

Eye rubbing predisposes corneal damage, progressive keratoconus and other eye diseases:

An evidence based approach to management

Increasing number of people are using different types of computer or other display device especially smart phones. It is estimated that almost 84% of the world's population will use these gadgets by the end of 2018.¹

About 60 million individuals are diagnosed of computer vision syndrome (CVS). It is manifested by visual, ocular surface (Figure 1), and extraocular symptoms linked to sustained use of visual display terminals.

- Visual symptoms: constant blurred vision, post work distance blur and intermittent blurred vision at near. About 75% of those who use computer for 6-9 hours as compared to 50% of the other workers reported visual complaints.²
- Ocular surface related symptoms: itching eyes, burning eyes, foreign body sensation, and sore eyes.

Individual who work for more than 4 hours daily can develop dry eye disease. Many of the symptoms of CVS can be prevented with proper eye care, patient education and by providing a proper working environment.²

The use of computers is associated with a decreased frequency of blinking and an increased rate of tear evaporation, each of which contributes to dry eyes. Reduction in the blinking frequency decreases the thickness of the lipid layer leading to increased evaporation of the aqueous layer.³ Incomplete blinking contributes to tear film instability and is variable with prolonged exposure to visual display terminal.⁴

Effect of eye rubbing on cornea

Eye rubbing has considerable effect on corneal topography by increasing the surface irregularity index.⁵ In a study researchers have reported that slight rubbing for 10 seconds with one finger, in a smooth circular movement, repeated 30 times over a 30 minute period significantly reduce the keratocyte density in corneas. There was also a higher concentration of inflammatory mediators in the tears.

The use of light to moderate force applied on closed eyelid by the finger pad of an index finger for 15min reduced central and midperipheral human corneal epithelial thickness by 18.4% and recovery to baseline was observed 15-30min centrally and 30-45min mid-peripherally, after eye rubbing.⁶ Rubbing induced mechanical damage exacerbates tissue weakness and increases tissue proteases such as matrix metalloproteinase-9.⁷

Rubbing of eyes can cause ocular problems

Rubbing of eye is more pronounced and frequent in the individuals suffering from the ocular consequences of extended computer use. School kids as well as pre-schoolers spending hours in front of a computer daily. It can be considered that computers and digital screens might trigger frequent eye rubbing and also account for the incidence of keratoconus.⁸

Eye rubbing facilitates lubrication, provides immediate comfort and relief, but it causes central corneal epitheliopathy leading to further discomfort, which triggers eye rubbing again, making it a vicious cycle.^{8,9} Eye rubbing may also increase the risk of infection, aggravate ocular allergy, increases the potential for injury, causes pesky dark circles and long-term side effects.

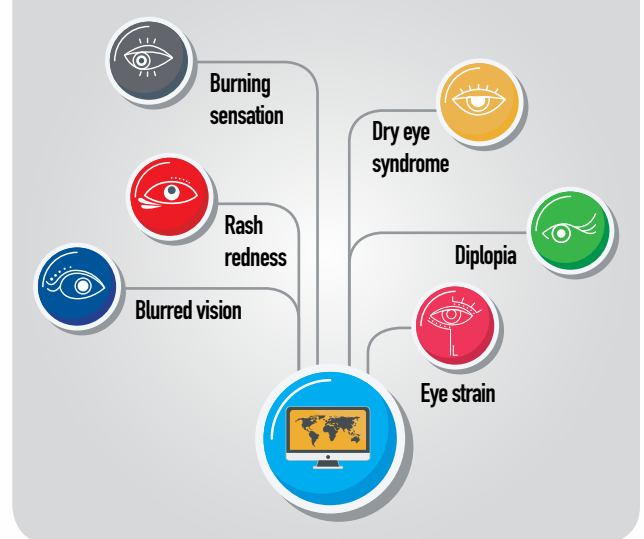
Corneal abrasions

Corneal abrasions result from cutting, scratching, or abrading the thin, protective, clear coat of the exposed anterior portion of the ocular epithelium. These injuries cause pain, tearing, photophobia, foreign body sensation, and a gritty feeling.¹⁰

Keratoconus

Chronic eye rubbing has been implicated in the development and progression of keratoconus. Frequent eye rubbing with very long episodes of vigorous forceful knuckle rubbing is observed in individuals having keratoconus.¹¹ In addition, structural changes and deformations in the cornea are initiated and aggravated by the mechanical force of rubbing the eye.¹²

FIGURE 1. THE SYMPTOMS OF COMPUTER VISION SYNDROME



The consequences of rubbing appear as an active process, while any recovery from these responses is apparently of passive nature. Hence, avoidance of the possibility of permanent adverse changes is clearly preferable, but advice to avoid rubbing may not eliminate rubbing.¹³

Significance of tear film

The tear film provides corneal lubrication, nourishment and protection to the optical surface. Tear film also has anti-infective properties, helps in the removal of bacteria, cells, and debris, and optimizes the optical interface between air and cornea. The key principle for the management of dry eye disease is to improve tear film by the administration of topical artificial tear substitutes.

Tear film is triphasic, comprising of a mucoid layer, aqueous layer, and lipid layer, Figure 2.¹⁴

The lipids layer: maintains the surface tension, viscosity, and elasticity, which aid the tear film to maintain the ocular surface integrity and reduce evaporation of underlying aqueous layer. The lipid layer also interacts with the mucin and enhances the formation of aqueous film that spreads uniformly over the ocular surface.

