OSI

Ocular Surface Insight

Issue 19

Giving the eye care stars of the future the chance to shine

A bright future for Optometry

TFOS lifestyle: Impact of societal challenges on the ocular surface

Ocular Surface Insight

"A person who never made a mistake never tried anything new."

Albert Einstein

Welcome to the Autumn Edition of OSI Magazine!

In this issue, we continue our quest for knowledge and insights into ocular surface health. We are thrilled to bring you Part 3-4 of the TFOS Lifestyle: Impact of lifestyle challenges on the ocular surface - a comprehensive resource that sheds light on the latest trends and research in ocular surface health.

We also turn our attention to contact lenses and their interaction with the TFOS lifestyle report. Dr Sònia Travé Huarte, presents a comprehensive analysis, and examines the interplay between these essential visual aids and our daily routines. It is a critical exploration which seeks to enhance our understanding of the effect contact lenses have on ocular surface health.

We have an insightful article from Brian Tompkins and Dr. Keyur Patel, which peers into the future of optometry. The next generation of optometrists are poised to bring fresh perspectives and innovation to the field, and this article explores their potential impact.

One of the true highlights of this edition is a candid and insightful patient perspective from our contributor, Dr Ruth M Machin, who bravely shares a personal journey and experiences. This firsthand account offers a unique and valuable perspective on ocular surface health, providing both professionals and fellow patients with a glimpse into the realities of managing eye conditions.

As you navigate through this edition, we invite you to mark your calendars for a significant event in the world of ocular surface health. The OSI Dry Eye Masterclass & Symposium is set to take place on April 18th and 19th, 2024, at the prestigious Millennium Gloucester Hotel in London. This event promises to be a unique opportunity to engage with leading experts in the field, further deepening your knowledge and insights into ocular surface health. Make sure you save the date and join us for this enlightening experience.

We encourage you to engage with the content in this edition, share your thoughts, and join the conversation about ocular surface health.

Thank you for your continued support, and we hope you find this issue of OSI Magazine enlightening and inspiring. Your feedback is invaluable to us, and we look forward to hearing your thoughts on this edition.

Samer Hamada

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Published October 2023

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We stand with Ukraine!

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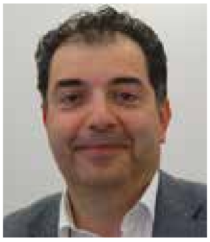

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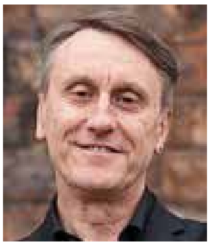

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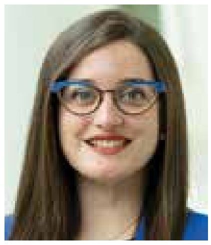

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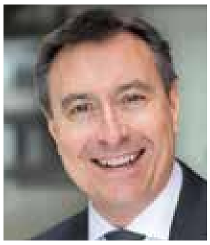

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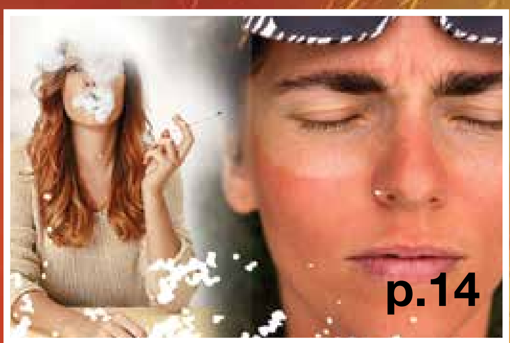
Contents



What's in the news?

A 7-year review of clinical characteristics, predisposing factors and outcomes of post-keratoplasty infectious keratitis: the Nottingham infectious keratitis study

Post-keratoplasty infectious keratitis (PKIK) is a unique sight-threatening clinical entity which often poses significant therapeutic challenges. This study aimed to examine the clinical presentation, risk factors, management, and clinical outcomes of PKIK.

This was a retrospective study of all patients who presented to the Queen's Medical Centre, Nottingham, with PKIK between September 2015 and August 2022 (a 7-year period). Relevant data on types of keratoplasty, clinical presentations, causative microorganisms, management, and outcome were analysed.

Forty-nine PKIK cases, including four cases of interface infectious keratitis, were identified during the study period. The most common graft indications for PKP, DALK and EK were failed grafts (9, 37.5%), keratoconus (6, 54.5%) and Fuchs endothelial corneal dystrophy (FECD; 8, 57.1%), respectively. Staphylococcus spp. were the most commonly identified organisms (15, 50.0%). Bullous keratopathy (18, 36.7%), ocular surface disease (18, 36.7%), and broken/loose sutures (15, 30.6%) were the most common risk factors. Concurrent use of topical steroids was identified in 25 (51.0%) cases. Of 31 functioning grafts at presentation, 12 (38.7%) grafts failed at final follow-up with 15 (48.4%) patients retaining a CDVA of ≥1.0 logMAR. The overall estimated 5-year survival rate post-PKIK was 55.9% (95% CI, 35.9%-75.9%), with DALK having the highest survival rate [63.6% (95% CI, 28.9%-98.3%)], followed by EK [57.1% (95% CI, 20.4%-93.8%)] and PKP [52.7% (95% CI, 25.1%-80.3%)], though no statistical difference was observed (p=0.48).

PKIK represents an important cause of IK and graft failure. Bullous keratopathy, OSD and suture-related complications are the commonest risk factors, highlighting the potential benefit of prophylactic topical antibiotics (for unhealthy ocular surface) and early suture removal (where possible) in reducing the risk of PKIK. Graft survival may be higher in lamellar keratoplasty following PKIK but larger studies are required to elucidate this observation.

Authors: Zun Zheng Ong, Thai Ling Wong, Lakshmi Suresh,Yasmeen Hammoudeh, Michelle Lister, Dalia G Said, Harminder S Dua, Darren S J Ting.
Publication: Front Cell Infect Microbiol. 2023 Aug 30:13:1250599.doi: 10.3389/fcimb.2023.1250599.eCollection 2023.

Tear film proteome changes following Tobradex® therapy in anterior blepharitis

The management of blepharitis continues to challenge clinicians due to the poorly understood aetiology of the condition. We authors identified the family of intracellular plakin proteins as essential driving forces underlying anterior blepharitis. A large-scale protein analysis was used to study if a topical dexamethasone/tobramycin solution could be used to reverse the expression of plakin proteins.

Tear film samples from treatment naïve patients with anterior blepharitis (n = 15) were collected with Schirmer filtration paper. A subgroup of the patients (n = 10) received treatment with a dexamethasone/tobramycin 1 + 3 mg/mL ophthalmic suspension (Tobradex®) for 3 weeks and collection of tear film samples was repeated. The samples were analysed with label-free quantification nano liquid chromatography-tandem mass spectrometry requiring quantification in at least 70% of the samples in each group. Proteins were considered differentially expressed if $p < 0.05$.

Following Tobradex® intervention, 27 proteins were upregulated while 61 proteins were downregulated. Regulated proteins after Tobradex® treatment were involved in intermediate filament cytoskeleton organization including downregulation of the plakin proteins envoplakin, epiplakin and periplakin. Plectin, a protein of the plakin family, remained unchanged after Tobradex® therapy. Tobradex® treatment resulted in the regulation of proteins involved in translation including a cluster of downregulated ribosomal proteins. Tobradex® intervention was associated with the regulation of proteins involved in fructose metabolism and glycolytic processes including fructose-1.6-bisphosphatase 1, fructose-

bisphosphate aldolases A and B, pyruvate kinase PKM and transketolase. Ig lambda chain V-I region, prominin-1, and protein Niban were upregulated after Tobradex® treatment.

The authors concluded that Tobradex treatment reversed the expression of plakin proteins in anterior blepharitis. Topical solutions which inhibit the expression of plakin proteins may have the potential to restore the ocular surface integrity in anterior blepharitis and should be explored further.

Authors: Danson Vasanthan Muttuvelu, Lasse Jørgensen Cehofski, Tor Paaske Utheim, Xiangjun Chen, Henrik Vorum, Marie Louise Roed Rasmussen, Steffen Heegaard, Asif Manzoor Khan, Ahmed Basim Abduljabar, Bent Honoré.
Publication: Acta Ophthalmol. 2023 Oct 14.doi: 10.1111/aos.15792.

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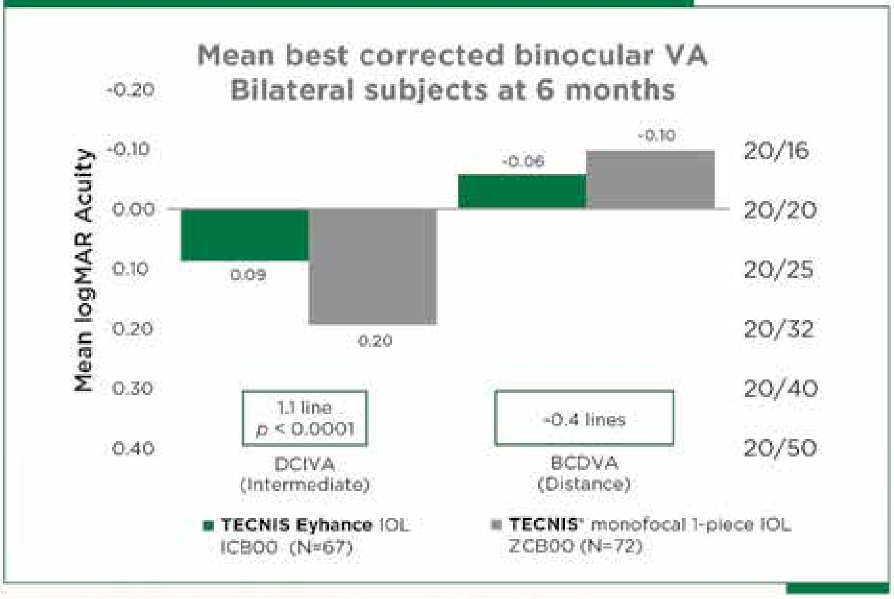

TECNIS Eyhance IOLs (ICB00) offer a statistically significant improvement in monocular and binocular intermediate vision vs. **TECNIS®** monofocal 1-piece IOLs (ZCB00).[1]

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- 20/20 distance vision[1*]

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Reference

1. Data on File, Johnson & Johnson Surgical Vision, Inc. Sep 2018. DOF2018CT4015.

*Based on a clinical study, N=134 achieved mean 20/20 monocular pooled distance BCDVA.

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What's in the news?

Serial Sessions of a Novel Low-Level Light Therapy Device for Home Treatment of Dry Eye Disease

This study aimed to evaluate the changes that a recently developed at-home device using low-level light therapy (LLLT) produced in signs and symptoms of patients with dry eye disease (DED) owing to meibomian gland dysfunction (MGD).

In this prospective study, patients with DED owing to MGD not successfully responding to first-line therapy (tear substitutes and eye lid hygiene) were treated with four serial sessions (every other day) of mask based on LLLT technology and dedicated for home use (my-mask®, Espansione Marketing S.p.A., Bologna, Italy). Non-invasive ocular surface examination was carried out by means of Keratograph 5M (Oculus, Wetzlar, Germany) before and after four mask sessions for the evaluation of (i) tear meniscus height (TMH); (ii) first and average non-invasive Keratograph breakup time (NIKBUT); (iii) meibomian gland loss (MGL). Ocular Surface Disease Index (OSDI) questionnaire was used to assess ocular discomfort symptoms.

