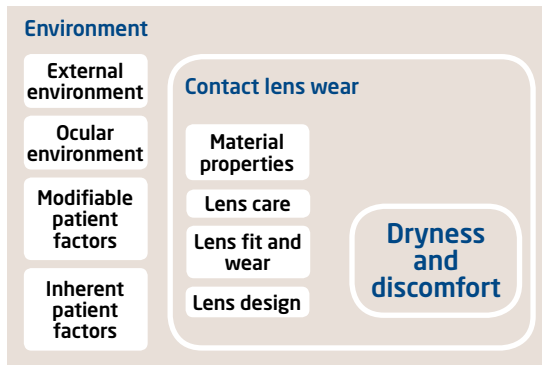


# The current state of soft contact lens comfort

Contact lens comfort is a complex and timely topic given the recent publication of the TFOS International Workshop on Contact Lens Discomfort. **Dr Robin Chalmers** reviews the latest research into soft contact lens-related dryness, the most important hurdle to satisfactory wear

**T**he past few years have seen important developments in the contact lens field designed to improve the comfort of soft contact lenses (SCLs). Comfort is a key feature of contact lens wear for patients and discomfort is the primary reason for discontinuation.<sup>1,2</sup> In fact, as many wearers discontinue each year as are newly fitted with lenses,<sup>3</sup> hindering growth in the wearer base.

Symptoms with SCL wear differ from those without lens wear in that dryness presents as a more important symptom.<sup>4</sup> Since findings from dry eye disease are difficult to apply to SCL-related dryness and discomfort, the Tear Film and Ocular Surface Society (TFOS) addressed the issue in an International Workshop on Contact Lens Discomfort (see panel below).<sup>5</sup> The workshop has recently published its report which identifies areas of consensus and controversy.



Contact lens comfort is, therefore, especially topical at the present time.

### What is contact lens comfort?

This review describes studies that focus on SCL-related dryness symptoms as a surrogate for discomfort. Chronic SCL-related dryness and discomfort must be differentiated from mechanical discomfort a patient may experience during adaptation, or burning and

stinging that may be associated with lens care products on insertion.

Previous reviews were published before a number of innovations became available and new usage patterns emerged.<sup>3,6</sup> Silicone hydrogels (SiHs) were introduced in the late 1990s, primarily to reduce complications related to hypoxia and allow patients to wear lenses continuously for 30 nights. Daily wear, with occasional overnight use, is now more often recommended.

An unexpected finding was that those SiHs also consistently delivered lower levels of dryness symptoms to subjects newly fitted with the lenses,<sup>7-10</sup> and longer hours of comfortable wear than earlier hydrogels.<sup>7</sup> One initial theory was that high oxygen levels alone improve wearer comfort late in the day, although no sensory or physiological mechanism for this phenomenon has been established.<sup>11-13</sup>

This review provides an overview of recent research into dryness symptoms in SCL wearers, and associated modifiable and non-modifiable factors (Figure 1). Clinical management strategies are suggested (Figure 2). Remember that ocular discomfort and dryness are not solely the preserve of the contact lens wearer; these symptoms are also experienced by spectacle wearers and those without vision correction.

### How can we assess comfort?

Researchers have recently validated questionnaires to measure changes in symptoms over time and symptom differences between lenses.<sup>14-17</sup> Clinical signs that relate to SCL-related dryness have also been identified, such as lid wiper epitheliopathy (LWE)<sup>18</sup> and lid parallel conjunctival folds (LIPCOF).<sup>19</sup> These signs are being studied to determine their relationship to ocular surface mucins,<sup>20,21</sup> friction

**Figure 1**  
Factors involved in dryness and discomfort

### THE TFOS WORKSHOP

The Tear Film and Ocular Surface Society published the findings of its International Workshop on Contact Lens Discomfort Report in a special issue of *Investigative Ophthalmology and Visual Science* (October 2013). The aims of the workshop were to:

