic diagnosis of KC can be present in absence of clinical signs.

Eur J Ophthalmol 2020 Jul 13;1120672120942691.doi: 10.1177/1120672120942691.
Authors: Alyaa Saeed Ahmed, Mohamed-Sameh H El-Agha, Mahmoud Osama Khaled, Shireen Mostafa Shousha

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1. Selected polysaccharides at comparison for their mucoadhesiveness and effect on precorneal residence of different drugs in the rabbit model. Drug Dev. Ind. Pharm. 35, 941–949, 2009

2. Open-label randomized clinical trial on the efficacy and tolerability of Hydramed in the treatment of dry eye syndrome. Data on file.

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Trends in Ocular Surface Reconstruction

by **Mr. Samer Hamada**

The last few years have witnessed an expanding interest in the diagnosis and management of ocular surface disease partially due to the growing number of studies that define eye surface disease as a chronic/recurrent eye surface inflammation. The term Ocular Surface Disease or Dysfunction (OSD) refers to a group of eye diseases ranging from the mild meibomian gland dysfunction (MGD) to the most severe ocular surface damage as in Steven Johnson syndrome (SJS), toxic epidermolysis necrosis (TEN), or Ocular mucous membrane pemphigoid (OC- MMP). At least 20% of the patients seen in a general eye clinic would be someone with acute or chronic eye surface disease, such as meibomian gland dysfunction, rosacea blepharitis, dry eye syndrome, chronic inflammation from topical glaucoma treatment, cicatricial conjunctivitis, Ocular Surface burn, immunological conditions, primary or secondary stem cell deficiency.

Even the mildest form of dry eye disease could be a challenge to diagnose and manage. While conservative treatment is expanding, there is only limited improvement in the surgical approach to eye surface failure. In the United Kingdom alone there are more than 240 cases of cornea Limbal stem cell deficiency every year.

The key elements are:

1 To consider the level of disease activity i.e. mild, moderate, or severe inflammation level of eye surface inflammation. This can be mild or severe inflammation but it is always progressive and reversible.

2 The level of eye surface and adnexa damage. This might include a change in the anatomy, physiology, or function of eyelids, fornices, lacrimal glands, and/or the surrounding tissue. The damage is usually cumulative and irreversible.

When approaching a patient with eye surface disease, I always ask myself the five key questions:

A Do eyelids look normal in terms of position and function?

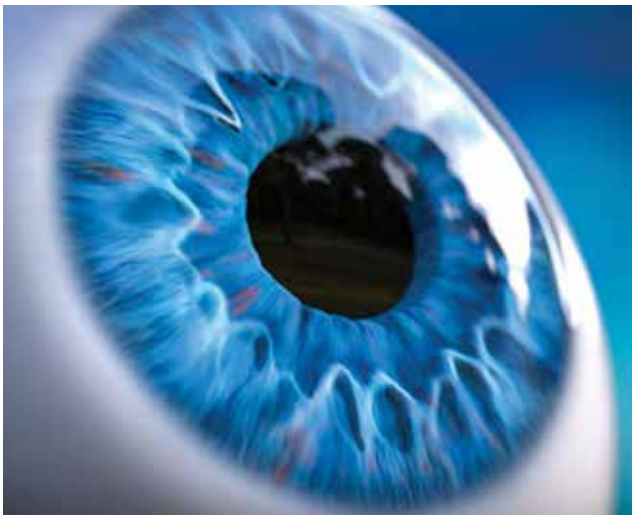
B Is the eye inflamed or quiet?

C Is it wet or dry?

D What is the corneal sensation?

E What is the functionality of corneal limbal stem cells?

Management of eye surface disease starts with optimising the surface and controlling inflammation and glaucoma. Restoring Ocular Surface will almost always require the use of immunosuppression treatment, amniotic membranes, and management of stem cell deficiency. Management options have expanded but strict control of eye surface inflammation, remains a top priority before other options. While modifications to Ocular Surface environment and heavy use of artificial tears can help, it is often a situation where topical steroid has to be used to break the inflammatory vicious circle. The topical use of non-steroidal anti-inflammatory drugs has been the trend, knowing that these patients rely heavily on topical steroid therapy to control the conjunctival and corneal inflammation. Topical Ciclosporine and Tacrolimos are the main ones, but others are being tested and might become available for clinical use in the near future. We know that the process of inflammatory corneal



neovascularisation is not easy to stop and will worsen the condition, and contribute to the failure of any future keratoplasty. Hence the use of Anti vascular endothelial growth factor (Anti-VEGF) to treat newly developing blood vessels; and/or fine needle diathermy (FND) to block the established corneal vessels could help to reduce further corneal damage, and increase the success rate of future corneal reconstructive procedures such as partial or full thickness corneal transplantation.

Once the ocular surface is optimised and ready for the next stage, then limbal corneal stem cell transplantation is considered to treat failed corneal surface.

Stem cell transplantation started more than 27 years ago and can be an allograft or autograft depending on degree of stem cell deficiency and whether one or both eyes are affected. Stem cell in allograft transplant could be taken from a relative which is called living related or from a cadaver eye and that would be cadaveric stem cell transplant. The cells are expanded in the eye bank and then transplanted to the diseased eye, so called living related or cadaver Ex-Vivo stem cell transplantation. Alternatively or jointly the kerato-limbal rim from the cadaver eye might be transplanted and this offers the advantage of having anatomical restoration to the damaged limbus.

If stem cells deficiency is unilateral then a biopsy of the healthy eye limbus is done and then expanded in the eye bank in the similar fashion as above. Alternatively it might be transplanted directly or over an amniotic membrane to the diseased eye and distributed in a mid- periphery of the cornea leaving the visual axis clear, the cell expansion will happen in Vivo in what is termed as Simple Limbal Epithelium Transplantation (SLET). As there is no need for the eye bank to grow the cells, this technique has increased in popularity. It is also a much cheaper method to rehabilitate ocular surface failure. Allograft transplantation carries the risk of rejection and therefore immunosuppression treatment is almost always required; posing various risks from drug side effects that could affect patients quality of life. Avoiding these risks is important especially in young patients and children.

In 2004, Kinoshita's group from Kyoto Prefectural University of Medicine in Japan investigated the use of autologous mucosal epithelium of non-ocular surface origin because these cells have high potential of proliferation with short cell turnover time. Oral mucosa was chosen as best non-corneal source of epithelial cells. Oral biopsies are safe and the transplanted autograft does not require heavy immunosuppression treatment.
The surgery was later called Mouth-to-eye-epithelial transplantation (MEET) or Cultivated autologous oral mucosal epithelial transplantation (COMET) and has been a popular choice among surgeons and patients alike with steady increase in clinical application in various patients' groups, leading to accumulating positive evidence on efficacy and safety.
A new modification to the technique is called Simple oral mucosa epithelial transplantation (SOMET) which allow for direct transfers of buccal mucosa to the corneal bed bypassing the need to expand the cells in the eye bank. This is fairly new and further evidence on safety and efficacy is awaited.

"Management of eye surface disease starts with optimising the surface and controlling inflammation and glaucoma..."

Autologous non-limbal epithelium (MEET or COMET) is favourable in bilateral disease, risk of limbal stem cell deficiency in the fellow eye, children, unwell patients, or when immunosuppression treatment is contraindicated. There are claims that the oral mucosal epithelial cells secrete angiogenic factors that induce neovascularisation in the periphery and that there is lack of absolute corneal epithelial clarity. However, by weighing risks against benefits these observations become less important. We don't know how it works; whether transplanted cells replace the host progenitor/stem cells for a long period of time or that the transplanted cells revitalise the host stem cells presumably through chemical signals such as the secretion of growth factors and chemotactic stimuli.

More than 260 patients had so far benefited from MEET/COMET. 20% were below age 30 and 40% above age 60. The growing evidence on safety meant that an increasing number of children are benefiting from the MEET surgery. The initial trials were performed on sever cases of Steven Johnson Syndrome (SJS) and by now those constitute around 22% of patients who benefited from MEET. Chemical and thermal burns constituted about 36% of the cases. Cases of non-inflammatory stem cell deficiency like aniridia had the best outcomes. Clinical success is measured by assessing ocular surface stability with no epithelial defect to last longer than one week, the morphological features of corneal phenotype and level of ocular surface staining and inflammation/vascularisation. Success was achieved in 72% of patients after 2 or less procedures, with 68% of patients felt improvement in their visual functions. Complications occurred such as corneal stromal melt in 4% and persistent epithelial defect in 22% (indicating failure of stem cell transplantation). Glaucoma or ocular hypertension happened in 9% of cases. Risk of infection was very low.

Unfortunately there are no a validated methods to measure patients reported outcomes and measuring success, relies purely on clinical assessment by the treating surgeon.