Overall, 17 patients (3 male, 14 female; mean age 61.47 ± 11.93 years) were enrolled and all of them regularly completed the entire cycle of four sessions without reporting any adverse event. The mean values of NIKBUT first and NIKBUT average increased significantly after treatment (from 5.29 ± 2.60 at T0 to 9.04 ± 3.49 s at T1 [P = 0.001] and from 9.40 ± 3.81 to 11.28 ± 2.81 s [P = 0.017]); in parallel, the mean value of TMH increased significantly from 0.27 ± 0.06 to 0.32 ± 0.09 mm (P = 0.029). Conversely, there were not statistically significant differences for MGL (P = 0.346). In addition, the mean value of OSDI score decreased after treatment (from 32.00 ± 7.96 at T0 to 20.71 ± 8.03 at T1; P < 0.001).

One week of serial sessions of a newly developed LLLT device for home use significantly improved tear film production and stability along with ocular discomfort symptoms in patients with DED owing to MGD. These findings open up a new scenario for patients with MGD who can enjoy the unique benefits of LLLT at home.

Authors: Giuseppe Giannaccare, Sabrina Vaccaro, Marco Pellegrini, Massimiliano Borselli , Giovanna Carnovale Scalzo , Andrea Taloni , Rocco Pietropaolo , Ali Saeed Odadi , Adriano Carnevali
Publication: Ophthalmol Ther. 2023 Feb;12(1):459-468.doi: 10.1007/s40123-022-00619-3.

Safety and Efficacy of Topical Vitamin D in the Management of Dry Eye Disease Associated With Meibomian Gland Dysfunction: A Placebo-Controlled Double-Blind Randomized Controlled Trial

The aim of this study was to investigate the safety and efficacy of topical vitamin D in the management of dry eye disease associated with meibomian gland dysfunction (MGD).

In this randomized controlled trial, patients with symptomatic MGD were divided into 2 groups to receive topical vitamin D drops or placebo in their randomized eyes. The exclusion criteria consisted of patients with vitamin D deficiency, previous ocular surgery, and patients with ocular diseases affecting the tear film. Patients and researchers were masked to the study groups. The outcomes included the score of Dry Eye Questionnaire (DEQ) 5 and Ocular Surface Disease Index (OSDI), corneal and conjunctival

staining score, tear breakup time (TBUT), Schirmer, and MG expressibility score evaluated at baseline and weeks 4 and 8.
Twenty-eight eyes of 28 patients were recruited in each group.
In addition to the improvement of subjective parameters in both groups, there was a statistically significantly greater improvement in the vitamin D group compared with control for average scores of OSDI (13.38 ± 7.32 vs. 27.94 ± 7.49) and DEQ5 (9.67 ± 1.86 vs. 14.14 ± 2.45) at week 8 (Ps <0.001). In addition, a significant improvement in TBUT and Schirmer test was observed in both groups in weeks 4 and 8 (P value <0.05). There was a significant difference between the treatment and control groups after 8 weeks for OSDI, DEQ5, Schirmer, TBUT, corneal fluorescein staining, and MG expressibility score (P value <0.05).

The preliminary results of this randomized controlled trial suggested that use of topical vitamin D drops with a lipid vehicle could be safe and might significantly improve the symptoms and signs of dry eye associated with MGD.

Authors: Kiana Hassanpour, Farideh Langari, Amir Rezaeian Akbarzadeh, Mozhgan Rezaei Kanavi, Maryam Barani, Bahareh Kheiri, Farid Karimian , Hamid Ahmadieh , Mohammad-Mehdi Sadoughi
Publication: Cornea. 2023 Oct 9.doi: 10.1097/ICO.0000000000003400.

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Adverse events should be reported. Reporting forms and information can be found at www.mhra.gov.uk/yellowcard, or search for MHRA Yellow Card in the Google Play or Apple App Store. Adverse events should also be reported to ParaPharm Development at (+44) 01183 217100 or info@parapharmdev.com

Nettacin® (netilmicin 3mg/ml + dexamethasone 1mg/ml) eye drops Prescribing Information. Consult summary of product characteristics (SPC) before prescribing. Name and active ingredients: Nettacin® (netilmicin 3mg/ml) eye drops. **Indication:** Topical treatment of external infections of the eye and its adnexa caused by netilmicin sensitive bacteria. Consideration should be given to official guidance on use of antibacterial agents. **Dosage and administration:** One to two drops three times a day in the affected eye(s) or as prescribed. Safety and efficacy in children and adolescents less than 18 years of age not established. **Contraindications:** Hypersensitivity to active substances, aminoglycoside antibiotics or excipients. **Special warnings and precautions for use:** Serious adverse reactions including neurotoxicity, ototoxicity and nephrotoxicity have occurred in patients receiving systemic aminoglycoside therapy. Caution advised when used concomitantly. Prolonged use of topical antibiotics may determine overgrowth of resistant microorganisms. If no clinical improvement reported within a relatively short period of time or irritation or sensitisation occur, discontinue therapy and start an appropriate treatment. Nettacin is not injectable, therefore it must not be injected subconjunctivally or introduced in the anterior chamber. During a superficial eye infection, use of contact lenses is strongly discouraged. **Interactions:** No significant drug interactions have been reported. Concomitant administration, even topical and particularly intracavitary, of other potentially nephro- and ototoxic antibiotics may increase the risk of such effects. Concurrent or sequential use cisplatin, polymyxin B, colistin, viomycin, streptomycin, vancomycin, other aminoglycosides and some cephalosporins (cephaloridin) or potent diuretics such as ethacrynic acid and furosemide may increase the potential for nephrotoxicity; concomitant use should be avoided. *In vitro*, the association of an aminoglycoside with a beta-lactam antibiotic (penicillins or cephalosporins) may cause reciprocal inactivation. A reduction of half-life or plasma levels of aminoglycoside occurred in patients suffering from renal insufficiency and in some with normal renal activity, even if an aminoglycoside and a penicillin-like antibiotic were administered by two different routes. Patients must be informed that if more than one ophthalmic medicinal product is being used, they must be administered at least 5 minutes apart. Eye ointments should be administered last. **Fertility, Pregnancy and Lactation:** Although preclinical studies show no foetal toxicity with topical administration of netilmicin, during pregnancy the product should be administered only after a careful benefit-risk assessment and under strict medical control. Not recommended during lactation. **Effects on ability to drive and use machines:** May cause transient blurring of vision, patients should not drive or use machines until resolved. **Undesirable effects:** Eye irritation, conjunctival hyperaemia, eyelid rash, eyelid oedema, eye pruritus, hypersensitivity and urticaria. Episodes of eye irritation and hypersensitivity caused by Nettacin are mild and transient. **Legal Category:** POM. **Basic NHS Price:** £9.83 per pack. **Pack Size:** 15 x 0.3ml single-dose containers. **Marketing Authorisation Number:** PL53941/0003. **Marketing Authorisation Holder:** SIFI Pharmaceuticals Limited, 29/30 Fitzroy Square, London, W1T 6LQ, UK. **Further information is available from:** ParaPharm Development Ltd c/o Draupnir Holdings Ltd, Building 1410 Arlington Business Park, Theale, Reading RG7 4SA, UK. **Date of PI:** January 2022.

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1. Nettacin Summary of Product Characteristics. 2. Netildex Summary of Product Characteristics. 3. Blanco A, *et al. Invest Ophthalmol Vis Sci.* 2009;50(13):2664. 4. Sanfilippo CM, *et al. Curr Eye Res.* 2016;41(5):581–589. 5. Papa V, *et al. J Cataract Refract Surg.* 2016;42:1312–1317. 6. Blanco A, *et al. Curr Eye Res.* 2013;38(8):811–816.

Date of preparation: February 2023. ALT-23-001.

ALTACOR

visionary eyecare

A patient's perspective: Dry Eye Disease – time for a name change?

by **Dr Ruth M Machin**

William Shakespeare once asked, "what's in a name"? I will argue that, when it comes to disease, words matter. I was once a Consultant Radiologist, now I'm a patient. I have corneal neuralgia secondary to dry eye disease (DED). It all started on Christmas day 2020 when I developed painful loss of vision in my left eye and ended up in my local eye casualty. I was diagnosed with DED and sent home with preservative free drops and night ointment. The vision came back in two days, but the pain persisted. A couple of months later, the right eye decided to join in. My pain progressed to the point where I was housebound, despite a couple of courses of steroids and commencing Ikervis (Ciclosporin). My eyes hurt all the time, day and night, disturbing my sleep. I had a few desperate trips to eye casualty as the pain was so intense, I thought I might have a corneal erosion, only to be told there was nothing to see. My mental health suffered, compounded by tiredness and at my lowest point I phoned the Samaritans at 3am in tears, as I wasn't sure I could go on living like this. Yet every time I saw an ophthalmologist, I was told my eyes "Didn't look too bad". I had a low tear meniscus and a poor tear break up time, but no staining and I was subsequently diagnosed with corneal neuralgia (CN).

CN is supposedly rare, although I think it's probably just under-diagnosed. From a patient perspective, the 2017 article by Dieckmann et al. gives a good overview[1]. My turning point was getting punctal plugs and being prescribed autologous serum eyedrops. These took a few months to work but were transformative, and I gradually improved to a place of stability. I now have a reasonable quality of life as long as I am really careful with my eyes and know my limitations. I need to maximise sleep, hydration and remove myself from triggering stimuli. A level of dryness which is acceptable for someone with normal eyes, can cause pain for someone with CN. The pain can feel like being stabbed in the eye or aching as if I have been punched. When it is bad, it spreads to my ear, nose, cheek and forehead. I know my life will never be as it once was and I have had a period of mourning for the things I can no longer do: drive for long periods of time, long haul flights, read a novel, late night gigs and festivals. I have to wear moisture chamber glasses all the time as my eyes are sensitive to the slightest breeze and they guard against excessive evaporation. These contain photochromic lenses as I am still light sensitive. I've converted to audiobooks, use voice dictation for word processing and emails, and can only use screens in really short bursts. The Dasung e-ink tablet has been a godsend for browsing the internet. I tried to get back to the job I love, but staring intently at four screens, two of which are incredibly bright, looking for tiny things is not compatible with this condition.
My attempt to work from home ended with a nasty flair-up of symptoms and another course of Softacort (Hydrocortisone sodium phosphate).
I have recently had to leave my job on the grounds of ill-health, and I am delighted to say that my application for the NHS ill-health pension was successful.