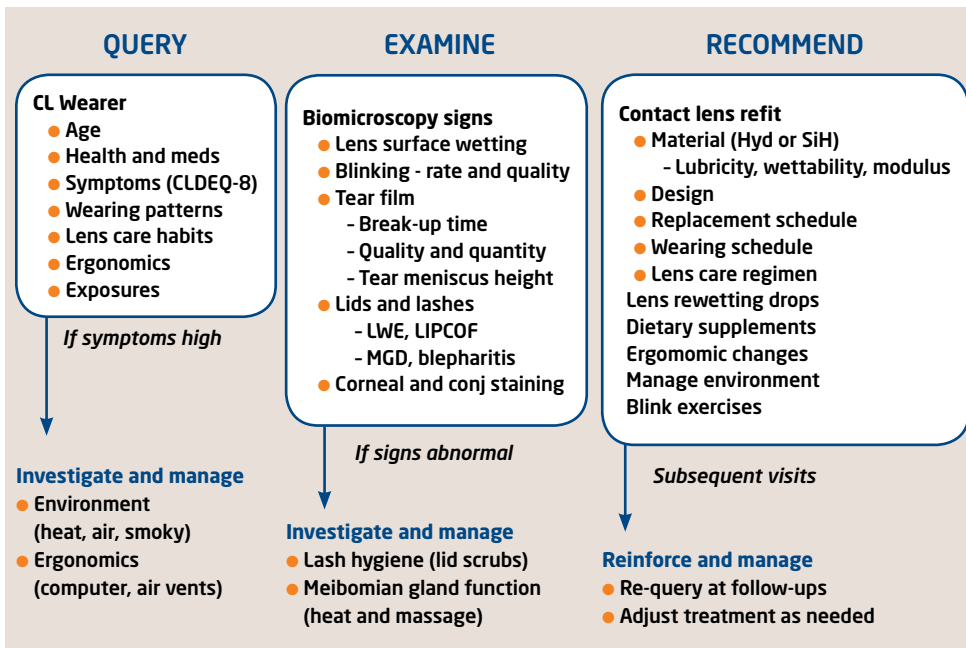
- Conduct an evidence-based evaluation of contact lens discomfort (CLD) in health and disease
- Develop a contemporary understanding of the definition, classification, epidemiology, and neurobiology of CLD
- Examine the role of lens materials, design, and care in the aetiology of CLD
- Assess biocompatibility of contact lenses with the tear film and ocular surface
- Develop appropriate norms of trial design, including outcome measures
- Develop recommendations for the management and therapy of CLD.

The workshop has provided a new definition of CLD:

‘CLD is a condition characterised by episodic or persistent adverse ocular sensations related to lens wear, either with or without visual disturbance, resulting from reduced compatibility between the contact lens and the ocular environment, which can lead to decreased wearing time and discontinuation of contact lens wear.’

The workshop also provides a global consensus on many aspects of CLD, and a framework for future studies and clinical activities. While describing what we do currently know, it also highlights there is still more for the contact lens industry and researchers to fully understand.

For the full report go to: [www.iovs.org](http://www.iovs.org) or [www.tfos.org](http://www.tfos.org)



**Figure 2** Clinical management of contact lens-related comfort

on the ocular surface, and symptoms in SCL wearers.<sup>22,23</sup>

Material scientists have adapted existing lens materials or engineered new lens surfaces to reduce friction by increasing surface lubricity. Methods include surface modifications, addition and slow elution of wetting agents from the material, and inclusion of internal wetting agents that are not released.<sup>24-29</sup>

Even though many SCL wearers experience discomfort and dryness, the proportion who self-assess as having dry eye exceeds the proportion who have a previous dry eye diagnosis.<sup>4</sup> Patient history-taking varies from practice to practice, and between practitioners, and often lacks key information. Until recently, even researchers had no validated tools to assess ocular surface symptoms in SCL wearers.

