

# Sodium hyaluronate for dry eye

Why would you recommend sodium hyaluronate-based eye drops to patients suffering from dry eye? This article explores the issues to consider

By TRB Chemedica

**D**ry eye is often referred to as a syndrome. However, in 2007 a revised definition was introduced following an extensive review of the literature and clinical experience by the pan-European Dry Eye Workshop (DEWS), which concluded: "Dry eye is a multifactorial disease of the tears and ocular surface that results in symptoms of discomfort, visual disturbance and tear film instability with potential damage to the ocular surface. It is accompanied by increased osmolarity of the tear film and inflammation of the ocular surface<sup>1</sup>."

Dry eye is characterised by a reduction in the quantity or quality of tears. This reduction alters the composition, increases evaporation, and impedes the distribution of the tear film on the cornea. Any or all of these changes can lead to instability of this protective shield. Instability causes the tear film to break up earlier than normal, leading to the formation of dry spots on the cornea. If not rectified, this can lead to dry eye.

## Function of tears

The most common cause of dry eye is an abnormality in the function of the lacrimal gland, where most of the tear film is produced. Dry eye may also develop if there is a deficiency in one of the aqueous components of the tear film.

A sensation of dryness happens whenever the tear film becomes destabilised, breaks down and thus no longer lubricates the eye sufficiently. The tear film is a complex structure and has various functions:

- It lubricates the surface of the eye
- It keeps the surface tissue of the eye moist
- It supplies nutrients and oxygen to the cornea
- It hinders bacterial infections
- It protects the eye from small dust particles.

Dry eye is often related to other disorders in the body such as rheumatoid arthritis, systemic lupus erythematosus or Sjögren's syndrome. It is also related to increasing age as well as certain types of medication. It is often the result of aggressive environmental factors such as smoke, exhaust fumes, dust, air conditioning, prolonged

use of a computer screen and contact lens wear. Refractive surgery that permanently changes the shape of the cornea can also result in dry eye.

It has been established that most forms of dry eye exhibit similar features:

- Burning, dryness, redness, itching or grittiness in the eyes
- Damage to the ocular surface
- Tear film instability – established by measuring tear break-up time
- Tear film hyperosmolarity (hypertonicity or surface tension), which is thought to be the common denominator between all forms of dry eye.

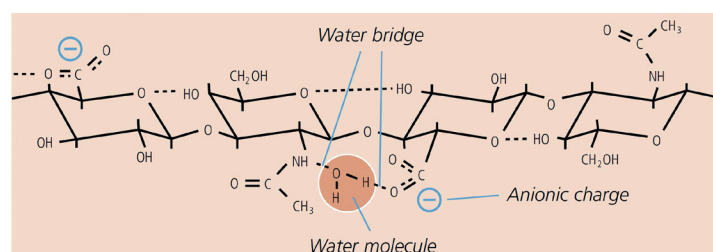
Strangely, there can also be an excessive tear flow, with the eyes watering constantly.

## Why sodium hyaluronate?

Sodium hyaluronate (commonly referred to as hyaluronic acid or HA) is a naturally occurring polymer and is ubiquitous throughout the interstitial cellular space in humans. It helps retain moisture in different types of tissue throughout the human body and aids lubrication between layers of tissue to eliminate friction – thus making it an ideal physiological tear film substitute.

As a result of its coiled structure and large hydrophilic domains, HA attracts and retains a large amount of water,<sup>2</sup> and therefore possesses the ability to retard water evaporation<sup>3</sup>.

Following instillation, SH solutions effectively moisturise the eye surface and prolong the beneficial wetting effect over time.



Hyaluronic acid has a polymeric structure that binds a large amount of water

Sodium hyaluronate also serves as a transport medium for nutrients and a filter for inflammatory molecules. All these functions make sodium hyaluronate the ideal molecule in eye lubrication.

Sodium hyaluronate does not alter the normal surface of the eye like other types of tear substitutes. It closely mimics the properties of a normal, healthy tear film, with a longer retention time on the corneal surface than a cellulose-based tear substitute<sup>4</sup>.

HA gels have also been used successfully in ophthalmic surgery for many years. As a result of their unique physical and chemical properties, HA solutions are similar to natural tears. For that reason, they are widely used in ophthalmology as lubricant eye drops for the treatment of sensations of ocular dryness<sup>5</sup>.