Some clinical commissioning groups have refused to fund Ikervis. People with neuropathic pain struggle to get referred for autologous serum drops.
I am one of the lucky ones, my doctors and optometrist are excellent and empathetic, and I am on the correct treatment. I run a dry eye patient support group and I started to feel that my story was atypical. So, I decided to investigate using a survey of demographics, symptoms, experiences with NHS care and had 250 responses. 29% described their symptoms as extreme or severe. 52.3% think about their eyes all or most of the time. 34.3% say their sleep is disturbed. 63.1% say DED has effected their career with 8.9% having to change jobs and 7.6% unable to work at all. 82.6% have paid to see an ophthalmologist privately because they thought care on the NHS was inadequate, too slow, or they wanted to access treatment options such as intense pulsed light therapy for meibomian gland disease. 43.3% did not think their eyecare professional appreciated how much DED impacted their life. The comments

So, on to my issue with the term Dry Eye Disease. It sounds so innocuous, doesn't it? A bit like having dry hair in need of a deep condition, or dry elbows requiring a dab of expensive body lotion. The 2018 NHS England guidance on reducing prescribing of OTC medicines, describes it as a minor condition[2]. Whilst it clearly states anyone with a chronic disease is exempt, I know of patients prescribed only one bottle of preservative free eye drops a month by their GP, despite severe symptoms.

make sobering reading. "I feel totally helpless. Dry eye and associated discomfort have ruined the best years of my life". 'It's devastated my life and I've been suicidal". "Care on the NHS is generally poor. DED is not seen as a priority as it's chronic and not usually sight threatening". "The health professionals didn't consider DED as debilitating. Unless you have experienced it, you don't know how painful it can be". "Consultants have no comprehension of the severity or impact of DED and have no enthusiasm to help". This is just a snapshot, but it seems there are a lot of unhappy patients out there who feel they are not getting the help they require in a timely fashion or that their condition is just not taken seriously. Irrespective of whether there is a neuropathic component or not, DED hurts. Try not blinking for 60 seconds, then imagine having that feeling constantly, whenever your eyes are open. A tear break-up time of one second means you cannot blink fast enough to maintain a healthy tear film to protect your corneal nerves from desiccating stress. There is research which shows the impact of DED on a patient's quality of life is equivalent to suffering from unstable angina[3].

So why do patients feel that they are getting a raw deal? Partly it is, I believe, a reflection of the current state of the NHS. If ophthalmologists are allocated only 10 minutes per patient in outpatient clinics, then this is often inadequate when dealing with a complex illness. If I could design my ideal dry eye service, as well as more time, there would be input from optometrists, demonstrations of correct eyelid hygiene and discussion of non-pharmacological adjuncts such as moisture chamber glasses and night goggles. Access to novel treatments such as intense pulsed light. Referrals, where required, to pain management specialists and counselling. Basically, it would be taken as seriously as other chronic, progressive and life altering conditions.

However, I also think we need a name change. The term 'dry eye disease' trivialises the condition. We use the same umbrella term for someone whose eyes might get a little uncomfortable in winter and a patient with severe and potentially sight threatening dryness due to Sjogren's, Stevens-Johnson syndrome or Graft vs Host Disease. My friend Rebecca Petris runs the Dry Eye Foundation, a not-for-profit organisation in the US. She says, "We don't actually believe in 'dry eye', although it's hard to avoid using the term. It's about ocular surface diseases and ocular surface pain". Prior to making a claim on my income protection insurance when I couldn't work, I was told, by a Consultant Ophthalmologist, that they would never pay out for DED. The implication being that it was not a severe enough condition. I am pleased to say he was wrong, and they did. My occupational health doctor has a better grasp of the significant morbidity associated with the condition than a few of the many ophthalmologists I have encountered on my patient journey. The prevalence of DED is increasing as we become ever more dependent on screens. Given DED effects vision related daily activities, including reading speed, its impact on productivity at work, as well as quality of life, should not be underestimated[4]. I truly believe the condition is ready for a change of name, to reflect quite how devastating an impact it can have on patients' lives.

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TFOS lifestyle: Impact of societal challenges on the ocular surface

Section 3-4

TO BE CONTINUED...

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1. Introduction

1.1. Approach

This report is part of the Tear Film & Ocular Surface Society (TFOS) Workshop, entitled 'A Lifestyle Epidemic: Ocular Surface Disease,' which was undertaken to establish the direct and indirect impacts that everyday lifestyle choices and challenges have on ocular surface health. It examines societal challenges in ocular surface diseases using an adaptation of a framework used to map the relationship between the individual, their environment and their health [1]. This approach was designed to enable interventions to be addressed at a health policy level and consequently it reflects the interplay and dependencies between the different factors. The model also recognises that certain factors can be considered to fit within one or more of the levels identified. The most recent iteration of this model considers the impact of the digital world directly and indirectly on human health [2].

The direct impact of certain individual lifestyle factors in ocular surface diseases, including [8], is explored in detail in the respective Reports from the TFOS Lifestyle Workshop. The Societal Challenges Report will predominantly focus on how those factors contribute to societal norms that in turn influence presentation, outcome and management of ocular surface diseases and will refer to the relevant sub-committee reports for their direct effects. For example, the Societal Challenges Report will explore the impact of the digital world on access to education of practitioners and patients, telehealth or access to services, rather than the impact of digital devices per se on the ocular surface; or the effect of climate change on determinants such as clean water or access to services, rather than the effect of climate change on the ocular surface. Each section within this report will cross reference the relevant TFOS Lifestyle Reports to minimise overlap. As for the other TFOS Lifestyle Reports, evidence is summarised in a narrative style review that, wherever possible, refers to outcomes from high-quality systematic review (Level I) evidence. The Evidence Quality Subcommittee provided a comprehensive database of appraised Level 1 evidence judged to be of potential relevance, which was factored into the writing of the report [9]. A key issue given the timing of this report was the impact of COVID-19 on the ocular surface. A systematic review to summarize the impact of the COVID-19 pandemic on the frequency and severity of ocular surface disease in both the general population and amongst those who had COVID-19, was conducted and is included in this report.

3. Individual lifestyle/social or community factors, including nutrition, smoking, exercise

3.1. Nutrition

Eating behaviour and nutritional status play important roles in ocular surface health and disease [168,169]. Societal factors are crucial determinants of ade 4.2. quate nutritional intake and healthy eating pattern [170,171]. The 'double burden of malnutrition', referring to undernutrition on one side and being overweight and obesity on the other side, was introduced into the literature at the beginning of the 21st century [172,173]. The rate of the double burden of malnutrition has increased over the past decades, and this increase was accelerated during the coronavirus disease 2019 (COVID-19) pandemic [174,175]. Ocular surface signs of nutritional disorders and the underlying mechanisms have been reviewed in detail in the TFOS Nutrition Report [3]. In this section, societal challenges with potential ocular surface consequences through nutritional or eating imbalances are reviewed.

3.1.1. Food insecurity

Food insecurity is understood as not having access to sufficient food, or food of an adequate quality, to meet one's basic needs. It is associated with multiple nutritional deficiencies with known ocular surface con- sequences [176,177] However, the relationship between food insecurity and ocular surface disorders has been infrequently studied. Several longstanding and emerging global and regional societal challenges threaten food security. Poverty is a well-known cause of food insecurity, not only in developing countries [178,179], but also in certain groups in high-income countries [180,181]. Climate change is an emerging challenge that may impose direct and indirect impact on food security. Extreme weather conditions result in increased poverty and reduced food consumption [182], and conversely, climate policies may impose a financial burden on developing countries through increased food and energy prices [183]. The emergence of the COVID-19 pandemic raised concerns for the exacerbation of poverty and food insecurity [184–186]. Unemployment, stay-at-home orders, and distribution shortages are potential causes of both short and long-term impacts of the COVID-19 pandemic on food security, which have a greater impact in low and middle-income countries [187,188]. Mass immigration due to environmental, economic and security crises, remains a global challenge. Food insecurity is a common health problem among immigrants, especially among undocumented immigrants and those seeking asylum [189–191]. Immigration has been associated with lower nutritional quality for multiple nutrients, including vitamins and minerals [192,193].

However, there is a lack of evidence regarding the impact on food insecurity specifically on the prevalence or severity of ocular surface diseases among immigrants and refugees (see Section 5.8).

3.1.2. Eating disorders

Anorexia nervosa is a psychological disorder characterized by fear of gaining weight, loss of appetite, and distorted body image. The incidence and lifetime prevalence of anorexia nervosa is 8/100,000 and 0.5%–2%, respectively [194,195], with a remarkable increase among young females over the past two decades [196]. Of note, there have been reports of increased risk of episodes of eating disorders during the COVID-19 pandemic, possibly due to changes in living conditions, social distancing, self-isolation, changes in food access, more intense use of social media, and more limited access to healthcare services [197–199]. There are no systematic reviews or meta-analyses on the ocular surface manifestations of eating disorders and their reversibility. A population-based study in the Netherlands with almost 80,000 participants, found eating disorders to be associated with a 1.6x increased prevalence of dry eye disease, after correction for age and sex. However, after correction for an additional 48 comorbidities, this increased risk was no longer significant [15]. Various ocular surface complications with different underlying mechanisms have been reported including a lower spontaneous blink rate during fixation tasks in patients with anorexia nervosa compared with healthy controls, which has been attributed to reduced dopaminergic activity [200]. In addition, incomplete eye closure due to neuromyopathy of the orbicularis oculi muscle was reported in an anorexic patient with vitamin C deficiency [201] and ocular surface symptoms secondary to lagophthalmos have been re- ported [202]. Although vitamin A deficiency may have implications for ocular surface signs of chronic anorexia nervosa, superficial punctate keratopathy, reduced tear production, and conjunctival squamous metaplasia may occur in the absence of vitamin A deficiency [203]. Further studies are required to determine the role of societal factors in eating disorders and their ocular surface consequences.

3.1.3. Obesity and metabolic syndrome

Obesity is a multifactorial disease with complex genetic and environmental risk factors [204]. Alongside high blood pressure, hyperglycemia, and hyperlipidemia, obesity is a risk factor for metabolic syndrome (a cluster of conditions which together increase the risk of heart disease, stroke and type 2 diabetes). The global prevalence of obesity and metabolic syndrome has increased significantly over the past few decades due to imbalanced nutrition, socioeconomic conditions and sedentary lifestyles [204–206]. Obesity has been associated with lower tear break-up time and greater meibomian gland dysfunction and ocular surface disease index scores, relative to a non-obese control group [207]. A study in Chinese adults revealed significant associations between moderate-to-severe meibomian gland dysfunction and being overweight or obese [208]. In a paediatric population, body mass index was associated with meibomian gland tortuosity and reduced lipid layer thickness [209]. Obese participants were more likely to develop dry eye disease compared with those with low body mass index (<23 kg/m2) [210]. This relationship was reversed in the Lifelines study, which found a strong association between both high (measured) body mass index and (measured) hypertension and less dry eye disease, when controlling for other variables [15]. This would suggest there is not a simple relationship between metabolic syndrome, its risk factors, conditions reflective of systemic inflammation and meibomian gland dysfunction or/and dry eye disease, in different population groups [211–213].

3.1.4. Fasting

Daytime fasting, either as a ritual practised for religious reasons or as a diet regimen (also known as intermittent fasting), may have impacts on tear production and ocular surface health. After 12 h of fasting, there is a temporary increase in basal tear secretion followed by a decrease [214]. Also, significant changes in the pattern of tear proteins and activity of tear enzymes were observed during fasting in Ramadan (the holy month for Muslims) compared with the previous month [215]. Moreover, religious fasting was associated with significantly increased tear osmolarity, ocular surface disease index score [216] and inflammatory markers [217] and decreased unanesthetized Schirmer value [216] and tear break-up time [217]. There is no report on the ocular surface effects of non-religious intermittent fasting (which is less strict than religious fasting), though potential impacts have been proposed [218]. Since intermittent fasting as a diet regimen is gaining popularity [219], further studies to explore its impact on ocular surface health are recommended.

3.2. Smoking

Nicotine is a drug that can act as both a depressant and a stimulant. It is a naturally occurring alkaloid which is present in cigarettes and to- bacco [220]. Smoking is a known cause of tear film alterations [221, 222] but the relationship between smoking and ocular surface diseases is less clear (also see TFOS Lifestyle Report [6]). Cigarette smoke can increase tear interleukin-6, decrease goblet cell density,

decrease the secretion of tear MUC5AC [223] and can irritate the ocular surface, resulting in symptoms [224]. Unanesthetized Schirmer score is reduced in smokers compared to non-smokers (13.3 11.5 mm vs 19.0 11.7 mm) [223]. The decrease in goblet cell density in smokers is associated with lissamine green staining of the ocular surface [223].