Success in Ocular Surface reconstruction is multifactorial, but the preoperative management is an essential element for success by optimising ocular surface, eliminating risk factors of rejection, and the use of immunosuppression treatment. Patients should be involved in decision making and surgeons should warn their patients to be prepared for failure rate up to 69%.

The reconstruction of ocular surface is a challenging long journey but patients' expectations should be measured at an early stage to exclude those with unrealistic expectations. The outcomes of modern ocular surface surgery are improving and although time consuming, it is very rewarding to both the patient and surgeon alike.

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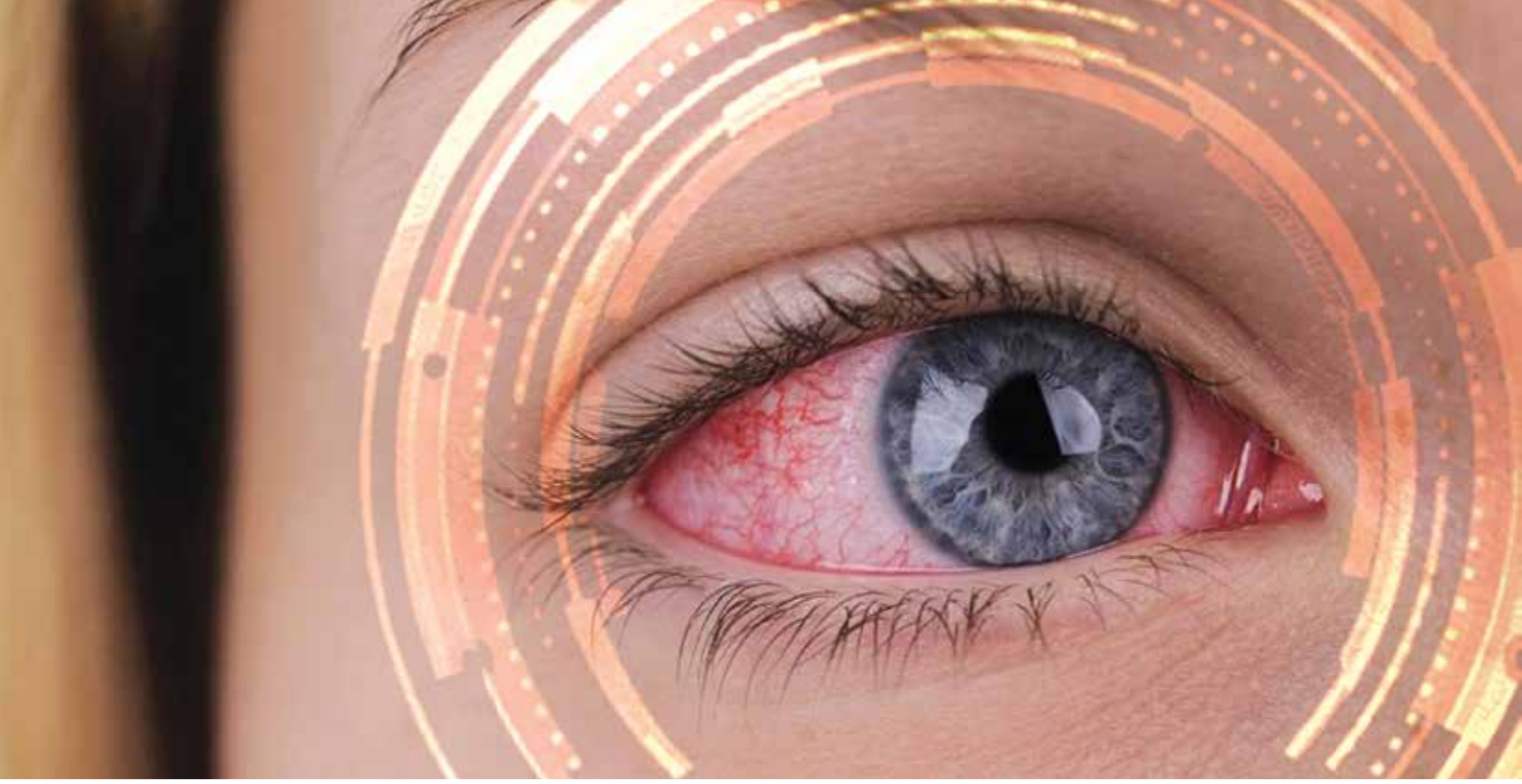
3. Robert P, et al. Eur J. Ophthalmol 4 . 2016. Amrane M, et al. J Fr Ophthalmol98–589-(8)37: 2014.
*versus conventional and standard hyaluronate (HA) eye drops.

PP-CATION-EMEA0014-; Date of Preparation: March2018



Dry Eye Disease – A patient's perspective

by **Ms. Liz Tester**

I am 32 now. When I was 22 I started to wake up at night with a gritty feeling in my eyes. For a while I just used Optrex and other over the counter drops. When it didn't get any better I went to my GP and for a year they kept telling me just to use Optrex eye wash or make my own saline drops. They didn't think someone in their early 20s could suffer from dry eyes. It didn't improve so I pushed to be referred to my local eye unit, where I was told it was likely connected to the mild facial rosacea I had.
I was prescribed Celluvisc and told to clean my eyelid margins with baby shampoo. The condition improved slightly and between 2007 up until the end of 2012 I had six monthly check ups. My eyes throughout this time were mildly dry, strong air- conditioning bothered me but on the whole it didn't really impact my life.

At the end of 2012 my eyes became much more uncomfortable to the point that working was extremely difficult, especially as my job involves a lot of computer work. I saw quite a few Ophthalmologists both in the NHS, and privately. I didn't feel anyone was really taking the condition seriously, appointments were 5 minutes long and I was told to use more eye drops and use warm compresses anywhere between once and 5 times a day and I'd get better. My condition didn't improve and I became depressed about it, my social life became non-existent and I was taking a lot of time off work.

After many trips back and forth to the eye unit, I finally saw an Ophthalmologist who was the first to acknowledge that it can be a difficult condition to treat, and told me it was in fact moderate to severe at that point (I already knew this myself). I continued to see him from mid-2013 to present. My condition is still on the severe end of the spectrum but having a knowledgeable and compassionate doctor was a huge turning point for me mentally and I haven't felt the despair I used to feel since being under his care.

A big turning point was also joining a dry eye forum dryeyezone.com started by an American lady called Rebecca Petris, who had suffered severe dry eye as a result of laser eye surgery. There are many stories on the forum of the awful experiences people have had with their eye doctors, but it is a very supportive forum and a lot of research papers are posted to give people some hope.
I honestly feel I know more than some of the Ophthalmologists I've seen about dry eye treatments from being a member of the forum. My ophthal-mologist welcomes me doing my own research where as other doctors didn't want to know as they felt I was undermining them.

In terms of treatments I spent £1300 on Lipiflow at a private clinic which did not help one bit and remains one of my biggest regrets! I still struggle on a day to day basis. I need to rest my eyes regularly and it is rare that I am able to go to the cinema, out for meals etc unless I'm having an 'OK day'.
I currently use Blephasteam goggles every evening to help the meibomian gland dysfunction and use Hylo Forte drops throughout the day, these are the only drops I can tolerate and I've tried A LOT of them. I've learned that eating sugary foods is really bad for my eyes, I assume this is because sugar causes inflammation.
I avoid alcohol as it is dehydrating and I drink a lot of water through the day.
I have tried Doxycycline but I have seen no improvement from it though I know it has helped many people.

I remain optimistic that there will be more treatment options available in the next 5 to 10 years and that my Ophthalmologist will let me know about them when he receives information!'.

What's in the news?

Effects of Cataract Surgery on Symptoms and Findings of Dry Eye in Subjects With and Without Pre-existing Dry Eye

The purpose of this study was to compare dry eye symptoms and findings in post cataract surgery eyes' with and without pre-existing dry eye. The design of the study was prospective, observational with case-control.

Sixty-seven eyes that had undergone cataract surgery were included; 48 were classified into group D (pre-existing dry eye) and 19 into group N (no pre-existing dry eye). No subjects received perioperative treatment for dry eye. We evaluated between-group differences in symptom scores, corrected distance visual acuity (CDVA), tear film breakup time (BUT), tear film breakup pattern (BUP), and ocular surface fluorescein staining scores, at 1 week, 1 month, and 3 months postoperatively.

Symptoms were unchanged in group N, but improved in group D ($P < .001$) postoperatively. CDVA was improved after surgery in both groups ($P < .001$). BUT was shorter preoperatively in group D than in group N although this difference was absent 1 month post-operatively. Fluorescein staining scores significantly increased at 1 month postoperatively in group N ($P = .01$), but did not change in group D. During the perioperative period, the predominant BUP was the random break pattern in both groups (≥ 85%). From 1 week to 3 months, dimple break patterns decreased in group D ($P = .007$), whereas spot break patterns increased ($P = .01$).