### Viscoelasticity

The most important property of HA solutions is their viscoelasticity, which combines the viscous properties of a liquid with the elastic properties of a solid, depending on the shear stress applied. When used as an ocular lubricant, the unique viscoelastic properties of HA increase the stability of the pre-corneal tear film and maximise tear film residence time<sup>6,7</sup>.

Sodium hyaluronate eye products coat the ocular surface like a subtly moisturising film, and keep the surface of the eyes moist. Consequently, the sensitive structures of the surface of the eye are protected and supplied with the necessary stabilising effect of an almost natural tear film.

Dry eye sufferers will feel immediate relief from their symptoms, alleviating the sensation of dryness, burning and grittiness for extended periods.

disorder characterised by exocrine gland dysfunction and a variable systemic course. Lymphocytic infiltration of the lacrimal and salivary glands results in the classic sicca complex characterized by dry eyes (keratitis sicca).

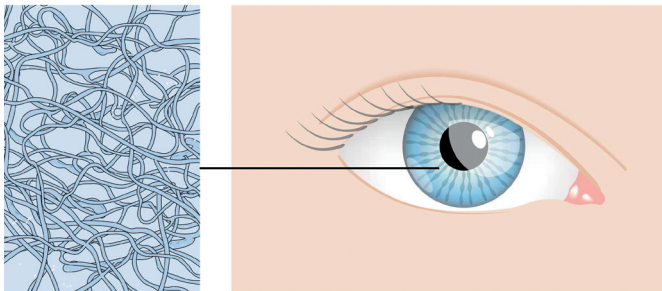
The vast majority of patients who have been diagnosed with Sjögren's syndrome say that the persistent sensation of dry eyes is a "major" problem, and that the very frequent instillation of tear substitutes and/or wetting agents was an inconvenient and enduring daily task.

Higher concentrations of hypotonic sodium hyaluronate have been shown to be more beneficial than isotonic solutions in patients with Sjögren's syndrome suffering from dry eye<sup>8</sup>. A 0.3 per cent HA solution has been shown to increase the thickness of the tear film more efficiently than buffer solution, offering increased protection from sensations of ocular dryness<sup>7</sup>.

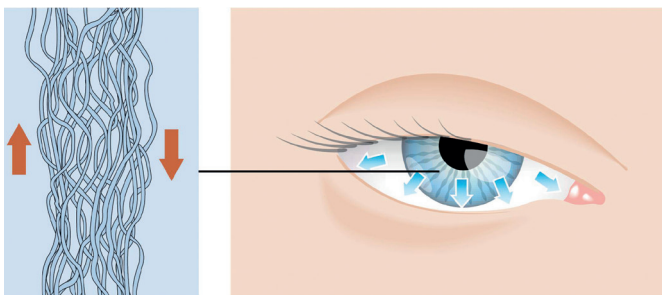
For patients with moderate and severe dry eye, any kind of unnecessary preservatives should be avoided as they may worsen the patient's condition. The risks of using eye drops containing preservatives are clearly stated in the DEWS 2007 report<sup>9</sup>: "Many components of eye drop formulations can induce a toxic response from the ocular surface. Of these, the most common offenders are preservatives, such as benzalkonium chloride (BAC), which cause surface epithelial cell damage and punctuate epithelial keratitis, which interferes with surface wettability. Use of preserved drops is an important cause of dry eye signs and symptoms in glaucoma patients, and it is usually reversible on switching to non-preserved preparations. Therefore, frequent applications of preserved artificial tear preparations should be avoided."

Natural tears also contain certain concentrations of essential ions. Calcium and magnesium are important in cell adhesion, cell junctions and cellular transport, and potassium contributes to the maintenance of corneal thickness<sup>10,11</sup>. Eye drops containing essential ions can offer the sufferer of dry eye an additional benefit.

Eye drops are presented either in individual preservative-free mono-dose units (vials), where any unused drops need to be discarded after the first day of use or in multi-dose bottles (ophthalmic squeeze dispensers). The patient satisfaction with multi-dose eye drops dispensing preparations has been shown to be very high<sup>12</sup>. ☒



Between blinks HA forms a long-lasting protective coating



While blinking, HA molecules align and spread easily over the cornea

### Persistent dry eye

Amongst the medical conditions that can affect the quality and integrity of the tear film, Sjögren's syndrome is one of the most commonly cited. Sjögren's syndrome is a chronic inflammatory

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