Population-based studies have not confirmed an elevated risk for dry eye disease with smoking, however. One study established smoking as a risk factor for dry eye disease [149] but this has not been confirmed in a systematic review of smoking and eye diseases [225], and the largest population-based Lifelines study has shown a reduced risk of dry eye disease in current smokers, but a higher risk in previous smokers, a result confirmed in a UK-based population study reported in the same paper [15]. The rate of smoking has increased in certain population groups, including women and adolescents [226,227].

Smoking is often associated with other demographic and societal factors, including family history and social factors [228], unemployment [229], low-income [230], and immigration [231].

There is a positive relationship be- tween smoking and depression, anxiety, and psychological distress, although the evidence does not support a causal role for smoking in developing mental illnesses [232,233]. Independent relationships between smoking and ocular surface diseases may therefore be confounded by other societal factors.

The use of e-cigarettes and vaping may be considered an emerging societal factor, and this may expand the demographic exposed to nicotine. Smoking nicotine-containing e-cigarettes significantly reduces tear film stability and increases ocular surface staining [234], adversely impacts the tear lipid layer [221], causes changes in conjunctival impression cytology [235], reduces corneal and conjunctival sensitivity [236], increases ocular irritation and decreases anesthetised Schirmer scores [237], alters tear ferning grade [238], increases tear osmolarity [239], increases eyelid margin abnormalities and decreases meibum quality [240].

E-cigarettes may be equally as harmful to the ocular surface as traditional tobacco or cigarettes, although this has not been confirmed in population-based studies. Vaping decreases non-invasive tear break-up time, fluorescein tear break-up time, and tear meniscus height compared to non-vaping controls, with the effect on these ocular surface parameters being worse with higher vaping voltage [241]. However, this study also reported significantly higher Schirmer scores in vapers compared to non-vapers [241], conceivably due to increased tear production from vaping smoke, although this was unproven.

3.3. Exercise

Exercise is an effective treatment for chronic systemic diseases including cardiovascular disease [242], where it can reduce systolic blood pressure, fasting glucose, fasting insulin and improve vascular and cognitive function [242,243]. In diabetic mice, eight weeks of aerobic exercise increased tear secretion and reduced oxidative stress markers in tears [244].

A large population-based study in Japan showed that a lack of physical exercise and sedentary behaviour were strongly linked with increased susceptibility to dry eye [245]. This association was also found in a large population-based study in the Netherlands, but was not pre- sent after further correction for 48 comorbidites including conditions that are consequently associated with decreased exercise, such as connective tissue disease and depression, indicating the importance of correction for associated comorbidities in these analyses [15]. In Japanese children, screen time and decreased physical activity was associated with obesity, dry eye and reduced academic performance [246].

In a small study in humans, 30 min of aerobic exercise improved Schirmer score, invasive and non-invasive tear break-up time and reduced levels of inflammation and stress markers in the tear film [247]. Ten weeks of aerobic exercise performed three times per week in 11 participants with dry eye disease improved dry eye symptoms as measured with the DEQ-5 [248]. It is conceivable that parasympathetic innervation to the lacrimal gland, specifically to the acinar blood vessels, is stimulated with exercise, which may increase the secretion of electrolytes and water [249]. There are limited published studies in both dry eye disease and normal participants for a conclusive statement to be made, however.

3.4. Alcohol/caffeine/recreational drug use/abuse

3.4.1. Alcohol (see TFOS lifestyle challenges [6] and nutrition [3] reports) Orally administered ethanol can be detected in tears, leading to decreased tear break-up time and unanesthetized Schirmer scores [250], and increased corneal staining and tear osmolarity compared to controls [251]. In a meta-analysis of 10 studies, alcohol consumption was a significant risk factor in dry eye disease, irrespective of age and sex [252].

A large population-based study reported alcohol consumption increased the risk of symptomatic dry eye disease in females (odds ratio [OR] 1.095, 95%CI 1.045–1.148) after correction for confounding variables such as demographic and systemic disease factors; but this finding was not significant in males in whom alcohol consumption was found to be protective against symptomatic dry eye disease [253].

The oral consumption of alcohol may also induce an upregulation of proinflammatory cytokines in the cornea [251]. Chronic consumption of alcohol has been linked to vitamin A deficiency via the induction of ethanol-inducible cytochrome P-450 in the liver [254], leading to morphological changes

on the ocular surface in the form of conjunctival and corneal keratinization, goblet cell loss [255], punctate keratitis, necrosis and corneal ulceration [256].
Some large epidemiological studies have reported no impact of alcohol consumption on dry eye disease [224,257,258].
Alcohol consumption, however, was noted to be protective for dry eye disease in an older Australian population [259].

3.4.2. Caffeine (see TFOS lifestyle challenges report [6])

Caffeine is a central nervous stimulant belonging to the methylxanthine family. It is one of the most consumed psychoactive substances and is known to have mild diuretic effect [260]. Due to this diuretic effect, caffeine, when consumed in large quantities, has been thought to exacerbate dry eye disease, however, there is little evidence to support this. In a large population survey study of 19,599 participants, the frequency of coffee consumption, based on the number of cups of coffee consumed per day showed no relationship with the risk of dry eye disease [261].
In a population-based study in the Netherlands, including 85,302 participants, caffeine intake was calculated by assessing dietary intake of coffee, tea, cola, and energy drinks [262]. Caffeine intake was associated with a slightly protective effect on dry eye, after correction for age and sex only. This association disappeared however after additional correction for over 50 possible confounding factors including smoking, alcohol intake and numerous comorbidities [262]. Similar findings have been observed using diagnostic criteria other than the Women's Health Study questionnaire for dry eye disease [259,263].
There is some evidence for a protective effect of caffeine in dry eye disease from the Beaver Dam Eye study cohort, where participants who did not consume coffee had significantly higher prevalence of dry eye disease compared with those who did (16.6% vs 13.0%) [224]. Confounding factors may have influenced this result, however.
The effect of caffeine on tear secretion was studied in a randomised controlled trial of 41 healthy young adults, with a mean age of 23 2.1 years [264]. Consumption of caffeine (5 mg/kg of body weight dissolved in 200 mL of water) resulted in increased Schirmer scores (without anesthetic) assessed at 45 min and 90 min post-consumption [264]. Caffeine intake between 5 and 7 mg/kg of body weight increased tear meniscus height in a randomized controlled trial of 78 healthy participants [265]. The underlying mechanism is unclear, but polymorphisms in cytochrome P450 1A2 and the adenosine A2a receptor gene may be implicated [265].
The effect of caffeine on other ocular surface disease parameters such as tear break-up time, tear osmolarity and ocular sur- face staining has not been explored in well-controlled studies.
Green tea contains xanthines (such as caffeine), amino acids (such as theanine, glutamic acid, tryptophan, lysine, aspartic acid, glycine, serine, tyrosine, valine, leucine, threonine, and arginine); catechins; polyphenols (such as flavanols, flavandiols, and flaconoids) and trace elements [266,267].
Green tea is mostly consumed for its benefits in cardiovascular disease, anti-stress, anti-inflammatory and antioxidative properties, as well as neuroprotective and cholesterol-reducing properties [266].
The effect of a single dose of green tea on tear production and quality was assessed in a case control study using the phenol red thread test and tear ferning test [268].
Tear film ferning is a measure of tear film quality and the tear fern pattern formed following the drying of tears collected on a glass slide under normal room temperature conditions is assessed qualitatively [269].
Normal tears produce a dense fern pattern while in patients with dry eye disease, the pattern is either absent or fragmented [270]. There was a reduction in median phenol red thread test length, with 80% of participants showing a reduction in length, and an increase in tear ferning fragmentation 1 h after consumption (2.0 g in 150 mL) [267].
The authors hypothesized that the serum lipid oxidative properties of polyphenols observed in a rat model, may be similarly exhibited in human tear film lipids and impact tear film quality. A further hypothesis is that a low concentration of caffeine, between 2 and 4%, may also contribute to the findings [267]. In contrast, a comparative study which evaluated the effect of topically-instilled green tea extract compared with artificial tears, reported an improvement in dry eye symptoms (ocular surface disease index), tear break-up time and meibum quality [271].
The available evidence would suggest that caffeine seems to offer a benefit to the ocular surface by decreasing dry eye symptoms, increasing tear secretion and tear film stability but the effect of green tea on the ocular surface is equivocal.

3.4.3. Recreational drugs

Recreational drug use refers to the unsupervised use of illegal or legal drugs for leisure or pleasure, including analgesics, depressants, hallucinogens and stimulants. Analgesic drugs in this context include narcotics such as heroine, codeine, fentanyl, tramadol and morphine. Depressant drugs inhibit the central nervous system and may lead to drowsiness, coma, sleep, anesthesia, and death, including alcohol, nicotine, barbiturates, and tranquilizers. Hallucinogens induce psychological effects such as distortions from reality, illusions and hallucinations, including marijuana, psilocybin, lysergic acid diethylamide, phencyclidine, peyote and ketamine. Stimulants increase the activity of the central nervous system and bodily activity in general, including cocaine, methamphetamine, and 3,4 methylenedioxymethamphetamine.
The prescribing of opiate analgesics for ophthalmic indications has increased, particularly in people with African heritage, individuals with higher income, and a lower level of education [272]. Despite the increasing use of these drugs in ophthalmology in both post-operative cases and in the treatment of neuropathic pain [273,274] and evidence of persistent opioid use after ocular surgery [275], the effect of opiate analgesics on the ocular surface has not been widely studied (See TFOS Elective Medicines Subcommittee Report [144]). Opioid receptors are present on the human cornea and topically applied opioids may stimulate these receptors to decrease ocular pain [276].
Morphine is used in pain management [277] and is one of the most commonly abused medications [278]. Users of morphine are more likely to be male, experiencing homelessness and unemployment [278]. Topically-applied morphine sulphate in post-surgical abrasions reduced pain and corneal sensation without retarding corneal wound healing [277].
Tramadol, another opiate analgesic, is an analogue of codeine that has been used to manage post-surgical eye pain [279].
There are no randomised controlled trials of its effects on the ocular surface in humans, but corneal sensitivity is reduced within 1–25 min of topical application [280] and temporary blepharospasm has been induced in animal models [281].
While corneal wound healing appears to be unaffected by the topical use of opioids, corneal anaesthesia may alter tear secretion and corneal epithelial physiology [282,283]. Importantly, the corneal analgesic effect is effective only in the presence of inflammation [277].
In animal studies, there was no impact of tear production measured with the Schirmer test following intramuscular