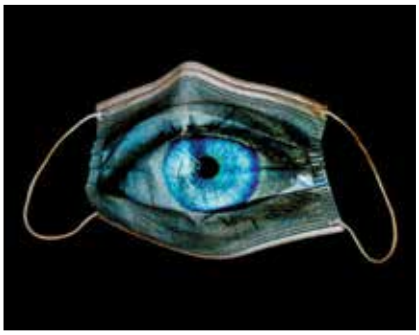
The authors concluded that cataract surgery has an influence on tear film stability and the ocular surface. There was either a transient improvement or worsening of ocular surface wettability in some patients without pre-existing dry eye.

What's in the news?

Impact of the COVID-19 lockdown on digital device-related ocular health

Since the declaration of the lockdown due to COVID-19, the usage of digital devices has gone up across the globe, resulting in a challenge for the visual systems of all ages. The purpose of this study is to assess the impact of the lockdown on digital device usage, and consequently, the ocular surface health implications and circadian rhythm abnormalities related to digital eye strain.
An open online survey was sent through various social media platforms and was open for a period of 2 weeks.

For the results a total of 407 usable responses were obtained; the average age of respondents was 27.4 years. Typically, 93.6% of respondents reported an increase in their screen time since the lockdown was declared.
The average increase in digital device usage was calculated at about 4.8 ± 2.8 h per day.The total usage per day was found to be 8.65 ± 3.74 hours. Sleep disturbances have been reported by 62.4% of people. Typically, 95.8% of respondents had experienced at least one symptom related to digital device usage, and 56.5% said that the frequency and intensity of these symptoms increased since the lockdown was declared.



The study highlighted the drastic increase in use of digital devices after the initiation of the COVID-19 lockdown, and along with it, the slow deterioration of ocular health across all age groups. Awareness about prevention of digital eye strain should be stressed, and going forward, measures to bring these adverse effects to a minimum should be explored.

Indian J Ophthalmol. 2020 Nov;68(11):2378-2383. doi: 10.4103/ijo.IJO_2306_20.

Authors: Aleksander Machowicz , Isaac Hall , Paola de Pablo , Saaeha Rauz , Andrea Richards , Jon Higham , Ana Poveda-Gallego , Fumiaki Imamura , Simon J Bowman , Francesca Barone , Benjamin A Fisher

Corneal Collagen Cross-Linking in Children with Keratoconus

by **Dr. Lisa McAnena** & **Professor Michael O'Keefe**

Corneal Collagen Cross-Linking has become a standard treatment for keratoconus over the past decade, and its safety and efficacy in halting the progression of this disease have been well established. It is becoming increasingly recognized that keratoconus in younger patients (aged 18 years or less) can often behave more aggressively; presenting at more advanced stages and progressing more rapidly than in older patients. Therefore, the application of CXL in this patient group is of significant interest, and the evidence is now supporting its particular relevance in children and teenagers with keratoconus.

Keratoconus is a progressive ectatic disorder of the cornea with a prevalence of 54.5 per 100,000 population[1]. The disease typically presents in the teenage years and progresses until the third or fourth decade and may be associated with chronic eye-rubbing behaviour, atopic disease and soft tissue disorders such as Ehlers Danlos and Marfans syndrome. Trisomy 21 is also a risk factor, with a recent paper reporting an odds ratio of 6.22 (95% CI, 2.08-18.66)[2]. Clinically, keratoconus presents with progressive loss of vision and increasing irregular astigmatism in the affected eye3. Clinical evaluation consists of visual acuity assessment, slit lamp exam and monitoring of topographic indices, namely maximum, mean and/or minimum K values, refractive errors (focusing on astigmatism) and central corneal thickness. Progression can be defined as a change of ≥ 1D in Kmax[4].

Keratoconus in children needs particular consideration as it can pose some significant clinical challenges compared with their adult counterparts. As mentioned, the disease may present at a later stage than in adults; in one study, 27.8% of children presented at stage 4 compared with 7.8% of adults[5].

Children are also more likely to demonstrate progression, with up to 88% doing do in the first year[6]. Children with keratoconus are also more likely to be eye-rubbers, male, and have allergic disease than adults[7] and younger age is an independent risk factor for requiring penetrating keratoplasty (PKP) in keratoconus[8-10]. Treatment of children with keratoconus with contact lenses may also be more challenging, as is the post-operative management of corneal grafts in these patients. Additionally, monitoring progression with topographic measurements may be difficult in children and should be performed by skilled technicians.

> "There are no randomized controlled trials of on CXL in children with keratoconus, rather, the majority of studies are retrospective case series, with some prospective and/ or comparitive studies..."

Originally developed at the University of Dresden, CXL is a technique that induces cross-links in the collagen of the corneal stroma by photosensitizing it with riboflavin and exposing it to ultraviolet-A (UVA) light, resulting in increased biomechanical rigidity[11-12]. This reinforcement of corneal integrity acts to stop or slow down the progressive ectasia seen in keratoconus. There have been 3 randomised controlled trials of CXL, a Cochrane systematic review of which concluded that CXL-treated eyes were less likely to progress (an increase of 1.5D or more in Maximum Keratometry (KMax)) than sham- treated eyes and that, on average, CXL-treated eyes had better uncorrected visual acuity and less steep corneas at 12 months[13]. These studies all examined the standard, "Dresden" protocol of CXL; as does the vast majority of the literature on the topic. This method involves exposure of the de-epithelialised corneal stroma to 30 minutes of 370 nm UVA with an irradiance of 3 mWcm whilst applying 0.1% riboflavin at 5-minute intervals. Although the efficacy of this method is well established, it carries the disadvantages of pain experienced in the post-operative days of epithelial healing and long procedure times. To tackle these issues, two novel methods of CXL have been introduced; the trans- epithelial approach (reducing post-op pain) and various "accelerated" protocols. Reduction of pain and faster treatment times would logically be of particular advantage in younger patients.

There are no randomized controlled trials of on CXL in children with keratoconus, rather, the majority of studies are retrospective case series, with some prospective and/ or comparitive studies. A systematic review and meta-analysis of all published studies of CXL in children with keratoconus was published in Acta Ophthalmologica in September 2014[14]. The authors searched MEDLINE® and Cochrane databases for all studies examining the effects of standard, trans-epithelial or accelerated CXL protocols in patients age 18 years or younger. The primary outcomes were; change in 1) UCVA and 2) Kmax at 1 year. The secondary outcomes were; change at 1 year in BCVA, mean refractive spherical equivalent (MRSE), central corneal thickness (CCT), endothelial cell density (ECD). Qualitative analysis was performed on all studies meeting the inclusion criteria and quantitative analysis was performed on those studies where pre-operative and 1-year data was known for the outcomes mentioned above. Preoperative/baseline characteristics

were used as controls to compare with one-year outcomes and the results pooled to give standard mean differences (SMD), size of overall effect, and levels of heterogeneity using the Review Manager 5 [Review Manager (RevMan) [Computer program] Version 5.3 statistical software.

A total of 13 articles published between May 2011 and December 2014 examining 490 eyes of 401 patients with a mean age of 15.25 (±1.5) years were included in the qualitative analysis, which reported on the study design, number of patients and eyes studied, main outcomes and complications. Of these, 8 employed the standard, epithelium-on CXL protocol, 1 compared standard and trans-epithelial protocols, 2 examined the effects of trans-epithelial CXL, and 2 looked at accelerated CXL. There were 365 eyes of 299 patients in the standard group, 51 eyes of 46 patients in the trans-epithelial group and 74 eyes of 56 patients in the two accelerated studies. The weighted mean longest follow-up time was 28.6 months. Nine of these studies were eligible for further quantitative analysis. The two papers examining accelerated protocols were not included in the meta-analysis as they employed different treatment regimes. One of these papers, by Ozgurhan et al15, examined 44 eyes of 38 patients. They found a significant improvement in UCVA and BCVA (by -0.13 and -0.08 LogMAR, respectively), in Kmax (by 1D) and in Higher Order Aberrations, with a stable MRSE, CCT and ECD at 24 months. The second paper, conducted by Shetty et al16, looked at 30 eyes of 18 patients and found a significant improvement in UCVA and BCVA (by -0.15 and -0.12 LogMAR, respectively), Kmax (by 2.07D) and MRSE (by 0.95D) and stable ECD at 24 months.

The meta-analysis found a significant improvement in UCVA in the standard protocol group at 6-months and at 1-year (SMD -0.36; 95% CI -0.55,-0.16, p<0.01), but this improvement lost significance at 2-year follow-up. Kmax remained stable at 6 months and 1 year (SMD -0.08; 95% CI -0.26 to 0.09; p=0.36) in the standard group. Similarly, there was no significant change in Kmax at 1 year in the trans-epithelial group. The results for this group however showed high levels of heterogeneity and should be interpreted with caution. BCVA was also significantly improved at 1- year (SMD -0.69; 95%CI -1.15 to -0.22; p<0.01) and 2- year follow up in the standard group. Although there was a small improvement in the trans-epithelial group at 6-months and 1 year, this was not statistically significant. MRSE and ECD remained stable in both the standard and trans-epithelial groups. Central corneal thickness was stable at 1 year in the standard group and reduced at 1 year in the trans-epithelial group.

