

# Tears

**Tears are a normal body fluid that flow continuously to lubricate the cornea (the clear “watch crystal” covering the front surface of the eye). The purpose of tears is the lubrication and cleaning of the front surface of the eye, the cornea and the conjunctiva.**

The volume of tears is usually low, but tears increase when the eye is irritated by a foreign body, infection (of the eye or the eyelid), or many chemicals (onion oil vapors, smoke, air pollution, dust, etc.) or during an emotional episode.

The tear film over the surface of the eye is comprised of three layers: 1) a mucous layer against the surface of the cornea and the conjunctiva (the transparent layer with blood vessels that covers the white of the eye and the inner lining of the eyelids) that serves as a coating or spreading factor; 2) a watery layer with salts and other nutrients to moisten the corneal and conjunctival cells; and 3) an oil layer on top or on the outer surface of the water layer, which prevents the water from evaporating.

This tear layer is critically important to keep the cornea clear and healthy. Changing either the total volume of tears or reducing one or more of the three major component may alter drastically the function of the tear film and may lead to drying, scarring, and loss of the transparency of the cornea, thus permanently impairing vision.

“Dry eye” or “dry eye syndrome” is a group of disorders of the tear film associated with reduced tear production (“tear deficiency”) or excessive tear evaporation that yields symptoms of eye irritation, discomfort, sandiness, or grittiness, and may cause damage to the ocular surface.

With the ectodermal dysplasias, the amount or the volume of tears may be either normal or deficient. When the eyes are chronically irritated, or when recurring infections, especially of the oil glands and eyelash follicles on the margin of the eyelids, cause crusting and matting of the eyelashes, the whites of the eyes may be red, inflamed, and uncomfortable.

Dry eye occurs more frequently in older individuals. It is estimated that 4.3 million people in the 65-to-84-year-old age group in the U.S.

experience symptoms of ocular irritation often or all the time, and nearly one million people in the 65-to-84-year-old age group meet the definition of dry eye. The prevalence of dry eye is higher in women 50 to 69 years old than in men of the same age group. Dry eye associated with systemic autoimmune disease is more common in women than in men.

Symptoms caused by dry eye may be worsened by some systemic medications such as diuretics (“water pills”). Environmental stresses, including low humidity (such as air conditioning both in homes and in automobiles) and wind, drafts, and heating, may worsen the ocular discomfort of people with dry eyes. Environmental irritants and allergens (pollens and dusts), although they don’t cause dry eyes, certainly may worsen the symptoms of dry eye.

While most forms of dry eye cannot be prevented, appropriate treatment may reduce symptoms and signs and moderate the possible permanent consequences. For those people whose symptoms are aggravated by medications and environmental factors, elimination of the offending drug or modification of the home, mobile, or work environment may offer substantial relief.

Thus the incorporation of a suitable humidification system into the home central furnace and air conditioning system or the adaptation of a small room humidifier at work may make noticeable differences in comfort.

Topically applied artificial tears are the mainstay of therapy for tear deficiency. Many tear preparations contain electrolytes and buffers aimed at normalizing tear thickness and coating effects. Non-blurring tear gels with polymers such as carbomer 940 and polyacrylic acid last longer than simple artificial tear solutions. The addition of an



oil component, such as castor oil, may serve as an evaporative barrier and may reduce irritating fats from the lid margins and skin.

Frequent placement of artificial tears makes people with tear deficiency particularly susceptible to toxicity from the preservatives in artificial tears, particularly benzalkonium chloride. Every artificial tear preparation that is sold in a multiple-dose bottle incorporates a preservative in the solution to minimize bacterial contamination in the bottle (from touching the lids or the fingers, and so forth).

In the last decade, the marketing of preservative-free lubricants sold in small single-use dropperettes has allowed patients to use these preparations as frequently as they desire without experiencing the preservative-related toxicity on the surface of the eye. Preservative-free artificial tears should be considered for dry-eye patients who must instill them more than four times a day to relieve their symptoms.

For person with severe or irreversible tear deficiency or with chronic conditions such as blepharitis (lid margin infections), the ophthalmologist must educate the patient about the chronic nature of dry eye and must acquaint him with its natural history. Patient education is an important aspect of successful management of these conditions.

For people with dry eyes associated with systemic disease, such as rheumatoid arthritis, anti-inflammatory/ immunosuppressive therapy may be appropriate.

For people with dry eye syndrome, the following surgical options are available when medical treatment has been inadequate or inappropriate: 1) correction of the lid abnormality that results from blepharitis, trichiasis (scarred or intumed lashes), or lid malposition (e.g., lagophthalmos [gapping open of the lids], entropion/ectropion [inturning/ outturning lids]); and 2) enhancement or salvage of existing tears by closing the punctum (the tear drain in the corner of the eyelid) or tarsorrhaphy (a surgical closure or bridging of the upper and lower lids together in a severe case).

Noninvasive therapies such as spectacle side shields, moisture inserts, and moisture chambers may be tried first, but they may be poorly tolerated because

of the adverse cosmetic effects.

For people with severe tear deficiency, punctal occlusion is considered when the medical means of tear supplements is ineffective or impractical. This can be accomplished simply with “semi-permanent” silicone plugs that are placed like small “champagne cork” into the punctal opening.

Semi-permanent plugs have the advantage of being reversible if the patient develops excessive tearing; they can be pulled out. Punctal plugs decrease symptoms of ocular irritation and decrease the frequency of use of artificial tears. Occasionally, semi-permanent plugs are lost, but they can be replaced easily.

Permanent occlusion of the tear drain can also be accomplished with a heated cautery or with a with laser. However, if it is ever necessary to open the drain, a major surgical adventure awaits. In general, therefore, the silicon or plastic plugs offer many more.

Richard Alan Lewis, M.D., M.S.  
Departments of Ophthalmology,  
Medicine, Pediatrics, and Molecular  
and Human Genetics  
Baylor College of Medicine

*The content of this document is for informational purposes only. Questions regarding specific patient issues should be directed to the appropriate professionals for resolution.*