tramadol in dogs [284, 285] or with morphine [286] or fentanyl [287]. Heroin use may lead to conjunctival injection [288] and a case of atypical kerato-conjunctival lesions due to transconjunctival heroin abuse has been reported [289].
Barbiturates are sedative and hypnotic agents used in the management of seizures, pre-operative anxiety, insomnia, and the induction of coma. There are limited human studies that directly explore the impact of barbiturates on ocular surface diseases, but one study did find that phenobarbital leads to a transient sicca effect in a patient being managed for seizures [290]. In animal studies, thiopental decreased tear pro- duction assessed by unanesthetized Schirmer scores in dogs when used in the induction of anesthesia [291].
The use of anxiolytic medications in patients with depressive or anxiety disorders has been linked to a higher odds ratio of dry eye disease [292,293]. Ketamine, a sedative medication used during surgery reduces tear production in both cats [294] and dogs [295]. Although there are few direct studies, the indirect evidence would suggest that these sedative medications may worsen dry eye disease by decreasing tear production.
Marijuana has psychoactive properties and has been used in medicine for increasing appetite, treating eating disorders and nausea, in the management of pain and chronic inflammation, multiple sclerosis and epilepsy [296]. In humans, marijuana use has been associated with reduced tear secretion [297] and decreased corneal endothelial cell density [298]. In mouse studies, the ocular effect of marijuana via its derivative, tetrahydrocannabinol, through acting on the ocular surface cannabinoid CB1 receptors, appears to be sex dependent as it leads to decreased tear production in males but increased tear production in female mice [299]. While marijuana use may lead to dry eye symptoms [300,301] and a decrease in tear production [297], it may however be useful in the management of corneal neuropathic pain [302]. Topical administration of 1% delta 9- tetrahydrocannabinol results in increased ocular irritation [303]. There is limited evidence of the benefits of cannabis on ocular surface disease and based on available data, marijuana use, especially when smoked, may worsen dry eye disease.
The data regarding the impact of hallucinogens such as psilocybin, and lysergic acid diethylamide are limited, however, conjunctival and corneal erosions have been reported in a case of trans-conjunctival lysergic acid diethylamide application to the inferior conjunctival fornix [304].
Other stimulant drugs such as snorted cocaine have been linked to decreased tear production assessed by unanesthetized Schirmer wetting scores (16.5 10.1 mm in eyes following cocaine use vs 22.5 12.9 mm in control eyes) [305]. Similarly, in individuals who snorted cocaine, there was a significant decrease in tear production, decreased corneal sensitivity, neurotrophic keratitis, and decreased blink rate [306]. Other conditions associated with the use of cocaine include anterior staphyloma [307], corneal ulceration [308,309], epithelial defects and corneal infiltration [310], and infectious keratitis [311]. Similarly, methamphetamine use has been reported to lead to conjunctivitis and corneal melting [312], and keratitis [313]. The mechanism of damage of cocaine and methamphetamine to the ocular surface has not been well studied, but it may well be related to the excessive release of dopamine, which leads to sensory nerve damage [314]. This may lead to a decreased blink rate, worsening exposure keratopathy, neurotrophic keratitis, corneal ulceration and ultimately corneal blindness.

3.5. Cultural and religious beliefs, including traditional medicines

Traditional medicines describe health practices based on animal or plant sources, spiritual or mineral therapies used in the diagnosis, prevention or management of illness or maintenance of general well-being [315]. There is widespread use of traditional medications and practices in developing countries, especially in Africa, India, and South America. Traditional medications may be in the form of vegetative matter, breast milk, plant extracts or animal waste products. Breast milk has been traditionally used by mothers for the management of conjunctivitis in rural areas in developing countries [316]. The protective mechanism is believed to be due to immunoglobulin A, lysozyme, lymphocytes, macrophages and protease inhibitors present in the colostrum, which confer antibacterial properties [317]. However, complications, including corneal infection and endophthalmitis, have been reported in a prospective study in a tertiary health setting [317]. Another prospective study also reported breast milk to be the most commonly applied traditional eye medicine in patients with corneal ulcers (45.2%) [318]. Other traditional eye medicines include vegetative matter (29.6%), castor oil (11.9%), and hen's blood (5.9%) [318]. The use of traditional eye medications has been associated with hypopyon at presentation, with a risk of central dense corneal scarring [319] and infectious keratitis as well as peripheral corneal ulcers [320]. Patients using traditional eye medicines tend to have a delayed presentation to seek medical attention compared to those using Western medicine [321].
While the harmful effects of breast milk on the ocular surface are well documented, there is also some evidence of benefit. In mouse models, human breast milk improves corneal epithelial damage comparably to cyclosporine [316].
In a prospective animal study comparing the use of breast milk, autologous serum and artificial tears in mice with corneal abrasions, the group receiving topical breast milk drops experienced faster corneal re-epithelization compared to other groups [322]. In a study of breast-fed infants 180 days,

breast milk was equally effective in treating eye discharge when compared to sodium azulene sulphonate hydrate 0.02% ophthalmic solution [323]. In patients with neurotrophic corneal opacity, especially post-viral infections, breast milk appeared to be effective in improving corneal sensitivity and visual acuity [324]. However, some patients developed bacterial conjunctivitis during treatment and the efficacy was poor in diabetics [324]. Topical bovine colostrum improves corneal re-epithelization following alkali burns in mice [325].
Castor oil is derived from the Ricinus communis plant and is used in cosmetics as an emollient (See TFOS Cosmetics Subcommittee Report [4]). It has been used as a wound dressing and a drug delivery system [326].
It has antibacterial, anti-cancer [327], anti-inflammatory, anti-oxidant and wound healing properties, making its use on the ocular surface logical [326]. In vivo, ricinoleic acid contained in castor oil is able to produce esters, amides and polymers which cover the ocular surface, decreasing the evaporation of aqueous tears and thus improving tear stability and decreasing ocular surface staining and dry eye symptoms [326]. In a randomized controlled trial, topical periocular castor oil significantly decreased ocular surface disease index scores, lid margin thickening, telangiectatic vessels, lash matting, madarosis, cylindrical dandruff and lid wiper epitheliopathy in patients with blepharitis after 4 weeks of use compared to untreated eyes [326]. Castor oil, applied topically, appeared safe and effective in decreasing tear film instability, symptoms, and ocular surface staining in strengths of 2% and 5% compared to placebo in a randomised controlled study [328]. Though widely believed to be of benefit in eye lash growth, the evidence suggesting the use of castor oil for eye lash elongation is lacking and the evidence for its use in hair growth is weak [329].
Poor access to health care facilities, distance from hospitals and illiteracy are some of the reasons for the use of practices that may lead to severe ocular surface diseases due to traditional medicines. Education of, and collaboration with, traditional healers led to a decrease in corneal blindness and changes in the pattern of corneal disease in rural areas in Africa [330]. In this study, traditional healers were discouraged from using traditional medicines applied directly to the eyes and they were advised to refer patients if there was no resolution of the ocular disease in three days.
After one day of training the healers, a change in the pattern of corneal disease was observed, with bilateral corneal dis- ease decreasing from 31% to 10% [330].
Due to religious beliefs, certain traditional practices have become popular in rural areas. Ayuverdic medicine is a form of traditional Indian medicine derived from natural substances such as roots, and herbs for the treatment of the mind and soul. Cow urine is notably used in the preparation of some of the formulations of this type of medicine and this has been used for treating a range of diseases, including coronary artery disease, hypertension, asthma [331] and cancer [332]. The cow urine is either boiled, or the distillate used [331].
Cow urine applied to the eye leads to corneal epithelial defects, corneal edema and decreased vision [331].

The type of traditional medicine use varies with cultural practices and geographic diversity. A systematic review reported the widespread use of Kermes, a red dye obtained from an insect Kermes ilicis in Saudi Arabia [315].
Kermes leads to severe ocular surface toxicity and cicatricial conjunctivitis [333]. Alum, a hydrated salt comprised of potassium aluminium sulphate used in making foods, as an astringent agent, and also as a flocculating agent [315], causes severe keratitis, corneal thinning, scarring and decreased vision [334]. In animal models, garlic extract has exhibited antibiotic properties similar to gentamycin and has been used traditionally in parts of Nigeria, Western Africa [335], how- ever, such vegetative extracts may also act as sources of ocular infections. Similarly, honey, used for its anti-inflammatory, anti-bacterial and anti-oxidant properties, has been used in the management of ocular surface diseases such as blepharitis [336], conjunctivitis [337], dry eye disease and tear film stability in meibomian gland dysfunction [338, 339], and even vernal keratoconjunctivitis [340]. Despite these numerous benefits, honey can become contaminated and has been implicated in Acanthamoeba keratitis [341].
Aloe vera is another naturally occurring plant with sap that has many benefits [342].

However, it has also been associated with ocular infections [343], and these plants (or their sap), when not properly stored, may become contaminated and become potential sources of infection [315]. Ushaar (Calotropis procera) is a xerophytic shrub found in Asia, Africa and some parts of South America, which can induce corneal toxicity [344]. The traditional Chinese medicine, Qiming may hold promise in improving tear film stability and secretion, as well as corneal wound healing properties [345]. Further studies are needed to thoroughly determine its therapeutic value.
Homeopathic medicines have been used to reduce ocular symptoms associated with allergic rhinitis, and a systematic review determined a small positive effect of Galphimia glauca or a homeopathic nasal spray on ocular and nasal symptoms [346]. However, risk of bias and lack of appropriate masking in these studies warrants further randomised control trials to determine their true efficacy.
While some traditional medicines clearly have benefits to the ocular surface, they may act as a source of microorganisms, induce toxic keratopathy and pose a threat to vision.
Where medications are not manufactured with strict hygiene protocols and tested for efficacy and safety, they should be used with caution. Their use should be restricted to those with no or limited history of ocular toxicity and by trained skilled practitioners with a low threshold for early referral, if conditions do not resolve quickly. In the absence of obvious improvement, or with worsening of the condition, the use of these agents should be discontinued, and appropriate management instituted.

3.6. Hobbies, recreational and sport-related factors

3.6.1. Recreational and sport-related factors

Although sports and recreation have numerous physical and mental benefits, traumatic injuries to the ocular surface may occur. In a retrospective study in the USA, the most common sports and recreation activities associated with eye injury in children younger than 17 years of age, were basketball (15.9%), baseball and softball (15.2%), and non- powder guns (10.6%) [347]. In Australia, cycling, football, tennis, trampolining, fishing and swimming were the sports responsible for the greatest number of eye injuries [348]. Sports such as soccer and hockey increase the risk of sight threatening eye injuries. A study analyzed the trends of soccer-related ocular injuries in the USA from 2010 to 2019, and found that serious visual consequences were associated with soccer-related ocular injury [349].
Field hockey is a popular high school sport among girls in the USA. Although not common, serious eye injuries and vision damages can happen when players are struck by the stick or ball during the game [350]. The National Federation of State High School Associations in the USA issued a protective eyewear mandate in sanctioned competitions in 2011. A prospective cohort study evaluated the incidence of eye/orbital injuries during two seasons of play before and after the national protective eyewear mandate and demonstrated that the mandate was associated with a decreased incidence and severity of eye/orbital in- juries [351].
Toy guns, usually a miniature non-functioning replica of a gun, but those which may fire caps or pellets, can also cause a range of traumatic injuries. A study from Finland found that toy guns can cause serious eye trauma, including blunt ocular trauma and corneal abrasions [352]. Both players and bystanders are recommended to use protective eyewear during the entire game [352]. Similar results were reported from a study on children in Canada [353]. A retrospective study reviewed the characteristics and outcomes of patients treated for ball bearing and pellet gun-related open globe injuries from January 2002 to November 2017 [354].
The result indicated that ball bearing or pellet guns could cause devastating visual damage, associated with multiple complications and the need for further surgery beyond the initial repair [354]. These results emphasize the importance of eye protection during the use of toy guns.
Based on a review of publications from 1980 to 2014 describing eye trauma and recreational fishing, sharp hooks and heavy sinker weights projected at high speed, can cause severe eye injuries and significant vision loss [355]. Open and closed globe Injuries occurred 9x more commonly in males and were most likely to occur via a hook [355] A retrospective observational analysis of the data from The United States Eye Injury Registry found that fishing-related eye injuries accounted for 19.5% of all sports related eye injuries and 28.2% of the open-globe injuries reported to the registry from 1998 to 2004 [356].

