More than three million people in the United Kingdom regularly use contact lenses. To many it is the preferred method of refractive correction, giving more natural, comfortable vision. Others wear lenses to facilitate practical and sporting activities or for socialising.

Eyecare professionals have been aware for some time that the main reason patients cease using contact lenses as a form of correction is due to a reduction in comfort while wearing the lenses1. In our two-part series, we will attempt to identify the chief causes of contact lens-related dry eye and the management options available to the eyecare practitioner.

In the earliest cases, many patients attempt self-treatment, using over-the-counter (OTC) lubricants to reduce symptoms and often continue this until the lenses can no longer be tolerated, becoming lost to follow-up. It is, therefore, critical that eyecare providers are aware of the importance of patient comfort when using their contact lenses, and are able to identify the earliest signs and symptoms of contact lens discomfort. Eyecare professionals are well trained to assess the fitting and stability of contact lenses in situ, modifying lens type, modality or materials when clinically necessary.

For many patients, contact lens discomfort occurs as a result of destabilisation of the tear film, or the development of ocular surface disease2. Where this is present, patients often experience symptoms out of proportion to the signs observed, with some patients being forced to reduce their wearing time or cease contact lens wear altogether.

Dry eye disease is a multifactorial disorder of the tear film and ocular surface, resulting in symptoms of discomfort, visual disturbance and tear film instability, able to potentially damage the ocular surface. The Dry Eye Workshop3 also described how dry eye disease was driven by a combination of hyperosmolarity and inflammation of the ocular surface. In the presence of tear film instability, comfort and visual quality are affected in contact lens wear4.

Eyecare professionals should, therefore, be aware of the increased risk of dry eyes in contact lens wearers, and confident in the identification and management of dry eye disease. With early identification and effective management, contact lens discomfort may be reduced, allowing successful continuation of contact lens wear.

**CAUSES OF CONTACT LENS-RELATED DRY EYE**

The surface of the eye exists in a state of homeostasis in order to provide refractive clarity, comfort of the ocular surface and lubrication for the movement of the eyelids over the surface of the eye during the blinking process2. The introduction of a contact lens as a foreign body disrupts this balance, with the potential to cause major visual and ocular health problems.

Often the timing of discomfort and dryness may indicate influencing factors, with discomfort upon waking indicating lid and tear film problems, while symptoms occurring later in the day are indicative of a lens-related cause. Occupations where the patient carries out extensive VDU work may lead to reduced blink rate, reducing the ultimate stability and volume of tears5. The presence of air conditioning can lead to an increase in evaporation of the tear film, reducing stability and increasing discomfort6.

The installation of a contact lens into the eye leads to a splitting of the physiological tear film, with subsequent thinning7 and loss of stability8,9. The presence of a contact lens on the surface of the eye has been shown to increase the osmolarity of the tear film10,11.
Hyperosmolarity (see Box 1) is an increase in the saltiness of the tear fluid \(^{2,12}\) and has been known for some time to contribute to and drive the development of dry eye conditions \(^{3}\). Increased osmolarity of the tear film leads to the release of inflammatory markers \(^{13-15}\), which contribute to low level inflammation and can over time damage the ocular surface with loss of goblet cell \(^{16,17}\) and meibomian gland function \(^{3,10,17}\).

Disruption to the smooth ocular surface, or interaction with an ill-fitting lens edge may lead to mechanical damage to the ocular surface. Poorly fitting lenses may cause indentation to the ocular surface, damaging cell function, causing staining (see Box 2) and encouraging further inflammation, while interaction with the lid during blinking may lead to the development of lid wiper epitheliopathy \(^{19}\).

The surface properties of contact lenses can also be crucial in determining the risk of developing contact lens-related dryness. Traditional hydrogel lenses with a moderate to high water content, while improving initial comfort, were more prone to dehydration and desiccation and staining of the ocular surface \(^{20,21}\). While this has largely been overcome by the development of silicone hydrogel lenses, the increased rigidity of these lenses and shear forces during blink may increase the risk of inducing superior arcuate epithelial lesions \(^{22}\).

Disruption to the wettability of the surface of the lens can greatly influence how the lens will interact with the tear film and ocular surface. The presence of deposits on the surface of the lens can encourage the destabilisation of the tear film, as well as influence how the lens will interact with the ocular surface \(^{21}\), with the potential to encourage tear film destabilisation and increase discomfort during lens wear.

**LID DISORDERS**

The presence of co-existing ocular surface or lid margin disease may cause discomfort for patients using contact lenses \(^{23,24}\). It has been well established that meibomian gland disease is responsible for many cases of ocular dryness due to its reduction of lipid production \(^{25}\).

The presence of surface or lid margin disease has also been demonstrated to present an ever-deepening cycle of tear film instability, hyperosmolarity, inflammation, and further tear film dysfunction \(^{3}\). Pre-existing ocular surface problems, when combined with the further destabilisation of the tear film due to contact lens wear can lead patients to experience discomfort while using their lenses.