Adding a short questionnaire to the pre-exam history would increase the clinician's ability to discover whether the patient has symptoms similar to satisfied or struggling wearers.<sup>14</sup> One important feature is that SCL wear seems to be associated with an increase in dryness and worsening symptoms during the day. Probing dryness and discomfort late in the day is the most efficient way to elicit symptoms that affect the success and continuation of lens wear.<sup>2</sup>

Recently a short version of the Contact Lens Dry Eye Questionnaire (CLDEQ-8) was validated across patients with a wide range of experiences with their habitual SCLs.<sup>14</sup> Mobile technologies have also

been used to follow patients in real time and assess symptoms throughout the day.<sup>30,31</sup> One study queried ocular surface comfort by pre-scheduled text messaging and found that comfort deteriorates during the day for many types of contact lens wearers.<sup>30</sup> Blackberry devices and smartphones can be used to remotely capture subjective data in clinical trials.<sup>9,31,32</sup>

### Which patients are most susceptible to discomfort?

#### Gender and age

Ideally, satisfied young SCL wearers would successfully wear contact lenses as their primary form of vision correction for decades if they so desired. The main challenge to long-term use comes from a decrease in overall comfort over years of wear.

Investigating symptom patterns in large populations of SCL wearers outside clinical trials characterises the most prevalent and severe symptoms and reveals risk factors.<sup>2,4,31-34</sup> Although age and female gender are important non-modifiable factors for dry eye in non-lens wearers, they have a much smaller role among SCL wearers. In most studies men and women wearers have similar dryness symptoms,<sup>4</sup> but men are more likely to report discontinuation of lens wear.<sup>2</sup>

Young SCL wearers aged eight to 14 have a much lower incidence of lens-related dry eye than adult wearers (4.3 vs 56.2 per cent).<sup>35</sup> Most epidemiology studies show a strong correlation between dry eye prevalence in non-lens wearers

and increasing age, especially when geriatric patients are included.<sup>36-39</sup> Among adults, age correlates to frequency and late-day intensity of dryness very differently in lens wearers and non-wearers. Increased age in hydrogel wearers aged 18 to 39 was associated with increasing frequency of lens-related dryness symptoms, previous dry eye diagnosis, and with patients considering discontinuing wear.<sup>40</sup>

Among SiH wearers, reports of dryness and considering discontinuation were significantly lower and were not associated with age. Lens material had an important bearing on symptoms and overall long-term success. Reports of fewer symptoms after refitting with modern SiH lenses,<sup>7,9,10,16</sup> are even more compelling because subjects who were SiH wearers on entering the study of young adults<sup>40</sup> were more likely to report a prior dry eye diagnosis.

#### General health and medication

There is little research on the impact of SCL wearers' general health on comfort during wear. However, many drugs for systemic health conditions can increase ocular symptoms in non-wearers and may play a role in symptoms in SCL wearers.<sup>36,41</sup> Corneal physiology in diabetic patients may impact safety during contact lens wear, but ocular symptoms were not addressed.<sup>42</sup>

### How do symptomatic wearers differ from asymptomatic wearers?

Symptomatic SCL wearers differ from asymptomatic wearers in more ways than just their number of complaints; for example, they have a larger decrement in comfort and increase in dryness during the day.<sup>43</sup> Even after six hours' wear, symptomatic wearers had less stable tears, lower tear flow and lower tear supply.<sup>44</sup> Other factors associated with lens-related dryness are female gender, frequent use of over-the-counter pain medications, high water content hydrogel lenses, low pre-lens break-up time and increased tear osmolality.<sup>45</sup>

In one study, symptomatic SCL wearers were 6.5 times more likely to report dryness in the absence of contact lenses, but reported only a slight increase in use of artificial tears or rewetting drops. These patients were less satisfied with lens wear overall, had reduced daily wearing time and were less likely to be able to



wear lenses as long as they desired.<sup>46</sup>

Another study identified 31 per cent of SCL wearers with dryness that was frequent to constant and intense late in the day.<sup>47</sup> Wearers who reported dryness did not differ from less symptomatic patients by gender, lens material or care product. They were more likely to have shorter comfortable wearing times and higher symptoms overall. Although 47 per cent of the SCL wearers self-assessed as having dry eye, only 38 per cent had been previously diagnosed with dry eye. Detailed clinical examination of subjects reporting CL-related dryness found nearly a quarter had no significant clinical signs of dryness.<sup>48</sup>

### How can we predict which patients will be uncomfortable?

LIPCOF and LWE both have predictive value to indicate which wearers report symptoms with habitual SCLs.<sup>22</sup> LIPCOF is observed on the bulbar conjunctiva at 4 and 8 o'clock and appears as loose folds adjacent to the lower lid in primary gaze (Figure 3). LWE appears as a line of lissamine green or fluorescein staining along the upper and lower lid margins (Figure 4)<sup>18</sup> and is more prevalent in established symptomatic SCL and dry eye sufferers without lens wear. Whether LIPCOF or LWE can be reversed has not been established and has important bearing on their use as outcome measures.