The aqueous layer: contains water, proteins, cytokines, growth factors etc, it is considered crucial in cell signaling and rehabilitation of the ocular surface during disease conditions. The aqueous phase also contains electrolytes and maintain the tear osmolarity.

The mucin layer: produced by the conjunctival goblet cells contains mucins, this mucin layer is in contact with the epithelium and acts as surfactant by evenly spreading the tear film on the ocular surface.

Management of patients with strong provocation to rubbing

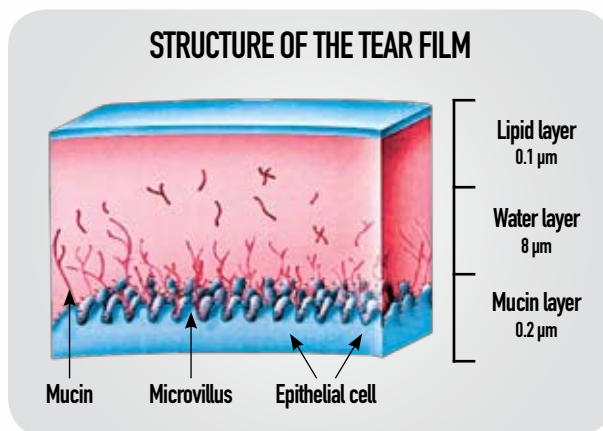
The patients who experience strong provocation to rubbing or have well established rubbing habit, a habit reversal program is indicated. Successful habit reversal may slow the rate of ectasia progression.

Role of dextran, HPMC, and Glycerin in protecting tear film

Dextran: Dextran, a high-molecular-weight polysaccharide, is a demulcent and enhances the demulcent qualities of HPMC, and HPMC and dextran act simultaneously to create a viscous and soothing drop.¹⁴

HPMC: HPMC, a viscosity imparting agent can be formulated as oil-in-water emulsions, and the mucoadhesive properties of the polymer in combination with an oil can help supplement both the mucin and lipid components of the tear film. The HPMC forms a thin film over precorneal tear film while dextran provides mechanical strength to this film.¹⁴ HPMC and dextran enhance tear stability. They reduce loss by evaporation, thus helps to retain moisture in the eye and relieve the chronic ocular inflammation associated with dry eyes. Artificial tear substitutes help to reduce patient discomfort improve quality of life and reduce the risk of damage to the corneal epithelium.⁵

Glycerin: Glycerin has been shown to draw/binds water to cells. Also may act as an osmoprotective agent, protecting the ocular surface from the effects of increased osmolarity.¹⁵



SUMMARY

There is increased incidence of long term exposure to computer or other display device especially smart phones. This long-term exposure has led to the development CVS which manifest a number of visual symptoms. Rubbing eyes may result in the development or progression of other ocular diseases such as keratoconus. Use of eye drops containing HPMC, dextran, and glycerine may help in reducing the visual symptoms.

References: 1. Parihar JKS, Jain VK, Chaturvedi P, et al. Computer and visual display terminals (VDT) vision syndrome (CVDTs). Medical Journal Armed Forces India. 2016; 7e 2(3):270–276. 2. Margareta BC, Elena SD, Andreea NC, et al. Eyesight quality and Computer Vision Syndrome. Romanian Journal of Ophthalmology. 2017; 61(2):112–16. 3. Zhang X, VimalinJeyalathaXV, YangluowaQu, et al. Dry eye management: Targeting the ocular surface microenvironment. Int J Mol Sci. 2017; 18:1398. 4. Hirota M, Uozato H, Kawamorita T, et al. Effect of incomplete blinking on tear film stability. Optom Vis Sci. 2013;90(7):650–57. 5. Mansour AM, Haddad RS. Corneal topography after ocular rubbing. Cornea. 2002;21(8):756–75. 6. McMonnies CW, Alharbi A, Boneham GC. Epithelial responses to rubbing-related mechanical forces. Cornea. 2010;29(11):1223–231. 7. Kittaka H, Tominaga M. The molecular and cellular mechanisms of itch and the involvement of TRP channels in the peripheralsensory nervous system and skin. Allergol Int. 2017;66:22–30. 8. Gatinel D. Eye rubbing, a Sine Qua non for keratoconus? Int J KeratEctCor Dis. 2016;5(1):6–12. 9. Gordon-Shaag A, Millodot M, Essa M, Garth J, Ghara M, Shneor E. Is consanguinity a risk factor for keratoconus? Optom Vis Sci. 2013;90(5):448–54. 10. Wilson SA, Last A. Management of corneal abrasions. Am Fam Physician 2004;70:123-8,129–30. 11. Osuagwu UL, Alanazi SA. Eye rubbing-induced changes in intraocular pressure and corneal thickness measured at five locations, in subjects with ocular allergy. Int J Ophthalmol. 2015; 8(1): 81–88. 12. MacMonnies CW. Management of chronic habits of abnormal eye rubbing. 13. Redkar M, Srividya B, Ushasree. Dextran-HPMC eye drops as artificial tears. Journal of Scientific & Industrial Research. 2000; 59: 1027–31. 14. Safarzadeha M, Azizzadeh P, AkbarshahiP. Comparison of the clinical efficacy of preserved and preservative-free hydroxypropyl methylcellulose-dextran-containing eyedrops. Journal of Optometry (2017) 10, 258-64. 15. McNamee A. Dry eye preparations: an update, Practice Guidece. 2014:1-3.