3.6.1.1. Firework injuries.

Fireworks are popular but can lead to severe eye injuries. Firework-related eye injuries and associated consequences were reviewed by the International Globe and Adnexal Trauma Epidemiology Study: Fireworks Study Group [357]. Cross-sectional or retrospective studies have been carried out in various countries, including the USA [358], China [359], India [360], Germany [361,362], Nepal [363] and the Netherlands and Finland [364], to quantify the national prevalence of firework-related ocular injuries. Firework-related ocular in- juries mostly occur in young males and the severity of the injuries ranged from mild irritation to ruptured globes. More severe injuries have major impacts on ocular morbidity and visual acuity. To significantly reduce firework-inflicted trauma, a ban of private fireworks in densely populated areas and in the vicinity of children should be considered. Greater education about, and prophylaxis for, firework-related eye injuries would help to reduce the risk of severe consequences.

3.6.2. Ultraviolet light exposure

Outdoor or indoor exposure to ultraviolet light is common due to sporting or vocational exposures, or due to societal expectations of having a tanned appearance (See also Section 4.2 and TFOS Environ- mental Subcommittee Report [7]). Persistent exposure can occur in outdoor and winter sports, including water sports, skiing, snowboarding and distance running, and persistent exposure is related to ocular sur- face diseases including pterygium, droplet keratopathy and snow blindness [365]. The level of protection for athletes and workers is dependent on the jurisdiction and level of regulation. Ultraviolet light eye protection in athletics is frequently mandated through uniform and eye protection policies at club and competition level [366].
Indoor suntanning is a popular way of enhancing skin tones for people with light skin color (See TFOS Cosmetics Subcommittee Report [4]). Because of a lack of universally adopted laws or guidelines, eye protection during indoor suntanning is not obligatory. A prospective study found ultraviolet light exposure during indoor suntanning could cause significant microstructural changes to the cornea and the bulbar conjunctiva [367]. Identifying sports and recreation-associated risk factors will help in the development of injury prevention strategies to protect eye health.

3.7. Societal supports or societal pressures (see TFOS Elective Medications subcommittee report [144])

Disfiguring eye conditions have major impacts on psychosocial functioning. In a multicenter study, 10–49% of the patients with dis- figuring eye conditions had high levels of psychosocial distress, evidenced by lower scores in standardized measures of anxiety, depression, appearance-related distress, and quality of life [368].
Similarly, almost 40% of ophthalmic clinic patients reported high levels of distress and dysfunction in relation to their appearance [369]. A prospective observational study in adolescents with manifest exotropia showed these individuals to experience abnormal scores on psychological distress evaluation scales and surgical correction significantly improved the outcomes of all these scales [370].
Patients wearing eye prosthetics tend to have a higher risk of depression, anxiety and stress, especially in employment, leisure and social functioning issues [371].
While appearance-changing diseases significantly impact mental health, cosmetic surgeries can improve personal wellbeing, self-esteem, and different aspects of daily life. A retrospective study found that blepharoplasty operations significantly improved quality of life for patients [372].
Cosmetic surgeries can impact ocular surface health (See TFOS Cosmetics Subcommittee Report). To create the appearance of a double eyelid, cosmetic blepharoplasty and double eyelid tapes have become popular in East Asian countries (TFOS Cosmetics Subcommittee Report [4]).
Upper eyelid surgery results in a temporary decrease in ocular surface sensation that returns to baseline after one month [373]. Cosmetic double-eyelid blepharoplasty may temporarily affect tear film dynamics and aggravate dry eye symptoms in young female patients, which generally recover within 3 months [374]. Similar results were observed in patients undergoing cosmetic transcutaneous lower blepharoplasty, which affects the ocular surface and tear stability for three months [375]. Double eyelid tapes worn for two weeks can

increase conjunctival staining, corneal staining, signs of meibomian gland dysfunction and incomplete blinking, and significantly decrease tear break-up time and intraocular pressure [376]. The association between cosmetic blepharoplasty and dry eye disease has been previously reviewed [374].
Botulinum toxin type A is an injectable neurotoxin that is widely used to treat eye diseases including strabismus, blepharospasm and facial wrinkles around the eyes (see TFOS Elective Medications [144] and TFOS Cosmetics Subcommittee [4] Reports). The impact of Botulinum toxin injection on the ocular surface is controversial, as periocular Botulinum toxin may cause dry eye disease through reduced lacrimal gland secretion and increased tear evaporation due to adverse events, such as eyelid malposition and abnormal blinking [345]. Conversely, injection in the medial eyelids can improve dry eye disease by decreasing tear drainage from the nasolacrimal duct [345].

3.8. Other determinants or choices

Cosmetic, sporting, occupational or other lifestyle preferences may influence an individual's choice to wear contact lenses (see TFOS Con- tact Lenses Subcommittee Report [377]) or undertake corneal refractive surgery (see TFOS Elective Medications Subcommittee Report [144]). Appearance concerns are more frequently reported by women than men and there is greater uptake of contact lens wear [378] with attendant ocular surface sequelae, and particularly complications associated with dry eye symptoms are more prevalent in females than males [378]. Women are also more frequent candidates for corneal refractive surgery than men [379] and more prone to iatrogenic dry eye disease following refractive or cataract surgery [380]. While such refractive choices may be associated with the development of ocular surface diseases, including dry eye disease [381], they may also exacerbate existing ocular surface diseases. Eyelid tattooing is a popular cosmetic procedure for women in certain countries, although there are adverse effects on the ocular sur- face (See TFOS Elective Medications [144] and TFOS Cosmetic Sub- committee [4] Reports).
These include a risk of direct mechanical trauma from the needle, which may conceivably cause damage to the meibomian glands. Meibomian gland loss, evidenced by a lower meiboscore, has been reported in those with eyelid tattoos [382]. Tattoo ink pigments persist as pigment granules in the epidermis and dermis [383]. Most of the residual pigment is located within the macrophages in the dermis and, focally, in the endomysial connective tissue of the superficial orbicularis oculi muscle [383]. Tattoo ink, particularly those containing para-phenylenediamine [384] or black henna [385] may induce contact dermatitis.

4. Living and working conditions

4.1. Unemployment

The rate of unemployment increases during economic downturns and financial crises and directly impacts physical and mental health of those affected [386].
Unemployment and retirement have been linked to various health problems, including dry eye disease [210,387].
This might be explained by the higher rate of ocular surface disease risk factors among unemployed individuals.
For example, obesity [388], smoking [389], alcohol consumption [390], and depression [391] are more common among unemployed individuals. Over the past two years, the COVID-19 pandemic has impacted the global economy, including causing a rise in unemployment and related health problems [392]. Further studies are required to explore the impact of employment status on ocular surface health.

4.2. Type of occupation (see TFOS Environmental Subcommittee Report [7])

The nature of an individual's occupation may increase their risk of ocular surface disease in several ways [393].
Occupational exposure to chemicals, corrosives and excessive heat may cause acute or chronic ocular surface injury, which may result in devastating short and long-term complications [394,395].
Registry data in the USA from January 2013 to December 2017, indicates there are 13,181 newly diagnosed ocular burn cases each year, with a modest increase in prevalence over time [396]. Jobs that carry a higher risk of ocular sur- face burn include cleaners, miners, construction workers, laboratory staff, food service industry workers, agricultural workers, fire workers, and mechanics [397]. Factors associated with occupational ocular injury are lack of use of protective eyewear at time of injury, male sex, expo- sure to biological or chemical hazards and risk-taking behaviour [398]. In rural populations, open globe injuries are more commonly seen in association with agricultural occupations [399]. While ocular trauma is a well-established predisposing factor for infectious keratitis, particularly in rural and low income regions [62], ocular trauma due to agricultural injuries in farmers is associated with a higher risk of infectious keratitis [63]. Environmental factors such as sunlight and air pollution increase the risk of ocular surface diseases in outdoor workers compared with indoor workers [393,400,401].
Outdoor workers with prolonged sunlight exposure are at higher risk of developing pterygium and climatic droplet keratopathy [402,403]. One large scale study showed agricultural workers to have a lower risk of dry eye disease [393]. Certain indoor environments, such as those having low humidity and high levels of particulate matter of 2.5 μm or less, have been associated with dry eye symptoms [404].
The prevalence of dry eye disease in office workers with prolonged use of visual display terminals ranged between 9.5% and 87.5% [20,405]. This very wide range in prevalence has been attributed to the use of different diagnostic criteria in studies of dry eye disease [20].

Animal handlers might be at higher risk for developing ocular surface injuries. Keratitis and ophthalmia nodosa have been reported repeatedly following handling of Tarantula spiders, which have become popular pets [406–408]. Ocular surface chemical injuries following exposure to sheep, turkey, and fish bile have been reported in abattoir workers [409–411]. Ocular bee stings may occur as an occupational hazard in beekeepers or farmers and can cause severe corneal or conjunctival inflammation, especially if there is a retained stinger [412–414]. Since the emergence of the COVID-19 pandemic, working and studying from home and prolonged use of face masks have resulted in an increased prevalence of dry eye symptoms (see Section 8). Occupations that require longer screen time [393] and/or continued face mask use (see section 8) or a combination of both might conceivably be at higher risk for developing or worsening of dry eye disease. Working night shifts is another occupational risk factor which is associated with meibomian gland dysfunction, tear film instability and exacerbation of dry eye symptoms [415,416].

4.3. Water and sanitation

Reduced access to clean water and sanitation may increase the risk of ocular surface diseases, particularly in the context of trachoma. A systematic review of 47 studies found that access to sanitation was associated with less trachoma, as measured by the presence of trachomatous inflammation-follicular, trachomatous inflammation-intense or C. trachomatis infection [417]. Reduced odds of trachomatous inflammation, of either form, were also found with having a clean face, and at least once daily face washing, soap use and daily bathing practices [417].
Conversely, living within 1 km of a water source was not significantly associated with trachomatous inflammation or C. trachomatis infection [417].
In Ethiopia, where 77 million people live in trachoma-endemic areas, a systematic review of 29 studies investigating associations between trachoma and access to water supply, sanitation and face hygiene revealed that households with no toilet facilities, no access to improved water and the lack of daily face washing in children showed increased odds of exhibiting active trachoma [418]. There are many other ocular diseases that can be directly attributable to contamination of water bodies by various chemical and pathogens.
These can occur through toxic, allergic, inflammatory or infective mechanisms [419]. Specific water-borne ocular infections include Acanthamoeba keratitis, Giardiasis, Toxoplasmosis, Gnathostomiasis, Coenurosis, Pseudomonas aeruginosa keratitis, Melioidosis, Leptospirosis, Toxocariasis, and Adenoviral disease [419], although some organisms are recognized to have additional environmental sources. Climate change will likely result in new hazards and water contaminants that may lead to further or changed ocular diseases [419].