"...it is encouraging that visual acuity appears to improve and Kmax appears to remain stable following treatment with CXL in children with keratoconus..."

Rate of complications were variably reported amongst the included studies. There was no reported incidence of corneal scarring or infectious keratitis in any of the studies. Transient corneal haze occurred in between 4.5% and 13.3% of cases. Progression (steepening of Kmax by 1D or more at 1 year) occurred at a rate of between 4-10% in 4 papers[17-20]. The results of this meta-analysis must be interpreted with caution, as the overall quality of the evidence, coming exclusively from observational studies with high levels of heterogeneity, is low. In particular, the authors were unable to advocate for trans-epithelial CXL based on the findings of this study.

However, it is encouraging that visual acuity appears to improve and Kmax appears to remain stable following treatment with CXL in children with keratoconus. This lack of improvement is at odds with the findings of similar meta-analyses of CXL in adult patients, including the Cochrane review and one by Chunyu et al[21], which found an overall improvement in Kmax at 1 year. There is a paucity of longer-term follow up of CXL in paediatric patients. At three-year follow-up, an initial improvement in Kmax was lost in two papers6&17. It may be that, because of the inherently less stiff/more plastic corneas in younger age groups, these patients have a higher risk of progression. Therefore, longer-term follow-up of children treated with CXL at regular intervals is crucial to rule out progressive corneal steepening which may occur 3, 4 or 5 years after CXL. We advocate that patients should be followed in to their late 20's/early 30's (i.e. the natural period of clinical stabilization of keratoconus).

It appears that CXL is effective in stabilizing keratoconus in children and its safety profile to date is very encouraging. Considering the disease can be more aggressive in younger patients, we advocate treatment at initial diagnosis, rather than waiting for documented progression. Another consideration in this patient population is anaesthetic choice. In our experience, children do surprisingly well with just topical anaesthetic, and rarely need a general anaesthetic. Further studies are required to ascertain the efficacy of accelerated or trans-epithelial approaches in younger patients.

Special consideration should be given to children with Trisomy 21 and keratoconus. Topographic and visual acuity monitoring can be very challenging and corneal grafts are much more likely to fail in these patients. Again, cross-linking, most likely under general anaesthetic, should be considered at diagnosis of keratoconus in these cases.

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Types of Allergic Eye Disease

by **Joanna Tregent**, Practice Manager, Eye Clinic London

The hay fever season is upon us and your patients will start to report various eye symptoms. As a refresher we will go through definition and symptoms of various types of allergic eye disease.

Seasonal Allergic Conjunctivitis

This type of eye disease, as its name suggests, is seasonal and affects people depending on the type of pollen, such as weed pollen; this is released in late autumn, tree pollen; this is released during spring, and grass pollen; this is released during the summer months. It normally comes as a side effect of hay fever. Common symptoms include irritated, red, and watery eyes.
The eyelids can be swollen or puffy.

Perennial Allergic Conjunctivitis

This eye allergy has the same symptoms as the seasonal form but they occur all year round instead of certain times depending on air pollen. The symptoms of this type of eye disease are generally milder than its seasonal cousin. With this year round allergy, people have a response to mold, pet hair, dust and other domestic allergens.

Atopic Kerato-conjunctivitis

This type of allergic eye disease is a form of eye allergy that is severe and involves the inner lower lid lining but can also include the cornea. Atopic keratoconjunctivitis mainly affects young adults but can persevere for years and can occur all year round. A lot of people who suffer with this type of eye allergy usually suffer allergic rhinitis, atopic dermatitis and sometimes asthma. Symptoms can include burning, intense itching, redness and the production of thick mucus. Common causes are dust mites and pet hair amongst others.
If atopic keratoconjunctivitis is left untreated complications can occur such as corneal scarring and infection.

Vernal Kerato-conjunctivitis

Vernal keratoconjunctivitis is more serious than some other types of eye allergies. It mainly affects boys and young men who mostly have a family history of allergies or have eczema or asthma. Symptoms include itching, photophobia, foreign body sensation, intense tearing and thick mucus production. Visually the eye area may be swollen and red and there are hard bumps underneath the upper eyelid. It can affect people all year round but symptoms can get worse seasonally. If left untreated this eye allergy may impair vision and in very severe circumstances can cause corneal ulcers leading to scarring.

Contact Allergic Conjunctivitis

This type of eye allergy is caused by contact lens irritation which is caused by an allergic reaction in the conjunctiva or it can be caused by the proteins found in tears binding to the surface of the lens. Symptoms include itching, redness, mucus and being uncomfortable in contact lenses.

Giant Papillary Conjunctivitis

This type of eye allergy is linked to wearing contact lenses and is a severe form of the contact allergy described above where papules develop on the lining of the upper inner eyelid and appear as hard bumps. The causes can be from an allergic reaction to the contact lens and/or solution, an allergy to a buildup of allergens, such as pollen, on the contact lens or rubbing from a contact lens, old scar or other types of foreign body in the eye. Symptoms can include itching, tearing, puffiness, foreign body sensation, mucus and being unable to tolerate contact lenses. This is an eye allergy that must be assessed by an eye clinic to determine the best treatment, which normally consist of not wearing contact lenses for some time and changing from one type of contact lens to another.

Is it Dry Eye or Allergic Eye Disease?

In the majority of cases it is easy to differentiate dry eye disease from allergic eye disease by taking a good history focusing on current symptoms, observing ocular surface, and performing simple diagnostics however in some cases it is difficult to tell. In our next edition we will discuss in details tips and tools to help you reaching the correct diagnosis.

Tips on helping patients handle the psychological impact of chronic health problems

by **Dr. Colin Williams**, CBT Therapist & Coach (MSc CBT & REBT)

Chronic health problems are one of the many challenges life presents that test our emotional resilience. Patients who are emotionally resilient are more likely to manage their chronic health problem more effectively.

What is emotional resilience?

There are many definitions of emotional resilience, using a simple definition increases the likelihood that patients will understand and be willing to develop their emotional resilience.

Emotional resilience can be described as
"Using skills to handle the difficult thoughts and feelings that naturally arise when faced with life's challenges, so they have less impact on us"
There are many myths about emotional resilience, here are some of the common ones.

- **You either have it or you don't. (Emotional resilience is a fixed characteristic)**

"Expand your awareness as you breath slowly, simultaneously notice your breathing, your body, look around and notice what you can see, hear, smell, touch, and feel..."

Facts:

Our emotional resilience varies based on the type of challenge we face in life (Health, relationship, money, work problems etc.) and what is important to us at the time we encounter the challenge.

- **It comes almost entirely from within us (Some of us have it some of us don't)**

Emotional resilience is learned and can be improved by anyone willing to practicse a few simple skills.

- **Its bouncing back from adversity with the minimum of discomfort**

Life's challenges, including chronic health problems, naturally lead to difficult emotions (worry, low mood, anger, guilt, shame) which we generally try and avoid or get rid of as quickly as possible. Trying to avoid or get rid of difficult emotions quickly is unhelpful in the long term, better to let them come and go in their own good time using skills to handle the impact they have on us.

The key to emotional resilience is psychological flexibility

Psychological flexibility improves emotional resilience and wellbeing and is developed by using skills that improve our ability to:

- Be present (Mindful)
- Accept difficult thoughts and feelings
- Do what really matters

How does psychological flexibility help improve emotional resilience?

- Being present (Mindful) helps by: Slowing us down, grounding us in the here and now, which reduces the impact unhelpful thoughts and feelings have on our behaviour or actions. The only time we can take effective action is in the present moment, but our minds are like time machines, constantly pulling us into the future or the past, this increases the likelihood we will act ineffectively in the present moment, it's as though we are on auto pilot.

Most of us have experienced going upstairs and forgetting what we went up for, passing the turning we were heading for on the motorway because we were on auto pilot.

Skill to improve mindfulness – 10 slow deep breaths.

This simple exercise will help patients centre themselves and connect with their environment, especially if they find themselves being distracted by unhelpful thoughts or difficult feelings about their chronic health problem. It should be practised as often as possible, in the shower, on the bus, when walking alone, before sleep etc.

