British Sjögren's Syndrome Association

Originally published in the Winter 2009, Volume 24, Issue 4 of Sjögren's Today magazine

The tear film - unseen but essential

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"Lest precious tears, lest precious tears,
Should drop from Susan's eye."

From 'Black-Eyed Susan'
by John Gay c1720

John Gay's poem may be rather sentimental in its treatment of the loyalty of Sailor Bill and his sweetheart Sue, but he does at least appreciate the value of our tears. Tears are both more complex and more important than most people realise. In order to keep your eyes healthy it is absolutely vital to have an adequate amount of good quality tears protecting and nourishing the surface of the eye. In many people, especially many with Sjögren's Syndrome, the amount or quality of tears is reduced. This results in the surface of the eye drying out which is not only uncomfortable, but which, if not treated, can lead to scarring and even sight-threatening problems. Fortunately the vast majority of the patients we see - with or without Sjögren's Syndrome – are fairly easily treated with the good range of tear substitutes that are now available. Some people with more severe disease are helped by additional measures such as anti-inflammatory drops or tablets or punctal plugs. Yet our key task remains the recognition of what's wrong with the tear film and the provision of a suitable tear replacement that is convenient and effective. In this article we will look further at the tear film and why it is so important.

The structure of the tear film

The tear film describes a complex structure that is part oil, part water, part protein that coats the surface of eyes (Figure 1). Although it is only one tenth of a millimetre thick, it is an absolutely vital barrier between our eyes and the outside world. The largest part is made up of our watery tears. These are produced by the lacrimal gland (Figure 2), a small almond shaped structure situated above and to the outside of each eye just under the brow. Each gland produces around 10ml (or 2 teaspoonfuls) of tears every day. From the glands multiple tiny ducts carry these tears to the inside of the upper lid where they can empty onto the surface of the eye. These watery tears help to wash the surface of the eye and also contain important natural antibiotics which help protect the eye. Inflammation of the lacrimal gland – as may occur in Sjögren's Syndrome – reduces tear production, specifically of this important watery part of the tear film.

On the outside of this watery layer is a layer of natural oils produced by numerous 'Meibomian' glands which line one's eyelids. This oily layer stabilises the tear film and massively reduces tear evaporation. It achieves all this despite being just a ten thousandth of a millimetre thick. However disease of the Meibomian glands (or blepharitis) is very common. The oily layer becomes thinner and is of reduced quality. More evaporation takes place resulting in a much reduced tear film. Whilst in many individuals this may be sufficient to give mild dry eye symptoms, it is much more of a problem for people who have Sjögren's Syndrome in whom the tear film is already compromised.

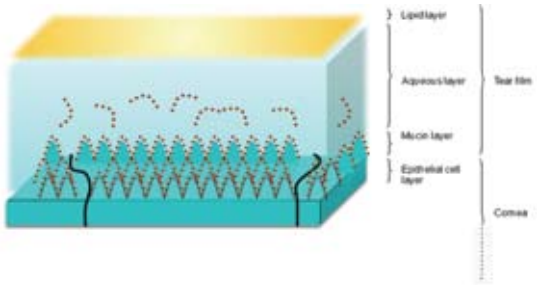

Figure 1. Schematic diagram showing the main layers of the tear film. Note however that there is much more mixing of the layers than is shown here.

On the inside of the watery layer is a special layer of proteins (or mucin) which help provide a smooth stable surface for the tears to lie on. These proteins are mainly produced by tiny glands on the surface of the eye (the conjunctiva) itself. Scarring of the surface of the eye - as may happen if Sjögren's disease starts to cause significant uncontrolled dry eyes – can start to damage this protein layer, and so further reduce the stability of the tear film.

The comings and goings of tears

Just as the quality of our tears is critical, so the distribution of the tears is very important. Every time you blink your upper lid sweeps these tears over the whole surface of your eyes. Normally most of your tears actually evaporate, and only a relatively small amount drain away. However the drainage system is important to prevent tears spilling down your face, especially under conditions when the eyes are irritated and produce more tears. As well as distributing your tears blinking also powers the 'lacrimal pump', a series of muscular contractions which actively drains the tears away. Tears drain through a small hole or punctum into a drainage tube or canaliculus which run within each lid to the side of the nose (Figure 2). Here the drainage tubes of the upper and lower lid meet at a reservoir (the lacrimal sac) and then drain down a further larger tube into the nose. This is why crying or peeling onions usually makes one's nose run.

An Irreplaceable Resource

Although our 'tear replacement' therapies will probably never be as good as 'real tears', they are an invaluable help in reducing dry eye problems. Some people with very mild dry eye problems may only require a fairly watery drop which they use occasionally throughout the day. Some will only get relief if they use a thicker drop or gel – these last longer but do cause some

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temporary blurring of vision. Others will need a more intense regime using gels during the day and a thick ointment at night; these ointments really blur your vision which is why they are usually only used at night. Some people with severe disease may benefit from one of the newer hyaluronate gels, a natural compound which bears some resemblance to the inner protein layer of the tear film.

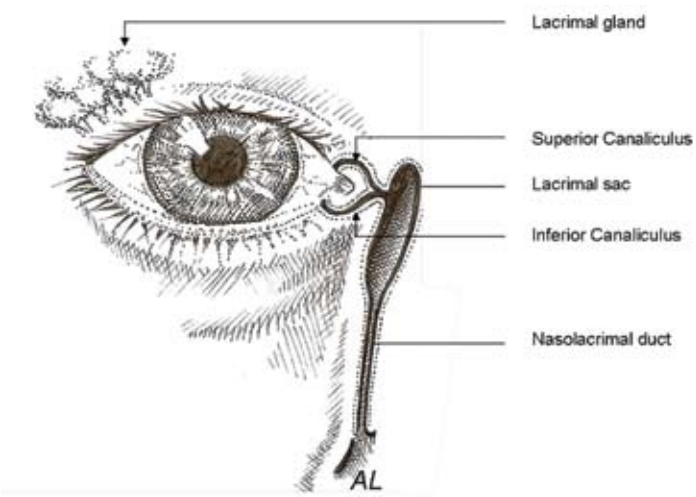

Figure 2. Outline showing the location of the lacrimal gland (which is the major producer of tears) and the drainage system (which carries tears away to the nose).

Additionally there are ways of conserving one's natural tears. The most useful of these techniques are the use of 'punctal plugs' which block the tear's drainage system. The main difference between the different types of plugs is how easy they are to put in and how long they stay in position. Sometimes the punctae need to be permanently sealed with micro-cautery.

Finally there are therapies directed towards the underlying cause. Active inflammation (as may occur in Sjögren's Syndrome) is usually treated with immunosuppressive drugs such as corticosteroids; this may be in drop form or as tablets. If there is Meibomian gland disease this is treated with cleaning of the eyelids (for example with a weak solution of bicarbonate of soda) and often a tetracycline - a type of antibiotic which improves meibomian gland function and inflammation if used at a low dose for a minimum of 3 months.

Finale

The tear film is a near-invisible barrier which though only a hair's breadth thick, successfully protects the eyes from the vast majority of challenges that the outside world throws at it. It can however be compromised in disease such as Sjögren's Syndrome. Fortunately once the problem is recognised there is now a wide range of treatments which can help preserve or supplement our 'precious tears'.