4.4. Education and childhood education

Education and childhood education may impact the risk of ocular surface diseases. There is a well-established link between education and poverty, socioeconomic class and access to health services, which affects both the prevalence and severity of a range of both systemic diseases [420] and ocular diseases [421]. Education is linked to better nutrition and therefore health consequences. Likewise, ocular diseases may conceivably impact societal factors, particularly those diseases which affect the quality of vision and may impact academic performance.
Infectious keratitis is more common in those with a low educational level [63–65]. There is a strong association between a low education level and a higher risk of both poorer visual outcome and infectious corneal blindness [64,65]. Having a higher education diploma was associated with an increased risk of dry eye disease in a large population-based study in the Netherlands, which persisted after correction for age, sex and other possible confounding comorbidities [15].
A possible residual confounding factor in this relationship may be increased screen use with higher education occupations. Reduced attention and concentration is reported in dry eye disease models [422], conceivably due to reduced blinking and resulting pathways to neural connections and brain stimulation, as well as diminished and variable optical performance in dry eye disease [423]. It could be argued that in the context of the increasing dominance of digital screens, eye strain and dry eye symptoms further increase, leading to a deeper lack of concentration and perpetuating this reduced performance cycle. There is evidence for increasing screen time and more time spent on remote education during the pandemic, with screen time reportedly doubling [424] (See sections 6, 7, 8, and the TFOS Digital Subcommittee Report [8]). Screen time has also been reported to be linked to dry eye symptoms in children [425], especially with the use of screens before bedtime [246] and higher screen times are associated with worse school performance [246]. While the mechanisms underlying these effects are unclear, it does appear that screen use is associated with dry eye disease and reduced academic performance [426]. Evidence for the influence of short-wave blue light on these diseases is limited and there is no evidence of the efficacy of protective devices [427,428].

4.5. Poverty and socioeconomic status

Socioeconomic status is an identifiable and well-reported societal factor contributing to the burden of ocular surface disease. There is a higher prevalence of a range of eye diseases in the homeless [429]. Neglected tropical diseases such as trachoma are highly prevalent in low and

middle-income countries and poorer individuals. The SAFE strategy (Surgery, Antibiotics, Facial Cleanliness and Environmental Improvement), proposed by the World Health Organization, includes many lifestyle modifications in endemic areas to eliminate trachoma. Several studies have demonstrated the efficiency of these strategies, however, the way of implementing them varies from study to study, as well as from region to region [417]. Several countries have developed intensive brigades, as well as prevention and control programs to target this disease. Implementing effective policies largely relies on targeting core groups and relevant societal factors in the remaining endemic areas, worldwide [430].

In addition to trachoma, fungal keratitis has a strong relationship with gross domestic product per capita of the region. A higher proportion of fungal keratitis compared with all infectious keratitis is strongly associated with low gross domestic product per capita [129]. Similarly, a low socioeconomic status and/or poverty are associated with a higher risk of infectious corneal blindness [64].

Evaluating and improving accessibility to ophthalmic diagnosis and treatment for all strata of society is important in improving treatable and preventable ocular surface diseases. Health economic analyses in ocular surface diseases are scarce, however, the great majority of them demonstrate interventions and treatments to be cost-effective [431]. Conceivably, the surge in uptake of telemedicine could prove to be a cost-minimizing alternative for screening and management of some ocular conditions [432], particularly for patients in remote areas or those lacking access to appropriate care.

4.6. Incarceration

Prison populations experience adverse health outcomes due to lack of access to services, delay in accessing appropriate care, limitations in nutrition and lack of awareness.

Health and eye health outcomes may be further compromised due to the overlay of other societal factors, including the overrepresentation of marginalized groups in prisons, low education, and poverty [433] and may be exacerbated in regions with low gross domestic product per capita. There are limited studies of ocular surface disease in prison populations. Ocular surface conditions that are over-represented in prison populations include allergic conjunctivitis, pterygia and xeropthalmia [434].

In a cross-sectional study in a Kenyan prison population, 24% of male prisoners had xerophthalmia [435].

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All references available here:

A summary of the "TFOS Lifestyle report: Impact of contact lenses on the ocular surface"

by **Dr. Sònia Travé Huarte**

Disclosure: The author of this article is not an author on the TFOS reports mentioned.

The Tear Film and Ocular Surface Society (TFOS) published earlier this year a series of reports, on various topics establishing the direct and indirect impacts that everyday lifestyle choices and challenges have on ocular surface health. Eight clinical topics (elective medications and procedures, contact lenses, lifestyle and societal challenges, environmental conditions, cosmetics, digital environment, and nutrition) were written by 158 experts from 38 countries around the world. An evidence quality report was also published with the aim of supporting the citations of reliable systematic reviews providing specialized and rigorous evidence-based approaches. These reports are now all available online, published on The Ocular Surface Journal.

This article provides a summary of the findings of the contact lens (CL) report. This report provided evidence in two areas; what practitioners, and patients can do to improve the CL wear. As an addition, this report has a systematic review on associations between lifestyle factors and soft CL dropout.

1. CL fitting choices (by practitioners) and its impact on the ocular surface.

1.1. Choice of CL and lens care solutions

The use of daily disposable CLs has several benefits over resuable CLs, such as lower rates of inflammatory-related complications, less solution-induced corneal staining, lower and reduced severity of inflammatory complications incidence and better visual outcomes following MK.

The incorporation of wetting agents on lens care solutions, such as hyaluronic acid, has been sugested for patients affected by contact lens discomfort and contact lens induced dry eye.

1.2. Frequency of replacement

It has been noted that in some instances eye care practitioners (ECPs) have encouraged the non-compliance of replacement. ECPs suggesting that two-weekly replacement means that they should be replaced after "14 wears of the lens", which for a part-time wearer could mean the lenses are replaced after several months. This behavior should be discouraged, as extending lens wear beyond the recommended timeframe can result in reduced comfort and vision.

2. Lifestyle choices (by patients) and its impact on CL wear and its success.

2.1. Supply chain

Some risky behviours such as getting CLs form unknown sources, such as online, unregulated outlets/supply chains, ill-fitting over the counter "party/ novelty" CL, and avoiding eye care practitioners test/fitting, is a risk that has a close impact on the end user. No wear care is provided, and variable quality of CL materials could lead to CL-related problems. The education and regular CL assessment by eye care practitioners is paramount for a sucessful and comfortable CL wear.

2.2. Health & ageing factors

There have been many beneficial indications for medical CL, such as: painrelief, accelerating re-epithelization, corneal healing, mechanical protection of the cornea, visual improvement, and facilitating binocularity. In cases where allergies are present, the TFOS report states that CLs can be used as they may have a protective mechanism, and even, in some new cases be used as vehicles to transport and deliver anti-allergy medication. Some systemic diseases with ocular manifestations and its medication can complicate the CL wear due to discomfort or lack of fitting, resulting in discomfort.

Interestigly enough, CL-associated risks were not exhacerbated by COVID-19, but external factors such as ill-fitted masks, extended screen usage and the use of hang sanitizer could impact CL performance and the ocular surface. Despite this, if a patient gets an infection, it is still better to cease the wear of CLs.

In terms of ageing, it is noted in the literature that young kids are very sucessful and have less complications than adults. Dry eye disease and Meibomian gland dysfunction tends to increase as we age, which also tends to have a negative impact on CL comfort and sometimes in vision.

2.3. Environmental factors

Some environmental factors have a negative impact on the clinical performance of CLs. Low humidity, high altitude, pollution, wind, dust, and fumes can all change the behaviour of the lens on the eye and the surface of the eye itself. Decreasing air temperature and relative humidity, results in a less stable and thinner pre-lens tear film, which increases its evaporation leading to increased dryness. Occupation, sports & recreation

When CLs are used in the presence of chemical fumes, vapours, aerosol droplets, and make-up, this poses a problematic such as a possible foreign body sensation. When working in front of digital devices, the ocular surface environment is also compromised due to a reduction in blinking frequency and amplitude which is associated with visual complaints, eye strain, dry eyes, burning, irritation and blurry vision.

The use of CL for sports or recreational, can have some impact under specific conditions. Due to the constant moving and of sports, CL are often preferred to spectacles because of comfort and convenience, helping avoid peripheral vision restriction of peripheral vision. Other types of CLs, such as orthokeratology, could be more useful in water sports as they pose some unique challenges. Altitude can result in reduced CL performance as well, due to the dry environment and low humidity, eventhough CLs have been reported to be worn safely when mountaineering and in space.

2.4. Non-compliant & risky behaviours

The single largest risk factor that can lead to CL-related adverse events has been proven to be sleeping in contact lenses, this can lead to non-infectious infiltrative keratitis, corneal ulcers, infections, and microbial keratitis (MK).

The non-adherence of stipulated replacements schedules (overwearing of daily disposable lenses, or lack of replacement) and maintenance protocols, negatively impacts the performance of CLs. It is also known that 99% of CL wearers have had, at some point of their CL journey, or will have, a risky behaviour. Patient personalities should be also considered as higher risk-taking personalities have been asscoiated with poorer CL compliance.

Re-using or using expired cleaning products, continuous topping off contact lens solutions, and a poor case storage, increase the risk of corenal adverse events from 2.25-3.7 times.

Some other high-risk activities are the contact of water to CL and resuming wear too soon after ophthalmic surgery, which increases the risk of ocular surface complications and dry eye disease.

Other known risky behaviours are the use of tobacco, marijuana, electronic cigarettes (vaping), or being under the influence of drugs and excessive alcohol intake. Those behaviours are linked to increased corneal staining, rates of inflammatory and infective complications, and CL reduced clinical performance.

2.5. Potential future uses of CL

The use of future CLs as a medical tool, could help in various ways. By using biomarkers to detect and/ or monitor biochemical or biophysical changes in tear fluid, ocular surface temperature, intraocular pressure and/or pH value, or by being used as a vehicle to deliver drugs directly onto the eye.

2.6. Impact of stress, depression, and physical inactivity

Direct impact has been noted in the literature between dry eye disease and greater levels of stress and depression, but there hasnot been a direct report on the impact of stress, depression, or physical inactivity on CL wear. One could think that given the known link between DED and reduced CL comfort, then it could be plausible that there could be a link, but evidence has not demonstrated this so far.

2.7. Impact of CL on 'quality of life'

It has been noted that patients with a superior quality of vision and comfort provided by CLs lead to increased patient satisfaction and improved quality of life. Resulting even in better quality of life results than glasses.

2.8. Impact of CL wear on the environment

There is an increased use of daily disposable CL, due to cost, ease, safety, and decreased risk of corneal events. Due to this, more lenses and blister-packs are used and discarded. CL industries are taken steps towards end-of-life options for CL, moving to more environmentally friendly disposal and recycling options.

Eye care practitioners play an important role in informing patients about proper disposal and recycling options available locally for CL and care products.

At the end of this report, there is a very useful diagram on strategies on how to manage CL discomfort. Starting with the assessment and identification of factors that can led to poor CL success on all aspects (lifestyle, environment/ health and CL related factors), followed by advice on either patient interventions or actively treating the ocular surface, and ending up on the re-assessment of sucessful/unsucessful CL wear, and closing the circle by repeating the process if the patient is not able to wear the CLs comfortably at that stage.

3. The systematic review: “Associations between lifestyle factors and soft CL dropout”

With over 140 million people wearing CLs and 86% of all lens fits being for soft CLs, this review aimed to understand which behavioral and environmental factors were associated to soft CL discontinuation.

For this report, 34 studies (15 andomised control trials – RCT - and 19 cohort studies) met the pre-specified eligibility criteria and were included (published 1988-2021).

The outcome measure was to understand the CL dropout, defined as permanent cessation of contact lens use for any reason and at any time point, and the meta-analysies were performed using Cochrane Review Manager.

Very few of the 34 eligible studies reported on the study participant behaviors or environmental exposures associated with CL dropout.