- **Take ten slow, deep breaths. Focus on breathing out as slowly as possible until the lungs are completely empty, then allow them to refill by themselves.**
- **Notice the sensations of your lungs emptying. Notice them refilling. Notice your ribcage rising and falling. Notice the gentle rise and fall of your shoulders. Notice the warmth of your breath on your nose or lips.**
- **See if you can let your thoughts come and go as if they are just passing cars, driving past outside your house as you inhale and exhale.**
- **Expand your awareness as you breath slowly, simulta neously notice your breathing, your body, look around and notice what you can see, hear, smell, touch, and feel.**
- **Accepting difficult thoughts and feelings helps by: Giving us a clearer view of what the real problem is, rather than becoming stuck in a struggle with our unhelpful thoughts and feelings about the problem. Acceptance reduces the impact unhelpful thoughts and feelings have on our be haviour, allowing them to come and go in their own time.**

We tend to want get rid of difficult thoughts and feelings for many reasons including:

- **they are uncomfortable**
- **we think we are abnormal for experiencing them**
- **we believe we can't do the things that really matter to us until they have gone or are controlled.**

Battling with, rather than accepting difficult thoughts and feeling has many unhelpful consequences including:

- **It is tiring**
- **It distracts us from what is important to us**
- **It reduces our ability to take effective action**

To get rid of difficult thoughts and feelings we focus on them, this leads to them staying around a lot longer.
One of the ways we struggle with, rather than accepting difficult (unhelpful) thoughts and feelings is to get into an argument with our mind about whether the they are, right or wrong, rational or irrational, positive or negative, normal or abnormal etc.

Skill to improve acceptance of unhelpful thoughts. Thanking your mind for unhelpful thoughts.

Suggest your patients experiment using the following question, if they struggling with the thoughts their mind comes up with about the problem or the impact it is having on their life (e.g. "It's all too difficult", "Why me?", "I can't be bothered doing this", "Nobody understands what it's like")
"Is the thought or idea going through my mind right now helpful or unhelpful to me in terms of handling my health problem or reducing the impact it has on what and who is important to me?"

If the answer is unhelpful:

- **Thank your mind for the unhelpful thought.**
- **Take ten slow deep breaths and focus on what you are trying to do at that moment in time**
- **Every time your unhelpful thoughts arise, go through the same process.**
- **Doing what really matters helps by: Providing a compass on the journey we are on called life with its many challenges, so that we continue to move toward being the person we want to be and build the life we want to build, no matter what challenge we face.**

We often search for happiness or meaning to our lives by perusing goals to get more things (money, friends, holidays, a better job) or goals to get rid of things, (difficult emotions or thoughts, chronic health problems).
We postpone or put off moving toward who and what is important to us until we have achieved the goal, which can lead to unfulfilling and less meaningful lives, particularly if the goal can't be achieved e.g. Getting rid of a chronic health problem, when the best we can achieve is handling it effectively.

No matter what challenge we face we can usually always find a way to move towards who and what is important to us rather than postponing it until we have achieved a goal.
We can always choose to behave in ways that are helpful or unhelpful in moving us toward who or what is important to us at any time, if we are clear about who and what is important to us.

"We often search for happiness or meaning to our lives by perusing goals to get more things (money, friends, holidays, a better job)..."

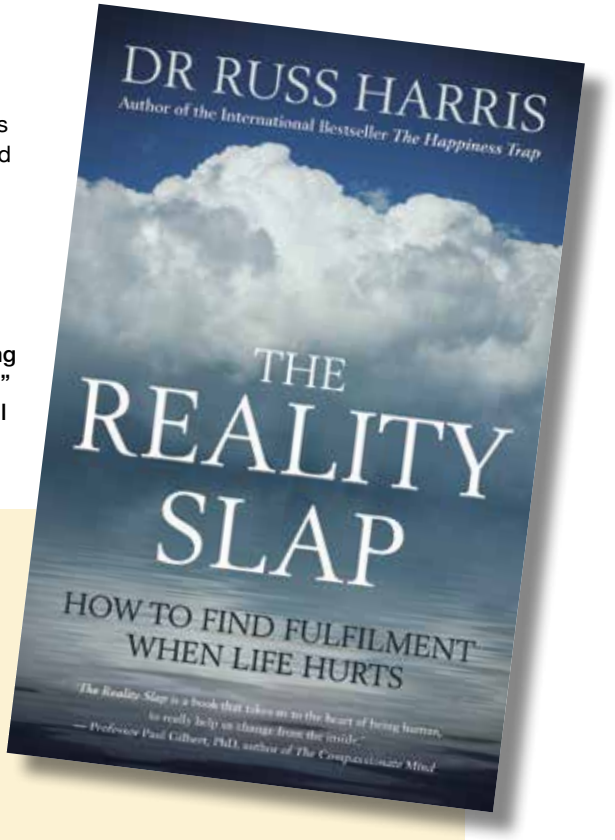
Skills to improve doing what really matters include - Identify who and what is important to you

Suggest your patients write down who and what is important to them and keep it in handy place. (A note in their phone) They can refer to it when they become aware that their behaviour is moving them away from who or what is important, influenced by difficult thoughts and feelings related to their health problem (frustration, guilt, worry, low mood). To get back on track suggest they:

- **Slow down using slow deep breaths**
- **Review what they identified as who and what is important to them**
- **Ask them-self. "Is the way I am behaving right now moving me toward or away from who or what is important to me?" If the answer is away, identify a step, no matter how small that could get them back on track**

Suggested CBT self help book for patients with Chronic or acute health problems -

The Reality Slap.
Author: Dr. Russ Harris



Assessing and managing dry eye, an Irish public healthcare system perspective

By **Brendan Cummings**

Dry eye of some degree is everywhere but where and when dry eye patients see an ophthalmologist varies hugely across healthcare settings. In refractive surgery settings, it's more often than not the case that the ophthalmologist is the one to bring up the subject at the pre-op assessment while the patient is often asymptomatic. Any amount of dry eye in this setting can lead to a patient's expectations not being met for a variety of dry-eye related reasons such as inconsistent pre-op refractions to post-op dry eye symptoms.

In the public system we often do not have the time to address issues our patients are not complaining about. The dry eyes we see are either in the Eye Emergency Department, in a non-dry-eye clinic, or extremely unwell patients intubated in the ICU.

For the patient attending a walk-in eye emergency department with dry-eye symptoms (as was often the case pre-COVID) we are sometimes quick to dismiss their complaints as trivial/non-sight threatening and send them home with a prescription for lubricants and a leaflet on blepharitis. I have found this approach ineffective as these patients will often return with the same complaint a few weeks to months later claiming the problem is back. Patients can tell when an examination is rushed and are less likely to follow instructions from a doctor who hasn't given them the attention they feel their complaint deserves. As with almost every situation in medicine, a thorough and detailed history is the cornerstone of the consultation. For this reason, when assessing a patient in the ED whom I have a suspicion dry-eye is causing their symptoms I will have them give me as much of a symptom history as they feel they need to (within reason) and I will carefully and obviously examine the eyelid margins at the slit-lamp making sure to evert the lids and express meibum from the meibomian glands using a cotton-bud. I examine every patient with fluorescein and cobalt blue light and count out loud, under my breath but loud enough for the patient to hear, how long before I see tear film breaking up. I then examine the cornea for SPEEs or signs of exposure keratopathy. I am now equipped to give the patient a diagnosis, which is what

they have often waited hours to receive. "You have a condition called blepharitis/meibomian gland dysfunction/rosacea/etc, and it explains the majority of the symptoms you are complaining of," is usually my line. More often than not patients seem relieved that they have something 'wrong' with their eyes and haven't been 'wasting my time', as they often quietly fear. I then explain the cause of their dry eye symptoms to them referencing parts of my slit-lamp. "The oil produced by the glands in your eyelids is too thick and congested to protect the watery part of your tear efficiently", "the layer of tears on the front of your eye should stay stable for more than ten seconds but yours starts to break up and evaporate after only three seconds." "I can see some evidence of the dryness on your cornea and we need to start to reverse this process before it gets worse."
Now when I explain how and why to perform hot compresses, lid massage, lid hygiene, how often to use lubricants, the patient is invested in the process and much more likely to take ownership of the problem and follow instructions. These patients also tend to return to the ED much less often than the ones we throw lubricants at as they walk in the door.

Assessing dry eye outside of the 'emergency' setting where we are in a non-dry eye clinic often happens towards the end of the consultation after having assessed and dealt with the primary concerns such as explaining to the POAG patient that their pressures are a little higher than optimal and there is some evidence of visual field progression meaning we are going to have to escalate treatment for them. "OK thanks, doctor. Just one more thing, is the glaucoma making my eyes scratchy all the time?". It's these times when we realise just how annoying dry eyes can be for patients. Living life with uncomfortable eyes is often as much of a concern for patients as slowly losing vision. In these cases, assessment of the ocular surface is a routine part of my glaucoma examination. We try our best to use preservative free drops as much as possible with glaucoma patients as often dry-eye symptoms in this population are as a result of drop toxicity.