### Is health a factor in comfort?

Patients with poor general health or with severe forms of dry eye often self-select out of wearing contact lenses. Contact lens wearers should have a healthy ocular surface in order to support lens wear and avoid serious complications. However, many wearers with milder concomitant conditions such as blepharitis or meibomian gland dropout report higher rates of dryness than wearers without those conditions.<sup>48</sup>

Contact lens wear is not mentioned in the classification of meibomian gland dysfunction (MGD).<sup>49</sup> However, recent studies showed morphologic changes to the glands and lower expression of meibum in patients who had worn contact lenses for more than a year, and duration of lens wear drives changes in meibomian gland anatomy.<sup>50-52</sup> These changes likely play a role in symptoms of dryness in many SCL wearers.

A patient's health may require use of systemic medication that can decrease tear production and increase

dryness symptoms in the nose, mouth and eyes. Examples include blood-pressure medications, anti-depressants and antihistamines. Many lens wearers have seasonal allergies they self-manage with topical or oral antihistamines. High prevalence of allergy makes antihistamines among the most frequently used medications, but patients may not report their use to their eye care practitioner since treatments are available over the counter without prescription.

Two daily disposable contact lens brands (etafilcon A and nelfilcon A) have FDA-cleared claims for improved comfort for many patients who experience mild discomfort and itching associated with allergies.<sup>53,54</sup> With use of a fresh lens each day, build-up of deposits and surface allergens is reduced.

### Does changing lens design or material help?

Contact lens manufacturers have researched the effects of lens properties such as modulus (stiffness), surface lubricity, movement, thickness, and edge design on SCL comfort. Recently a study compared edge designs, conjunctival staining and lens comfort in marketed lens brands, albeit with differing material properties.<sup>55</sup> A thin, tapered edge was most comfortable and a round edge least comfortable, with the former associated with more, although clinically insignificant, conjunctival staining than the other designs. Overall physical properties (lens shape, surface, modulus, edge design etc) are likely to be inter-related and must be manipulated as a whole to achieve good comfort.

SCL-related dryness has also been studied by refitting either satisfied or struggling SCL wearers with new SiH materials.<sup>7-10</sup> Note that these studies rarely include a group that has no change in treatment as a control, hindering interpretation of the results. New hydrogel options designed to alleviate dryness are now available, and many patients continue to wear hydrogels; this suggests that acceptance is patient dependent. Few studies to date have involved refitting patients from SiH lenses to hydrogels.

One analysis compared symptoms in previous hydrogel lens wearers and age-matched non-wearers. Symptoms in the hydrogel lens wearers were then compared with those of SiH wearers after entering clinical trials. Dryness during the day and at the end of the day was reported half as often



Figure 3 Lid parallel conjunctival folds



Figure 4 Lid wiper epitheliopathy

after refitting with the SiH lenses.<sup>10</sup> Reduction of dryness symptoms after refitting with SiH lenses was stable over three years of follow-up.<sup>56</sup> Dryness (at least 'sometimes' and 'moderate' in intensity) one week after refitting was associated with future discontinuation.

A large prevalence study among SCL wearers found that 52 per cent had some criteria that classified them as problem patients, the most prevalent being two hours' uncomfortable wear a day followed by reports of frequent to constant dryness; again, very few subjects had ocular signs.<sup>8</sup> Among a subset of problem patients refitted with senofilcon A SiHs, at least three-quarters had less dryness, better comfort or fewer hours of uncomfortable wear, and a reduction in clinical signs. Objective and subjective responses improved after refitting long-term successful wearers of hydrogel lenses with SiHs.<sup>7</sup> Compliance with two-weekly or one-monthly replacement schedules with SiHs can improve comfort and vision throughout the lifetime of the lenses.<sup>57</sup>

In a large-scale analysis of SCL wearers as they entered clinical trials, 12.2 per cent reported having 'sensitive eyes'.<sup>58</sup> These subjects reported significantly higher levels of dryness, irritation and redness than those with 'non-sensitive' eyes but





no differences in clinical signs. They were then randomly refitted with senofilcon A lenses or other SCLs (lotrafilcon B, omafilcon A, balafilcon A). With senofilcon A, subjects reported lower dryness, irritation and redness, and longer comfortable wearing times.