Overall, the most reported reason for dropout was CL discomfort (9/34 studies), and vision - presbyopes fitted with multifocal Cls - (6/8studies). Particpiants using CLs for vision correction were found to be twice as likely to discontinue its use compared to participants wearing spectacles.

After careful literature discussion, this report stated that there is a clear need for research to specifically examine the lifestyle factors associated with soft CL dropout, in all; type of lens design, age and lens modality.

As a conclusion, this whole report stated...

- Patients with ocular allergies can wear CLs, they may provide a physical barrier to exposure of allergens, and they could be given as a vehicle for drug delivery such as anti-allergy medications.
- The use of ill-fitted masks and the inadvertent introduction of hand sanitizers into the eye is a potential risk for CL success. CLs use should be ceased during systemic infections.
- Some systemic diseases with ocular surface manifestations can complicate successful CL wear.
- Consideration of atmospheric factors, work and physical environment can negatively impact vision and comfort of CL. Therefore, practitioners should advise which type of lens and care system would be the most appropriate.
- Several inflammatory and infective complications in lens wearers have been reported when wearers smoke tobacco, marijuana, or electronic cigarettes (vaping), or while under the influence of drugs and excessive alcohol intake.
- Superior quality of vision and comfort provided by CL leads to increased patient satisfaction and improved quality of life.
- The increased use of daily disposable lenses provides advantages over reusable CLs.
- Known risk factors for discontinuation of CL use are; discomfort, lens handling difficulties, and vision issues, but lack of high-quality evidence is noted in areas such as:
  - CL use during upper respiratory tract infections.
  - CL success whilst there is ocular surface disease.
  - CL performance whilst there are mental health issues such as stress and depression.
  - Purchasing CL through unregulated outlets and avoiding frequent follow-up care carries increased risk of CL-related problems.

Giving the eye care stars of the future the chance to shine

by **Brian Tompkins** and **Dr Keyur Patel**, TK&S Optometrists

There's a lot of talk about the future of eye care and the opportunities that advances in technology will offer, but while emerging automation and AI systems will undoubtedly have a role to play, we shouldn't fall into the trap of simply thinking the robots are taking over.

There will always be a place for the eye care professional and investing in people, as well as technology, is vital for the continued evolution of practices as we adapt to new ways of working in the years to come.

Our clinical team here in the practice have around 100 years of combined experience. That extensive knowledge – built up over decades of treating patients, learning from peers, attending conferences and sharing best practice with contemporaries – stands us in good stead to deal with almost conceivable circumstance we find ourselves confronted with, but we would never claim to know it all.

With new technologies come new ways of doing things and, while these particular old dogs love learning new tricks, there are undoubtedly times when a fresh pair of eyes can shed new light on a situation and come up with a solution that we perhaps didn't even know existed.

As a profession, optometry is fortunate to benefit from a number of exceptional university courses which supply a ready-made pipeline of ambitious students ready to kickstart their careers.

These courses are often led by experienced eye care veterans who combine academic research with 'real-world' knowledge to produce the next generation of opticians and optometrists.

It makes sense to tap into this emerging talent pool and give these students a chance to shine and this summer we have made a concerted effort to provide a number of young people with the opportunity to put their learning into practice in a real-world setting.

By spending time with us here at TK&S they can experience first-hand what it is like to work as part of a team and award-winning independent practice.

It gives them exposure to patients, picking up invaluable tips on how to speak to people, how to read body language, how to react to the ever-changing pattern of the working day. It gives them an insight into real-life optometry, rather than classroom-based theory.

It also gives us the opportunity to see what the next generation of potential recruits are learning and the areas in which they are interested in developing further.

Five BCLA student ambassadors have spent time at our Northampton practice this summer, sitting in on eye examinations, carrying out tasks to help the clinical team and getting hands-on with state-of-the-art technology in our diagnostics suite.

Palak Kapadia and Habeeb Rahman were the first two students to grasp the opportunity and were followed by Sarah Campos, Nouralhuda Idriss and Bonnie Ki Yan Lam. Cardiff University student Deepika Khali also joined us for a two-day placement after she won a raffle prize offering the opportunity at her course's 'Eye Ball' gala dinner.

What we have seen and heard from all of them is hugely encouraging.

The passion for patient care is evident and there is a genuine hunger for learning. But what has really stood out is the level of interest in specialist areas such as scleral lens fitting, dry eye, ortho-k and myopia management.

For many eye care professionals these are seen as emerging areas of treatment but for our students they are embedded from day one as a vital part of their toolkit.

That paves the way for a new generation of eye care professionals who go the extra mile from the very beginning of their careers, who are already looking at advanced treatment pathways and who are displaying an aptitude for clinical excellence.

Habeeb, aged 21 and a student at Bradford, said: "I've enjoyed the chance to shadow the scleral lens and binocular vision clinics. They are something we touch on at University and that side of things really interests me. Scleral lenses are gaining a lot of traction at the minute and that is a fast-growing side of the profession so may be something I look to specialise in eventually."

Palak, aged 19 and a student at Cardiff, said: “This is my first time working in a UK practice. I am from Kenya originally and things are very different over here, there is so much more technology available and I have learnt so much, particularly the way Brian talks to patients and makes it all about them – everyone is treated as an individual with their own particular needs.”

During her visit to TK&S, Deepika had the chance to sit in on eye examinations, contact lens appointments and specialist binocular vision clinics.

She said: “I feel really lucky because it has given me an opportunity to learn from the best people in optics who I’ve been following on Instagram for a very long time.

“Having the chance to learn about fitting scleral lenses, complicated refractions, binocular vision and myopia management has been a real eye-opener.

“Working in an independent practice feels very cosy, in the sense that anyone that walks through the door you’ve known them for a while, you’re on first name terms, so it feels a lot more intimate.

“I would definitely consider a career in an independent practice in the future because you are exposed to a lot more equipment, a lot more techniques and a lot more knowledge. You get to spend a lot of time with the patient to get to know what they want.”

We always hope to instil passion, dedication and real heart into the students that we have here. We want every student that comes through our door to think differently and do things differently.

Giving them the chance to experience life in practice is a crucial part of their development and ultimately leads to better treatment of patients. Students get to look at pioneering techniques and they start to realise that investment in technology is an investment in patient health.

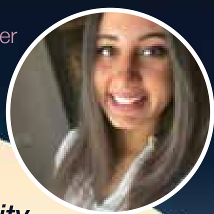
They pick up invaluable experience that will stand them in good stead for third year at university and allows them to benefit from as much ‘real-world’ experience as possible ahead of their pre-reg year.

Students coming through now have a higher-level education than we ever did. They are learning techniques we have had to learn on the go and they will become second nature to them.

Optometry is in good hands and it has been our pleasure to give the stars of the future the chance to shine.

OSI Symposium Testimonial

Nevien Lotfy Abdelkader

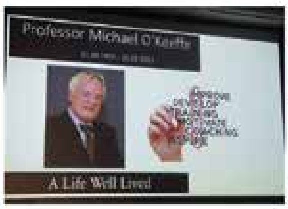


“I had the absolute pleasure of attending the OSI symposium and dry eye masterclass, and as someone who is deeply focused on the Cornea, it was a golden opportunity to enrich my knowledge in so many aspects.

What set this two-day symposium apart was the outstanding presentations from numerous eminent speakers, who conveyed their expertise through real-life clinical experiences that cannot be found in literature.

The Dry Eye Masterclass was comprised of 7 workshops, which provided a hands-on experience that enabled participants to witness the hows and know-tos for themselves. The open discussions that followed were particularly useful, leading to productive and interactive sessions.

In summary, my experience was incredibly fruitful, diverse, and friendly to young ophthalmologists.”



A bright future for Optometry

by **Dr. Trusit Dave**, PhD, BSc(Hons), MCOptom, FAAO, Dip(IP)

The landscape of optometry is changing. A growing number of Optometrists are specialising in Glaucoma, Medical retina and can prescribe topical and oral therapeutics for the treatment of eye disease. Furthermore, consumers are increasingly turning to internet purchase of products such as contact lenses and glasses. Increased waiting times for non-urgent conditions and follow-ups means that there is a real opportunity for skilled Optometrists to grow their practices by providing fee-based services such as dry eye.

That said, the main reason why I decided to invest and upskill in dry eye was because of my personal interest in dry eye and the anterior segment. Passion and genuine interest should be the key motivators to specialise. If you find yourself reading the latest research on dry eye then this is a highly rewarding specialty on several counts. Firstly, it requires a broad knowledge of several disciplines. For example, dry eye management requires a understanding of immunology, pharmacology, pain management as well as good diagnostic and communication skills and an understanding of the sensory nervous system to appreciate the disparity between signs and pain. Most importantly, there are many patients desperately in need of better management that superior to conventional remedies such as ocular lubricants and warm compresses.

Research shows that the impact of highly symptomatic dry eye disease in terms of physical and mental quality of life is on a par with serious eye conditions like macular degeneration. When compared to other non-ocular conditions, physical quality of life is comparable to IBS and COPD whilst mental quality of life is impacted more than Rheumatoid arthritis, Obstructive sleep apnoea and Fibromyalgia (Morthen et al, 2021).

Dry eye disease is also highly prevalent, with approximately 25% of the over 50s population having symptoms of dry eye (Stapleton et al, 2017). Clinically, I am also finding younger patients attending my practice, this is undoubtedly related to the changing environments related to increased screen time.

I invested in an IPL machine almost five years ago. It was a significant investment for the practice, but it was clear after reading many peer-reviewed studies that IPL tackled the management of evaporative dry eye related to MGD from several angles to reduce inflammation and realign the immune system to something more physiological. The treatments are not difficult but there is a steep learning curve when comes to understanding the whole patient, co-morbidities ane knowing when to treat and not to treat. Most importantly, it is about having multiple options in your armamentarium so that you are able to offer a full-scope dry eye service that includes therapeutics, IPL, probing and Demodex management.

As part of our standard eye examinations, we ask triaging questions and then perform basic tests to identify symptoms and basic signs of dry eye then recommend a more in-depth dry eye consultation, which is chargeable. A dedicated dry eye consultation allows me to assess the presence of any relationship between systemic disease and dry eye as well as understand relationships between medications. Furthermore, the actual dry eye assessment involves more detailed investigations such as meibography, non-invasive tear break-up time, MMP9 and tear osmolarity measurement. In all cases it is important to assess the level of discomfort/pain in relation to signs and be aware of neuropathic versus nociceptive pain. Once completed, I spend quite a bit of time providing detailed explanations and an individualised treatment plan.

My investment in IPL technology has allowed me to successfully treat MGD, with most patients experiencing an improvement in symptoms, a reduction in their dependency on ocular lubricants, improvement in tear film stability and reduction in ocular staining. It has allowed improved the quality life for many patients and I find this incredibly rewarding.

Other areas of specialism I see for Optometrists include glaucoma. It's a life-long eye condition that can be effectively treated by Optometrists if they have the right equipment, specialist qualifications and mentoring. With the significant burden on the NHS – particularly for follow-up glaucoma appointments, glaucoma management is another opportunity to extend Optometrists' scope of practice.

In essence, there is a bright future for skilled Optometrists with higher clinical qualifications. In the UK we are fortunate that Optometrists and Ophthalmologists work together. I strongly advocate that Optometrists interested in specialising proactively reach-out to our Ophthalmologists and Specialist Optometrists to build relationships (networks?) and utilise their significant expertise to learn and collaborate.

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