I have cancelled a handful of lower-lid lateral tarsal strip surgeries on the morning of surgery when, during the consent, the patient's description of their symptoms fits much better with epiphora secondary to blepharitis than entropion! Most of the time these patients have been put on the 'minor-ops' waiting list by a junior working in an oculoplastic clinic following a GP referral for watery eyes. Skimming over a dry eye assessment can potentially lead patients under a scalpel they have no business being under and having a procedure done that isn't addressing their symptoms, even if they do have a little lower lid laxity!

The easiest dry eye assessment used to be wondering up to ICU with a fluorescein drop and a hand held slit-lamp to see how dry an exposed cornea under high flow oxygen could get, then handing over a tube of ophthalmic ointment to the ICU nurse and asking for it to be applied every 2 hours before getting lost trying to find your way back to the ophthalmology clinic. These days getting up to an ICU involves so much PPE you can't see a red-reflex so now I just send the ophthalmic ointment with instructions.

The Most Important Reasons That Dry Eye Syndrome Is So Crucial For Cataract & Refractive Surgeons

by **Mr. Arthur Cummings**, FRCSEd

When you think about the cool technology that we as refractive surgeons have access to and use daily, the topic of dry eye seems, well... a little uncool. Lasers have specifications and computers and ablation profiles. Phaco machines have the same as do femtosecond laser cataract systems. All this super advanced technology and promise of wonderful vision, provides us with hope and expectations. And here is the reason that we now see dry eye as such an important factor: it has the potential to provide us with these expectations or bring them all crashing down.

How does that work? Well, it works on several levels. Dry eye impacts the actual vision following the procedure. Dry eye also impacts several special tests that we do to further enhance the outcomes, and if the information is not accurate, negatively impacts the outcomes.

Alice Eritropoulos recently performed a study looking at the effect of dry eye and osmolarity on biometry values. The higher the osmolarity and hence the worse the dry eye level, the greater the odds were that the astigmatic values would differ on 2 consecutive measurements taken 1 month apart. The better the osmolarity, the more likely the biometry values were to be very repeatable. When I read this article, I performed my own small study by remeasuring patients that had a high osmolarity at their first visit by repeating their cataract diagnostic workup 4-6 weeks later after initiating treatment for dry eye. The measurements did differ and sometimes they had a significant impact on the IOL power and the toricity required. My cataract workup routinely includes a Pentacam exam, a placido disk topography, an IOL Master and a Lenstar evaluation. When the patient has more than 1.5D of astigmatism we do the Cassini multi-coloured LED system too to obtain even more data regarding the toric IOL to select. The Cassini, like the Pentacam, provides posterior corneal surface data too thereby providing the total corneal power. So, the first reason that the quality of the tearfilm is important is due to the impact that it has on IOL selection. Cataract surgery today is refractive surgery and the refractive outcomes are paramount.

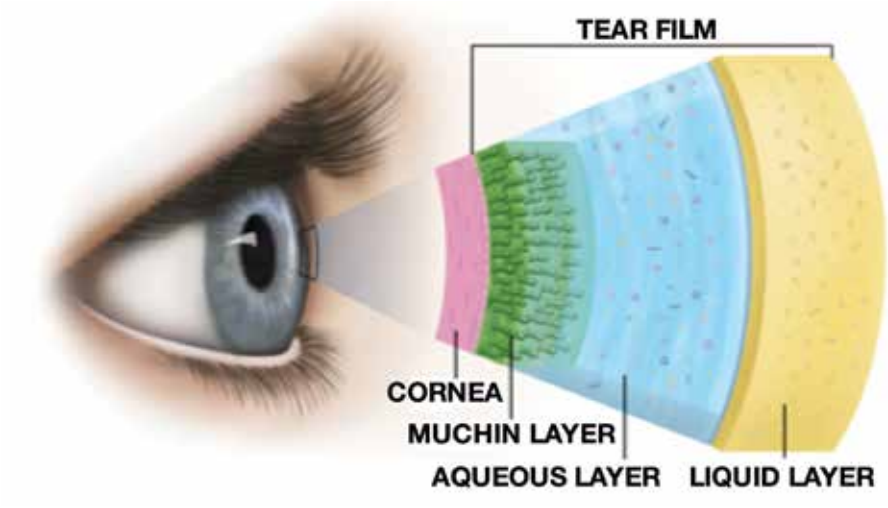
Being surgeons that are familiar with the cornea we sometimes forget just how important the tear layer is. The surface of the tear layer is the very interface where light changes direction as it enters the eye to focus on the retina (Fig.1). This very same tear layer is providing the keratometric data that many of the devices are using that eventually gets plugged into the various IOL formulae.

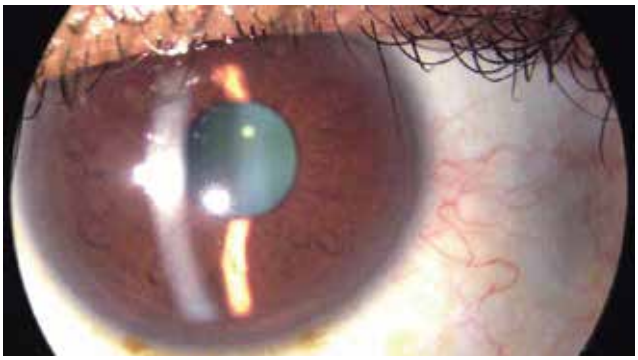
Once I had observed this effect for myself, I had another thought. In corneal laser, refractive surgery, I was using topography-guided ablation profiles more and more for primary treatments. These treatments were being generated

by data derived from the placido disk topographer and could be subject to the same variations possibly.
I performed a study looking at the tear osmolarity and the quality of the topographies that were obtained prior to the procedure. The software has a validation process that either gives a green tick if the quality is approved or a red cross if the quality is not up to standard (Fig 2). The study looked at the correlation of the osmolarity (and hence the level of dry eye) with the number of automated software approvals (Fig. 3). The outcome showed a correlation between low osmolarity (good quality tears) and the quality of the topographies.
The better the quality of the topographies, the better data that the laser has on which to base the topography-guided ablation profile.
At the same time, I have been comparing topography-guided laser corrections to regular wavefront-optimised outcomes and just as in the FDA study for topography-guided studies using the WaveLight laser, found that the outcomes were excellent and superior to WFO treatments. Having seen the impact that the tears have on the quality of the topographic data, the dry eye assessment has just become even more important than it was before as part of the refractive workup.

Devices such as the HD Analyzer have allowed us to evaluate the optical quality of the tearfilm and simply cannot be underestimated in the value that they bring to our workup. When patients that are suffering with low quality and fluctuating vision, see the optical scatter caused by the tear film breaking down due to evaporative stress, it becomes very clear to them what the issue is and greatly enhances compliance.

Having the ability to monitor these patients and their response to various therapies is very helpful in the treatment of these conditions. When treatments take time and effort and the patient does not see improvement, they become despondent and their compliance goes down. All the while however they could in fact be improving but because they are still above threshold, do not see the improvements. Tear osmolarity and the tear film scatter could be improving in the meanwhile despite the lack of subjective evidence, and when patients see this, it encourages them to persist with treatment. One day the symptoms are suddenly below threshold and they can subjectively experience the benefits of all their efforts.





In a nutshell, this is why the tear film is so important to cataract and refractive surgeons. Light changes direction at the interface between air (RI of 1.0) and the tear surface (RI of 1.33698). This impacts how we see the world and how the world of diagnostic devices sees our ocular surfaces.

"Being surgeons that are familiar with the cornea we sometimes forget just how important the tear layer is..."

If there were only 2 devices that I could have in my clinic besides my slit-lamp and fluorescein they would be the TearLab osmolarity device and the HD Analyser. No devices have had a greater impact yet on the well- being and success of my dry eye practice than these two devices.

If you want to be a top refractive and cataract surgeon today, you can no longer ignore the tear film. Technology today has greatly enhanced our ability to diagnose dry eye and to determine the appropriate treatment. Taking care of dry eye prior to our surgical interventions ensures better outcomes due to better data input driving the procedures and simply by having a better optical surface through which to enjoy your new eyesight and freedom.

Disclosures: Dr Cummings is a consultant for TearLab that is mentioned in the article. He is also a consultant for Alcon, ClarVista Medical, ReVision Optics, Scope Ophthalmics and WaveLight Lasers GmBH that are not mentioned in the article.

Dedicated NHS Dry Eye Clinic - Queen Victoria Hospital, East Grinstead. UK

by **Mr. Damian Lake**

Despite two years of visits to Hospital eye services and high street Optician practices, all she had to show for this was a polythene bag containing almost every ocular lubricant preparation on the market. Her symptoms were the same. The story is a familiar one, multiple visits to General Ophthalmic clinics, labelled as "dry eyes" and managed with increasing or decreasing lubricant drops depending how symptoms were on the day.