### Is comfort better with daily disposable lenses?

If lens deposits on reusable SCLs have any influence on the sensation of contact lens-related dryness, switching to daily disposable (DD) contact lenses could help.<sup>59</sup> Total protein and total lysozyme was shown to increase during a one-day study, but the proportion of active lysozyme decreased slightly and with no difference between symptomatic and asymptomatic subjects. However, the amount of active lysozyme correlated with comfort and dryness after even two hours' wear.

Several studies refitted wearers of reusable SCLs with DDs.<sup>60-63</sup> A contralateral comparison of two brands of DD over 10 days' wear found that 60 per cent of patients selected omafilcon A lenses for end of day comfort and for overall preference yet 20 per cent did not discern a difference between the lenses.<sup>60</sup> A larger randomised trial compared comfort after refitting SCL wearers with either etafilcon A or nelfilcon A DDs.<sup>61</sup> After one week, the etafilcon A group reported better comfort, and longer comfortable and overall wearing times.

Another study enrolled subjects who were symptomatic with daily wear hydrogel and SiH lenses replaced every two or four weeks and refitted them with a DD lens material that elutes non-cross-linked polyvinyl alcohol during wear (nelfilcon A).<sup>62</sup> Frequency of dryness symptoms was reduced in 54 per cent of patients and 40 per cent had less severe dryness.

Few studies have looked at lens comfort with SiH DD lenses. However, a trial that involved fitting new wearers with DDs found that ocular symptoms with narafilcon A lenses were no different from symptoms among non-wearers. Symptoms improved over the first month of wear, the point at which they ceased to show a decline in comfort during the wearing day.<sup>63</sup> The only sign that differed between wearers and non-wearers was low level conjunctival staining; limbal redness, corneal staining and other signs were similar with narafilcon A lenses to no lens wear at one year.

One unique aspect of DD use is that patients are exposed every day to the solution in the blister pack and to an unworn, clean lens surface. The surface qualities of the unworn DD lens material as it leaves the packaging may influence on-eye wettability after the patient begins to wear the lenses.<sup>64</sup> Practitioners have many DDs to choose from to find a lens that is compatible with the patient's tear film and maintains good wettability throughout the day.

### Do recent enhancements to lenses designed to improve comfort work?

There have been many attempts to re-engineer lens materials or develop novel materials that ameliorate dryness symptoms.<sup>24-29,65</sup> Moisture strategies incorporated in current lenses include the elution of polyvinyl alcohol (PVA) from the lens bulk,<sup>24</sup> or adding polyvinylpyrrolidone (PVP) or hyaluronic acid (HA) to the material<sup>28</sup> to increase lubricity. Future strategies may involve controlled release of high molecular weight HA from the lens bulk by biomimetic imprinting of the lens material.<sup>26</sup>

New techniques have also been developed to measure coefficient of friction (lubricity) by incorporating the physiological environment in which the lens functions on the ocular surface into the model.<sup>27</sup> Refinements in laboratory techniques will hopefully add to the predictive value of these *in vitro* tests as they relate to ocular signs of friction (contact lens papillary conjunctivitis and LWE), and result in more lubricious or biocompatible materials and care systems.

Compared to wearers of spherical SCLs, toric lens wearers report more

frequent and intense discomfort and dryness.<sup>16</sup> The reason for this is currently unknown, although toric wearers may experience faster front surface drying as lenses are rotationally stable, or interaction of the lids with certain stabilisation zones might be misinterpreted by patients as dryness. Choosing materials that minimise symptoms may be critical in astigmatic patients with borderline dryness.