Systemic diseases may lead to reduction of tear production by a number of mechanisms, the most familiar to the eyecare practitioner perhaps being Sjögren syndrome, a chronic auto-immune disease where the body’s exocrine glands come under attack by the cells of the immune system. In patients suffering Sjögren’s syndrome the lacrimal gland is infiltrated by T-lymphocytes leading to a reduction in the production of aqueous \(^{26}\). The use of medication, particularly those that are known to reduce tear production (such as anti-histamines or tricyclic antidepressants) may also provide the root cause of dryness.

The causes of dryness and discomfort in contact lens wear may be multifactorial and often initially unclear, and so a thorough history and examination should be carried out (see Box 3). An identification of the underlying causes allows practitioners the ability to prescribe an appropriate treatment plan, reducing patient symptoms and maintaining lens wear.

**PATIENT COMMUNICATION AND ENVIRONMENT**

The successful management of contact lens-related dry eye requires a thorough understanding of the onset, frequency and duration of symptoms in addition to patient compliance to recommended treatment.

---

**Box 1: Osmolarity in dry eye**

It has been found that the main driving force in dry eye disease is due to increased osmolarity or saltiness of the tear film. This is often caused by a dysfunction in lipid production from MGD or blepharitis. When the top layer of the tears is missing or not sufficient, water evaporates from the surface, leading to an increase in the saltiness of the tear film. This increase in saltiness is responsible for driving inflammation and many of the symptoms of dry eye.

Many people use drops, such as those shown in Figure 1, to manage dryness of the eyes. Ideally an eye drop or ocular lubricant should be:

- Preservative free
- Hypotonic
- Electrolyte balanced
- Retained in the eye for a reasonable time
- Suitable for use with contact lenses

Patients using such drops should be encouraged to use them frequently (three to four times a day) to minimise symptoms, and even to put drops in just prior to lens insertion to aid lens comfort.
At the outset of management, it is imperative to inform the patient of their condition, give an insight into pathogenesis and explain fully the nature of treatments and how these options aid in the management of dryness. A thorough treatment plan, appropriately communicated to patients, not only builds patient confidence in their eyecare provider, but also encourages compliance to the treatment plan (see Box 4).

Patients should initially be encouraged to avoid, or where possible modify, environments which might encourage tear film destabilisation (see Box 5).

In the presence of dryness due to low humidity, patients can be encouraged to modify their environment to improve the humidity around the eye. This may be achieved by a number of ways: radiator humidifiers can be used in the home or office environment, and can alleviate the dryness experienced in day-to-day wear. Patients may also choose on occasions of low humidity to wear moisture chamber type spectacles to improve the ocular environment. If humidity remains a problem, other routes should be considered such as tear supplementation, or avoiding lens use in environments of low humidity.

Patients working in an office environment may also experience an increase in symptoms during VDU use. The use of back-lit screens is known to lead to a reduction in blink frequency, leading to an increase in the symptoms of dryness.

Patients experiencing dryness when using back-lit devices should be encouraged to carry out blinking exercises to reduce this risk.

Patients should also be encouraged to minimise their use of ocular cosmetics, such as face creams, mascara, and make-up removers, when using contact lenses. These products have the potential to adhere to the lens, adversely affecting wettability, may mix with and destabilise the tear film, and in some cases may occlude meibomian glands reducing lipid production.

Discomfort during use is the main reason many patients discontinue contact lens wear. The causes of this discomfort may be multifactorial and it is imperative that the eyecare practitioner carries out a thorough examination, and takes time to discuss the details of their findings with their patients.

Patients should be advised on the causes and management options available to them, with practitioners discussing the purpose of each aspect of management.
Where possible, patients should be encouraged to avoid known triggers of their conditions and be advised on appropriate modifications that may help their condition. In our next article, the treatment options of ocular surface disease and modification to lens parameters in the management of contact lens-related dry eye will be discussed.
Box 5: Risk factors for environmental dryness

Dryness during contact lens wear can be caused or aggravated by a number of factors. The discomfort and dryness experienced may be from a number of sources, which disrupt the harmony of the tear film, leading to tear film instability and discomfort. Patients with symptoms suggesting an environmental cause should consider:

- Avoiding locations using aggressive air conditioning
- Avoiding drafts
- Minimising lens wear in areas of decreased humidity
- Using room humidifiers

REFERENCES


3. The Ocular Surface ISSN: 1542-0124.


Andrew Matheson is a specialist therapeutic optometrist in both private practice and the hospital eye service, specialising in glaucoma, medical retina and dry eye. Malcolm Maciver is clinical optometrist and senior lecturer in optometry at Portsmouth University, with specialist interests in ocular surface disease, medical retina, and binocular and developmental vision.

Manufacturer-specific products and services are included as examples only. No endorsement by ABO of the products mentioned or pictured should be implied.