

Tear Substitute

Deficient volume or poor quality (deranged composition) is the cause of disease labelled as “dry eye syndrome”. The visible cornea of an eye is covered by a tear film having three layers of different materials, mucous, aqueous and lipid from back to forward. Total volume of this tear film is 1 to 1.5 μ lit. While most of the tear fluid (5-9 μ lit) is kept as reservoir behind the lids and fornices of conjunctiva.¹ There is flow of tear as lacus lacrimalis on the lower lid margin, towards punctii for its final drainage. The eyelids wipe the cornea with their sharp posterior margin thousands of times daily either voluntarily or involuntarily. In each blink the lids not only clean and clear the optical surface of cornea like wipers of a car but also move the tear fluid from lacus to strengthen the tear film.

Tear film also provides nutrition and removes excretory products from the conjunctival sac.² The three components of tear film mucous, aqueous and lipid are secreted by different set of glands at different places. Therefore in clinical practice, the patients have different causes and similarly have different clinical presentation in each component deficiency. Obviously the patient will get relief only when the actual pathological process is addressed in the treatment.³ Various systemic diseases and drugs also have their role as etiological factors.⁴

The tears tend to become acidic when eye is kept closed while pH increases on the other hand when eye remains open due to release of carbon dioxide. Understandably the tears of dry eye patient have high osmolarity. Hence the substitute should have high pH and of hypo or atleast Iso osmolar for its normal function.⁵ Normal tears have electrolytes, mucous, lipid, and colloid (proteins) in it. These components are replaced in artificial tears like important electrolytes e.g. potassium and bicarbonate are added. Mucous and lipids are replaced by demulsants but there is not a single commercially available preparation having proteins in it. Preservatives are also added to keep the drug sterile imparting it a long shelf life. But this component has toxic effect to already diseased epithelium of dry eye patient. Modern tears substitute are therefore single use preparations (minims) without any preservatives in it.

Presently six different types of demulsants are being used namely Cellulose derivatives, Dextran 70, Gelatin, Liquid polyole, Polyvinyl alcohol and Povidone. Tears substitutes are available in combination upto three demulsants in one preparation.⁵ Old known toxic preservative like BAK (Benz alkonium Chloride) and Thiomersal are replaced by new, less toxic oxidative type preservative like Stabilized Oxychloro Complex (SOC) and Sodium Perbolate. SOC is a bleaching material having good anti-bacterial activity but no anti-fungal activity and Sodium Perbolate disappears once it comes in contact with tears by converting itself to Hydrogen Peroxide (H₂O₂).^{3,4}

Studies have been done on autologous serum, when used in patient of dry eye, improves their corneal health.² Similar study is being done in Eye Department of Sheikh Zayed Medical College, Rahim Yar Khan with the title of “Biological Tears”. Another treatment modality is parotid duct implant in conjunctival sac which provides all the normal tear components including every type of protein like Albumin, Lysozyme and Ferritin to the dry eye patient.⁵ Ultimate option to replace all the tear components in a patient of dry eye seems to be parotid duct implantation in conjunctival sac. But this is not possible in a patient with concomitant parotid gland involvement in disease process like Sjogren Syndrome. Although this is a tedious & difficult surgery but a ray of hope for the patients of dry eye providing them tears which do not have preservatives and no chance of allergic reaction.

REFERENCES

1. Pflugfelder, Stern ME, Beuerman RW, eds: Dysuntion of the lacrimal functional unit and its impact on tear film stability and composition. In: Dry Eye and Ocular Surface disorders. Dekker;2004:75-76.
2. Gilbard JP, Rossi SR, Gray KL. Tear film osmolarity and ocular surface disease in two rabbit models for

- keratoconjunctivitis sicca. Invest ophthalmol Vis Sci 1988;29:374.
3. Schaumberg DA, Sullivan DA, Dana MR. Epidemiology of dry eye syndrome. Adv Exp Med Biol 2002; 506(Pt B):989-98.
 4. Semeraro F, Forbice E, Braga O, Bova A, Salvatore A, Salvatore AD, Azzolini C. Evaluation of the Efficacy of 50% Autologous Serum Eye Drops in Different Ocular Surface Pathologies. Biomed Research International;2014(1):1-11
 5. Saeed M, Cheema A.M, Shah SAR, Niazi JH, Memon MS, Khan FM. Surgical treatment of dry eye with protid secretions Pakistan Journal of Otolaryngology 1999;15:16-18.

Prof. Dr. Mahmood Saeed

Head, Department of Ophthalmology,
Sheikh Zayed Medical College/Hospital,
Rahim Yar Khan.