### Can contact lens care product influence comfort?

Disinfection systems and their potential interactions with SiH lenses have come under scrutiny. The original focus was on transient, superficial, corneal fluorescein staining observed after short-term acute exposures to certain lens/lens care combinations.<sup>66</sup> Attention has now turned to the effect of care products on patient comfort and the interaction between solutions, materials and ocular signs.<sup>67</sup>

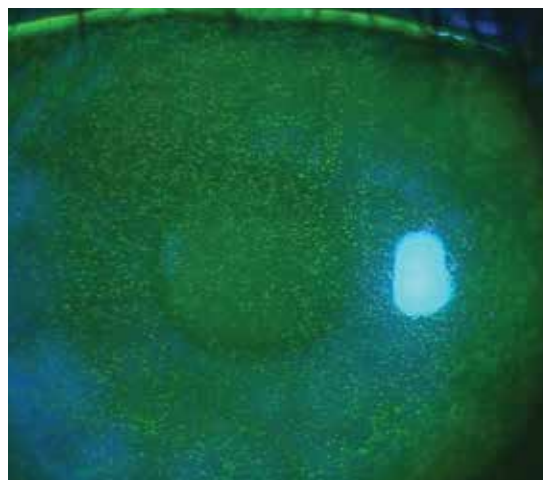
#### Short-term exposure

In a six-hour study using pre-soaked unworn lotrafilcon B and galyfilcon A lenses, a Polyquad/Aldox multi-purpose solution (MPS) was associated with lower comfort, and more burning, stinging and lens awareness than a polyhexanide (PHMB) preserved system.<sup>67</sup> The two systems showed distinct patterns for the time course of solution-induced corneal staining (SICS, Figure 5). Both showed low amounts of SICS but the level was higher with the PHMB system. Thus, signs and symptoms did not appear to be correlated. Another study found staining varied by SiH after one day's wear and an overnight soak in different care systems, but there was no difference between solutions for staining or symptoms.<sup>68</sup>

#### Routine patient use

One small study compared the clinical performance of a one-step hydrogen peroxide system versus a Polyquad/Aldox solution with two SiHs, lotrafilcon B and senofilcon A.<sup>69</sup> After one month with each system there were no differences in clinical variables but subjects reported longer comfortable wearing times when using the peroxide system with either material.

One month's use of a Polyquad/Aldox solution with habitual brands of lenses resulted in better comfort (on insertion and end of the day)



**Figure 5** Solution-induced corneal staining (with kind permission of Gary Andrasko)



and greater overall satisfaction than with PHMB-preserved systems.<sup>70</sup> Comparing ocular comfort, vision and SICS over three months' use of 24 combinations of SiH brands and disinfection systems, patients with SICS had poorer comfort during and at the end of the day than patients with no SICS.<sup>71</sup>

Researchers compared subjective responses with SiH lens/solution combinations known from previous studies to provide the best and the worst end of day comfort.<sup>72</sup> Ocular comfort, dryness and lens awareness in symptomatic wearers could be perceptibly improved by switching to an alternative combination. No significant differences were found in non-symptomatic subjects.

Incorporating a rub and rinse step may influence comfort. A dispensing study using three care systems with galyfilcon A lenses found that in the small number of subjects who developed significant levels of lens deposits the rub step did reduce deposition.<sup>73</sup> Other authors suggest rubbing and rinsing lenses with MPS before disinfection could help many patients achieve better comfort.<sup>74</sup>

New formulations aimed at enhancing comfort have also been investigated. One system containing a surfactant and a di-block copolymer to improve surface wetting was compared to a PHMB-preserved system.<sup>75</sup> The new formulation resulted in better comfort and other symptoms, and lower corneal staining severity and area. A separate study looked at the effect of two new MPS with moisture additives on *ex vivo* lens hydration and subjective symptoms.<sup>76</sup> The rate of lens dehydration slowed for both systems over one month of wear and subjective responses were also lower.

### Will re-wetting drops help?

If prescribing less-drying materials, moisturising solutions or DD lenses is insufficient to reduce SCL-related dryness, other treatments may be necessary. Use of rewetting drops is a predictive factor for SCL-related dryness.<sup>45</sup> There are many drops available and all have certain shared physical qualities; instilling a drop during lens wear temporarily rinses the front surface of the lens and may help remove deposited debris by dilution. Theoretically, rewetting drops may also change the surface friction for a short period of time.