15% of adults complain of dry eye symptoms in surveys1. The prevalence increases with age, female gender is an independent risk factor with up to 20.8% of women affected in a UK prevalence study[2].

The present situation for patients suffering with dry eye symptoms is variable. The NHS choices website directs sufferers to "your high street optician or GP who can confirm whether you have dry eye and give you advice about treatment". This seems to reinforce the popular misconception that Dry eye disease is simply a lack of tears, treated by applying artificial tears.

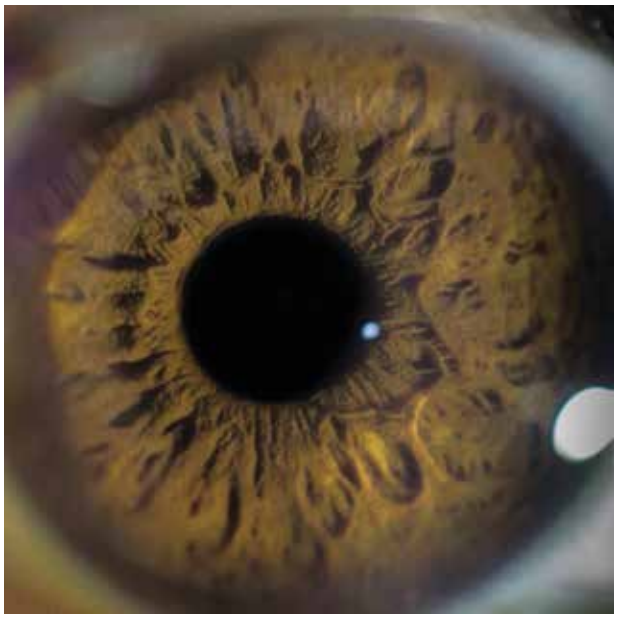
Since the DEWS and Delphi collaborations, more focus has been applied to the complex and diverse range of diseases and mechanisms, often multiple and overlapping, which contribute to the patients' symptoms of dry eye.
The current NHS system often does not investigate, treat and inform patients in a meaningful way, perhaps due to resource pressures, perhaps due to the prejudice that Dry eye is not a serious condition, perhaps due to an unwillingness for clinicians to address an often complex and difficult problem.

This has led us to begin developing a dedicated NHS Dry eye service at QVH, East Grinstead. Why would we do this? Well firstly there is a demand from patients and primary care to deal with this issue more effectively, and secondly it can be very rewarding to diagnose and treat a condition that hitherto patients had not had any relief from.

In the beginning, there was hostility to this idea that dry eye patients deserved a clinic of their own, so to develop momentum we engaged in a series of Educational events for General practice and Eye Care professionals, to inform people of the complexity of the issue and the large and increasing population prevalence. What was interesting was that often a large percentage of individuals within the room, when questioned exhibited symptoms of dry eye disease and could therefore empathise more easily with the patient case reports we presented.

The pre planning phase involved collaboration with our Hospital optometrist, Nurses and Ocular surface consultants and constructive ideas and organisation from our Hospital management. Amongst the issues were time and space required, manpower, investments in diagnostic and treatment equipment and funding for treatments.

The numbers of patients were conservatively estimated at 20% of our current patient cohort (exact numbers in the Hospital eye Service were not available at that time) which allowed us to calculate our initial follow up rates, and an incidence of 5% of total referrals to calculate our new rate (this would change as the knowledge that the service was available increased) and hence the manpower we would need. It became immediately clear that a Doctor delivered service would not be possible within current resources and alternatives such as Optometrist, Nurse and Orthoptist staffed clinics would need to be utilised for follow ups (the initial consultation is always Consultant led, and oversight remains with a Consultant for follow ups).This required further time invested in protocol development to manage the process and allow clinical governance processes to provide safety for patients (and satisfy the Hospital).



"The numbers of patients were conservatively estimated at 20% of our current patient cohort..."

To facilitate the consultations and increase throughput, as much information as possible was requested prior to consultation, in the form of Ocular Surface disease questionnaires to monitor symptoms, and systemic screening/general health questionnaires to elicit any general health issues, drug causes including systemic drugs particularly anti cholinergics and topical drops either preserved or due to the drug itself, hormonal issues, prior surgery (Laser vision correction, cataract surgery, lid surgery, lacrimal surgery, neurosurgery (skull base surgery such as acoustic neuroma), contact lens wear, allergic diseases, autoimmune conditions which may suggest Sjogrens syndrome.

The questionnaire provides important symptom information such as exacerbation in certain environmental conditions, variability with hormonal cycle, diurnal variability with symptoms how this affects function, i.e. visual fluctuation and other functions of daily living (dry eye disease is now associated with low mood and depressive symptoms).

The Consultation interview is important, particularly to listen to how this effects the patient and what has been tried before so as not to lose trust by commencing an already failed management.
The examination focusses on isolating the many mechanisms and causes of "Dry eye".

Observation initially concentrates on skin and whether there is a dermatological issue such as Rosacea, Seborrhoeic dermatitis, eczema, psoriasis or other Oculodermatosis.

Lashes should be directed outwards and be complete, is there blepharitis, which type, are there missing lashes, is there trichiasis. Lid function is assessed for completeness of blink, adequate rate, lid wiper zone pathology and Marx line defects, correct lid apposition, tarsal plate pathology and fornix depth (important for retro- lid tear reserve)
The Meibomian glands should on gentle pressure with a cotton tip, excrete clear

meibum, if the majority of Meibomian glands do not allow this, then there is dysfunction and this is graded as a baseline. The grading looks at meibum quality, expressibility and surface staining. We then perform meibography to demonstrate whether the Meibomian gland is atrophied or not. This allows us to exclude Meibomian gland treatments to patients who would not benefit and who would become demotivated at the lack of efficacy.

Corneal sensation is measured before any anaesthetic or topical drops are applied. The Cochet Bonnet anaestheisometer is used in all four quadrants of the conjunctiva and cornea, the degree of pre-existent ocular surface nerve supply helps explain the differing symptom expression between those with early disease but extreme symptoms and those with advance disease and less symptomatology.
A measure of aqueous tear production can be challenging. Schirmers test can be utilised but is often quite variable.
A very low Schirmers test will allow a positive diagnosis of aqueous deficiency, and a very high result can exclude it, but often the result maybe in the middle on one occasion and low another. We try to standardise the procedure by using one drop of anaesthetic and five minutes later implanting the tear strip at the outer canthus, followed by eyes closed and no talking or eating for 5 minutes.

Tear volume can also be assessed by proxy methods such as OCT of the tear film, The Keratograph 5M (Oculus Optikgerate GmBH, Wetzlar,Germany) and interferometry such as Lipiview (Tear Science Inc Morrisville NC) but require greater investment. Despite the investment there is a value in the demonstration to the patient of their problems in an easy to understand graphical interface, and the repeatable non-invasive nature of the investigation.

There have been remarkable improvements in imaging the tear film, but measuring the chemistry of the tear film has lagged somewhat behind. Initially we have invested in the Tearlab device to measure the osmolality for patients, which can be useful, but due to the variable nature of dry eye, the osmolality can also vary, which in itself is not an issue, the variability can explain the symptoms, but it creates some confusion amongst patients who wish to have a measure of whether things are better or worse. Inflammadry is a rapid diagnostic immunoassay tool to measure the presence of metalloproteinase 9 (MMP9) in the tear film, this helps confirm or deny inflammation at the initial assessment. An incredibly simple test, the ocular surface is touched by the applicator, reinserted into the test cassette and buffer solution and a result is available in 10 minutes. This helps direct our use of steroid drops and other immunosuppressant (cyclosporine, tacrolimus etc.).It has been shown that the final common pathway is ocular surface inflammation in dry eye, and treatment for this initially improves patient symptoms even before the underlying cause is found and treated.

For those with a systemic diagnosis such as rheumatoid, or with symptoms suggestive of Sjogrens syndrome such as dry mouth and other mucosal surfaces a labial biopsy is arranged to confirm the diagnosis.

"Dry eye disease is now associated with low mood and depressive symptoms..."

Collaborative, multidisciplinary teams can be required with open access to oral surgeons for labial biopsy and Gynaecologists and Endocrinologists for women with cyclical dry eye which may vary with hormonal levels and can benefit from androgen replacement after appropriate measurement.

The tests are all simple to perform and require equipment and technical staff only. This maximises the initial consultation chair time with the consultant to cover the issues in the lifestyle questionnaire and address lifestyle issues. It is important to exclude at this first visit any systemic issue and if necessary arrange the systemic screen, hormonal tests if needed and biopsy as necessary. Once this issue is resolved and the diagnosis directed to the ocular condition (Meibomian gland dysfunction most commonly), the patient maybe more appropriately managed in a protocol directed dry eye clinic, delivered by Ophthalmic nurse or Optometrist with Consultant oversight.