Re-wetting drops have limited success because relief is not as



**Figure 6** Re-wetting drops have limited success

complete as desired or as lasting.<sup>74</sup> The effect of rewetting formulations of various viscosities on comfort was tested with contralateral wear of hydrogel and SiH lenses.<sup>74</sup> All lubricants increased comfort just after insertion, but after six hours comfort was significantly worse with hydrogels. With each lens type, comfort after six hours was no better than half the rating just after insertion.

Symptomatic, middle-aged lens wearers were observed for 60 days after four times per day use of a hypo-osmolar lens rewetting drop.<sup>77</sup> Ocular Surface Disease Index (OSDI) score improved significantly, as did most clinical signs. The study did not incorporate a control treatment or observer masking.

Another study compared clinical performance and lens protein deposition with a rewetting drop containing surface-active surfactants and unpreserved saline.<sup>78</sup> As neophyte SCL wearers used lenses for 30-nights' continuous wear, symptoms increased late in the day regardless of treatment group. Those using the drop reported better comfort on insertion and had a lower amount of and less denatured lysozyme deposits. Symptoms of dryness *per se* did not differ between treatment groups.

Another method of investigating the residence time of drops is to measure the tear meniscus volume over time. A study in symptomatic lens wearers, asymptomatic lens wearers and non-wearers at 5, 10, 20 and 30 minutes after instillation found symptomatic wearers had lower tear volumes at all time points, and tear volume and lens-related comfort decreased over a 10-hour wearing day for all wearers.<sup>79</sup> After drop instillation, an increase in tear volume and comfort lasted only 10-20 minutes

for asymptomatic and symptomatic lens wearers alike.

One research team measured the *in vivo* osmolarity of contact lens materials and the effect of hypo-osmotic versus hyper-osmotic saline drops in symptomatic and asymptomatic lens wearers.<sup>80,81</sup> There were no differences in tear instability, corneal staining, lens wettability or water content between drops but 60 per cent of the subjects preferred the hypo-osmotic drops overall and reported less dryness and lens awareness. These drops may therefore be useful for the management of lens-related dryness symptoms.

### What about other therapies?

In some countries, the anti-inflammatory cyclosporine (Restasis, Allergan) is widely used to treat moderate to severe dry eye.<sup>82</sup> In SCL wearers with self-reported lens-related dryness, cyclosporine (0.05 per cent) plus rewetting drops improved subjects' assessment of dry eye severity compared with rewetting drops alone. After three months' use, mean wearing time increased and the drops were less frequently used.<sup>83</sup> Topical use of an experimental macrolide antibiotic solution (1 per cent azithromycin) tested against an over-the-counter rewetting drop was associated with improved hours of comfortable wear and fewer end-of-day dryness symptoms.<sup>84</sup>

Ocular allergies in many SCL wearers can negatively impact comfort. A study compared subjective results and ocular signs in subjects who used 0.05 per cent epinastine (an ocular antihistamine plus mast cell stabiliser) and rewetting drops to rewetting drops alone.<sup>85</sup> The antihistamine treated group reported longer comfortable wearing time, slightly increased wearing time, less ocular itching and use of fewer rewetting drops. Since allergies are often a seasonal condition for SCL wearers, topical antihistamine may help cope with periods of highest symptoms.

### Punctal plugs

Retention of lacrimal fluid is one strategy to decrease dry eye symptoms with and without contact lens wear. Plugs are inserted into the lower punctum and increase tear volume by blocking tear outflow. The treatment model assumes that volume and not the chemical makeup of the tears is the essential feature driving dry eye symptoms, but many patients with



dryness symptoms have sources of inflammation along their eyelids (blepharitis, MGD) or in the lacrimal gland.<sup>86</sup> Clinical trials of punctal plugs have not shown them to be successful for treating CL-related dryness.<sup>87</sup>

## Dietary supplements

Dietary supplementation with omega-6 fatty acids is another therapeutic approach. Middle-aged female SCL wearers were observed over six months, dosing with evening primrose oil (EPO) or with olive oil as a placebo.<sup>88</sup> The EPO group improved only in dryness, while all other symptoms remained the same in both groups. Oral dietary supplements may increase production of anti-inflammatory 1-series prostaglandins in the body.<sup>89</sup> If the same underlying inflammatory mechanisms are causative in dry eye and SCL-related dryness, these treatments may be useful in contact lens wearers as well.