The measure of success for this clinic has been the overwhelming feedback from patients, and the referrals from community, pleased with the efficiency of investigation and the attention to detail that they have received. Patients are happy as their condition is given the importance is deserves, and primary care physicians are pleased to be able to direct these otherwise unhappy people to a clinic which can help diagnose and treat this debilitating condition.

This service is providing the community with a valuable resource, and hopefully decreasing the numbers of people who wander from practice to practice with a polythene bag full of lubricants without satisfaction.

1- Paulsen AJ, Cruickshanks KJ, Fischer ME et al. Dry eye in the beaver dam offspring study: prevalence, risk factors, and health-related quality of life. Am J Ophthalmol. 2014;157(4):799-806.
2- Prevalence and risk factors of dry eye disease in a British female cohort.Verhof et al, BJO 2014.

The importance of dry eye assessments

Author: **Karl Jeebaun**
CEO Sparca AOS Anterior

Our understanding of the eye is ever evolving. A case in point is the discovery of the Dua layer by Professor Dua, who only had his findings published back in 2013. I had the pleasure of unknowingly sharing an impromptu conversation with Professor Dua on a train heading to ESCRS Copenhagen. We talked about the advances in technology in the industry and how the way we treat, manage and diagnose the eye is constantly improving. We agreed that the more and more we adopt technologies, the more accurate the results become, and which allows the correlations between pathologies to be better understood. The point here is not my random encounters, but the fact that whether directly or indirectly, technology is helping the industry know more about the physical makeup of the eye, root causes of pathologies, and how to better manage or treat ocular conditions at a much earlier stage.

Dry eye - let's face it - has until recently been dismissed by many as a minor condition or even just a trend or fad designed to sell more product. Did you know that on average 80% of your customers suffer from some sort of dry eye? Even with the amazing work done by TFOS to produce DEWS & DEWS II, we have yet to see this filter down to the everyday eye-care professional. We have dry eye specialists, ocular surface disease specialists and many other specialities that understand that dry eye assessment is a vital part of achieving a better ocular condition - however, it is still not conducted as a matter of routine by all eye care professionals.

Dry eye is now a growing concern due to climatic changes, pollution, pollen, increased screen time, contact lenses, IOLs, and laser surgery to name a few. All can result in your patient having to manage dry eye for the rest of their lives and, if left unchecked, can lead to a worsening of their ocular condition.

In the aftermath of the COVID-19 pandemic, we need to change the way we operate, see patients, better manage conditions remotely and reduce unnecessary chair time. All point to more widespread adoption of technology as the answer, but importantly, how do we do this without the use of all the diagnostic hardware we use as a matter of routine in practice? How can we connect our patients to the clinicians whilst remaining compliant, protecting personal information, increasing loyalty and treatment compliance? All of these are traditionally improved through practice or healthcare system increase efficiencies, reduce waiting lists, increase paid chair time and drive up revenue. The triaging, monitoring and continued assessment of dry eye is now a vital cog in this new ophthalmic landscape, so the tools we adopt need to be fit for purpose.

You don't use a shovel to dig a hole (although many people do). Best practice is to use a spade to dig the hole and a shovel to "shovel" the remaining debris clear. It is a case of using the right tool for the right job. Telemedicine in this analogy is the shovel, and telehealth is the spade. You could do the job with either, but not to maximum

efficacy. Combine them and you become more effective, efficient and more productive!

To run a virtual clinic or in-house for dry eye, ocular surface, or speciality lens purposes, you will need the right tools to effectively meet the challenge. The question then arises: 'How can I turn this into a viable business or healthcare solution?'. In any case, you can drive up revenues and drive down cost both directly and indirectly, if properly implemented. Next week I will dive into both the business case and the cost savings in more detail - for now though, I'll leave you with some areas a dry assessment can add value to your business or healthcare system:

- The majority of many opticians main revenue comes from sales of contact Lenses and glasses. By offering a dry eye assessment as a part of a standard eye health check pre sale of either glasses or in particular contact lens, benefits the patient who may al ready suffer from dry eye before wearing contact lens, which will only make the issue worse and often is then blamed on the contact lens as well as benefit the business from additional assessment fee and OTC product sales.

- Creating a virtual dry eye clinic will enable you to have "persistent touch" with your patients, through remote triaging, preassessments and monitoring, without clogging up practice time or waiting rooms, you can increase your eye health and product revenues, treatment compliance and build loyalty with your patients.

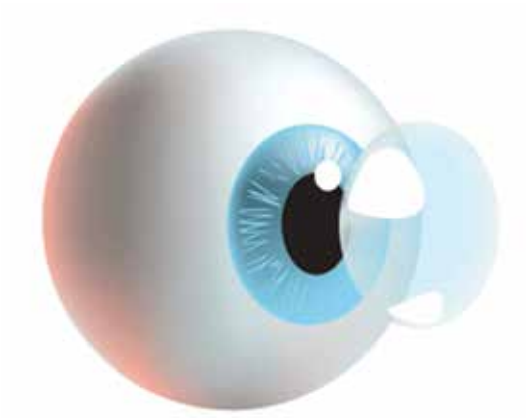
- Pre- and post-ocular surgery dry eye assessments as well as use of digital tools to help with predicting epithelial growth rates, can offer some interesting ways to better manage patients out of practice and increase paid chair times by reducing follow up visits. - Use within speciality lens fitting as in normal practice can help with initial assessment of their ocular condition prior to fit, manage it after, but in this case also help both the practice and contact lens labs by reducing the number of blank wastage the labs save money and the practice has increased chair time available.

The key takeaway is that dry eye is a problem and there is an under realised opportunity to offer additional income sources, reduce costs, chair time and waiting lists in both a simple and affordable way. Using the right tools and adopting preventative measures within both practices and healthcare systems within Ophthalmics as a whole, we can monitor and improve both individual cases and the wider landscape.

To find out more on how we at AOS are addressing this please contact us to find out more.

Bandage contact lens and topical steroids are risk factors for the development of microbial keratitis after epithelium-off CXL

Tzamalis A, Romano V, Cheeseman R, Vinciguerra R, Batterbury M, Willoughby C, Neal T, Ahmad S, Kaye S.
BMJ Open Ophthalmol. 2019 Feb 16;4(1):e000231. doi: 10.1136/bmjophth-2018-000231. PMID: 30997402; PMCID: PMC6440609.



Although relatively rare, infectious keratitis has been reported to occur after CXL and many factors have been proposed to increase its incidence. In a retrospective cohort study, we attempted to identify common risk factors for microbial keratitis after epithelium-off corneal cross-linking (CXL) for progressive corneal ectasia, mainly focusing in the role of bandage contact lens (BCL) and topical steroids applied after the procedure.

Therefore, all subjects undergoing epi-off CXL were divided into 2 groups regarding their postoperative management: those receiving a BCL, topical antimicrobial and steroids (Group1) and those managed only with a topical antimicrobial until complete epithelial defect healing (Group2). 1273 eyes of 964 patients were identified and enrolled in the analysis, 316 eyes in Group1 and 957 eyes in Group2.

9 eyes of 8 patients (0.71% of treated eyes) developed a microbial keratitis at a time-point 1 to 5 days after CXL. All cases of microbial keratitis were noted in Group1 (incidence=2.85%) and none in Group 2 ($p<0.0001$). Following treatment, there were no significant differences in the presence of persisting corneal haze or scarring between the two groups ($p=0.57$), when cases of microbial keratitis were excluded. Patients developing microbial keratitis were found to be atopic in a higher frequency (75%). Staphylococcus aureus was the only pathogen identified, being isolated from the cornea in 7 patients, from the conjunctiva in 2 patients and the nose in 3 patients. Further parameters such as age, gender, preoperative minimum corneal thickness, history of atopic disease, bilaterality of treatment and preoperative Kmax were evaluated but none of them was shown to increase significantly the risk of infection in contrast to the use of BCL and steroids in the early postoperative period ($p=0.005$).

In conclusion, our results would suggest that avoiding the use of BCL and delaying the introduction of topical steroids until epithelial healing, may significantly reduce the risk of developing microbial keratitis and does not seem to increase the risk of persistent corneal haze.

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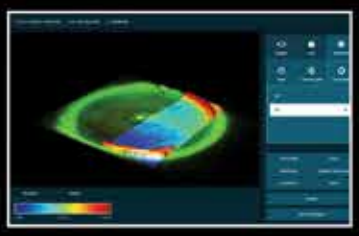

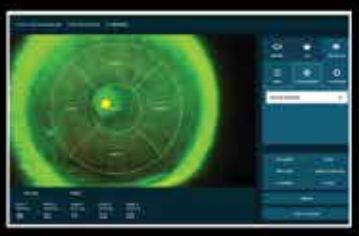

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