Lastly, the lay literature is rife with recommendations to consume two litres of water a day and avoid an excess of diuretic beverages (coffee, tea, alcohol, energy drinks) to maintain good general health. Although this belief is widely held by practitioners and patients, the role of liquid intake on contact lens comfort has not yet been studied.

## Does improving the environment help?

Environment has a significant impact on reports of dryness during contact lens wear but SiH lenses minimise some of those effects, as shown in a large clinical trial where hydrogel SCL wearers were refitted with three SiH lens materials.<sup>90</sup> After two weeks, use of all three lenses was associated with better comfort in many of the most challenging environments (sitting under air conditioning, low humidity, smoky environments, dusty or polluted environments, and while napping or sleeping). Refitting with senofilcon A and galyfilcon A resulted in improvement for all challenging environments.

SCL wearers who use video display terminals (VDTs) for more than four hours a day reported the highest level of visual and dryness symptoms and also had lower tear meniscus height compared with non-wearers or less VDT use.<sup>91</sup> A comparison of symptoms among SCL wearers and non-wearers in various work environments found



Figure 7 Environment has a significant impact on dryness

a dose response with VDT use and burning among lens wearers.<sup>92</sup> Even in non-wearers, VDT use exacerbated symptoms. Air-conditioned and heated environments drove higher rates of symptoms among the SCL wearers compared to non-wearers.

Finally, subjects have been tested in a highly controlled adverse environment while wearing their habitual lenses, senofilcon A lenses and no lenses.<sup>90</sup> Use of senofilcon A lenses while sitting and performing visual tasks in low-humidity conditions resulted in better comfort compared to habitual lenses or no lenses at all. The lens material could be providing protection from tear break-up and the ensuing corneal sensations.<sup>93</sup>

## Conclusions

This review considered the most important aspect of lens-related discomfort to be dryness since it drives discontinuations from lens wear. Every eye care practitioner should assess soft contact lens wearers to differentiate likely sources of problems leading to dryness symptoms. But the available tools will

only help if the practitioner actively questions lens wearers about their symptoms. Questionnaires can help identify those who could benefit from clinical management.

Staying current with research will allow the clinician to understand the many underlying factors that may drive dryness symptoms, such as patient age, medication, toric lens use, occupation, amount of computer use, and exposure to challenging environments, and help initiate discussion with patients on how to enhance the lens-wearing experience. Comfort is patient dependent and it is therefore important to fit the lens to the patient rather than the patient to the lens.

Differential diagnosis should include a careful examination of the tears, ocular surface, lids, tarsal plates and meibomian glands to help identify patients who have physiological issues that need active management. Remember that many soft lens wearers with complaints have no obvious signs that relate to dryness. For patients who may have had reactions to lens care solutions, daily disposable lenses could remove those irritants.

Recent developments such as improved hydrogel and SiH materials and lens care products increase the likelihood of the patient achieving a good standard of comfort during lens wear. But at the same time, the way we use our eyes, staring for long periods at computers and mobile devices, and worsening indoor air quality, puts an extra burden on the ocular surface. These opposing forces keep the challenge of good comfort with soft contact lenses a relevant topic for eye care practitioners. ●

● A full set of references is available online at [www.opticianonline.net](http://www.opticianonline.net) or on request.

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● Dr Robin Chalmers is an independent clinical trial consultant and vice-chair of the American Academy of Optometry Research Committee

## KEY POINTS TO APPLY IN PRACTICE

- Use questionnaires to elicit symptoms and indicate struggle with habitual lenses
- Probe dryness and discomfort late in the day
- Question patients about work and leisure environments, health and medication
- Include LIPCOF, and MGD in clinical observations
- Refit symptomatic wearers with a change of material, design or replacement schedule
- Choose a lens and lens care combination that works well for the individual patient
- Recommend daily disposables for allergy-suffering patients
- Remember that discomfort and dryness do not only affect the contact lens wearer