

## Salivation induced better lacrimal gland function in dry eyes

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### ABSTRACT

The dry eye syndrome is a common eye symptom causing blurry vision. To meet the demand of the modern world students and professionals are compelled to expose themselves to the computer screen for long stretch of time, which is one of the causes of dry eye. It is not always feasible to instil eyes with artificial tears time to time to protect them from dryness. Rather to adopt any simple physiological process associated with optimum lacrimation is a better option to keep eyes moist during computer works. Volunteers (n=22) having mild dry eyes participated in this study. Tear production was assessed by Schirmer test by keeping Schirmer strip on ocular surface for 5 minutes and recording the length of the moistened area. Then the subject was allowed to keep a piece of lopsy candy (a sour fruit pulp mixed with sugar that is sweet and sour in taste) in mouth for 5 minutes that caused salivation. During salivation, again tear production was assessed. [It was standardized in such a way that, the length of the moistened strip will be 25 – 30 mm for normal eyes, 15 – 10 mm for dry eye, 06 – 10 mm for mild dry eye, 02 – 05 mm for moderate dryness and 00 – 01 mm for severe dry eye.] Tear production was found to be increased significantly (supported by increased length of moistened area of Schirmer strip) during salivation especially in dry eye in all volunteers. The lacrimal gland is the major contributor to the aqueous layer of the tear film which consists of water, electrolytes and proteins; secretion of which are under tight neural control. Anticholinergic agents play an important role in ocular dryness because of hypo-secretion. The sensory root of facial nucleus contains efferent preganglionic parasympathetic fibers for submandibular and sublingual salivary gland and lacrimal gland. The sensory root conveys gustatory fibers from the presulcal area (anterior two-third) of the tongue via the chorda tympani and via the palatine and greater petrosal nerve, taste fibers from the soft palate; it also carries preganglionic (secretomotor) innervations of the submandibular and sublingual salivary gland, lacrimal gland and gland of nasal and palatine mucosa. The taste sensation from the anterior two-third of the tongue, carried by the seventh cranial nerve, a nerve, parasympathetic in nature that contains efferent preganglionic fibers to lacrimal gland. Being stimulated, seventh cranial nerve helps in secretion of tear from the lacrimal glands and gives a sense of relief to the persons facing the problem of mild dryness of eyes.

**Keywords:** Schirmer test, dry eye, lacrimation.

### INTRODUCTION

The dry eye syndrome is probably the most common eye symptom causing blurry vision.<sup>1,2</sup> Recent studies reported 21.0% of the adult Chinese in Beijing suffer from dry eye.<sup>3</sup> Factors increasing the symptom are environment, mechanical ventilation, ageing population, refractive surgery of the eye etc.<sup>1</sup> Precorneal tear film alteration leads to complaints that may be caused by thermal factors (low relative humidity; high room temperature), demanding task content (attention decreases blinking and widens the exposed ocular surface) and individual characteristics (eg, tear film alteration, blinking anomalies, lacrimal gland dysfunction and use of contact lenses). These factors and conditions are able to progressively increase water evaporation and faster thinning of precorneal tear film which causes dry spot formation on the cornea causing dry eye syndrome.<sup>4</sup>

To meet the demand of the modern world students and professionals are compelled to expose themselves to the computer screen for long stretch of time, which is one of the causes of dry eye. It is not possible to use artificial tears time to time to protect eye from dryness. Nevertheless, if there remains any option to protect eye physiologically from dryness in working hours it would be definitely better. The present study was planned to search such a physiological process.

### PARTICIPANTS AND METHODS

Volunteers (n=22; male 12, female 10) having mild to moderate dry eyes participated in this study. Tear production in 5 minutes was assessed by Schirmer test (Fig. 1.). Then the subject was allowed to keep a piece of lopsy candy (a sour fruit pulp mixed with sugar that is sweet and sour in taste) in mouth for 5 minutes that caused salivation. During salivation, again tear



Fig.1. Schirmer test

production was assessed. Schirmer test was done by using diagnostic ophthalmic sterile strips (35 mm long 5 mm wide) calibrated for easy reading as shown in Fig. 2. (Lot MDS/SCH/0117 Mfd 2008; Exp 2013) As per direction, participant was positioned in a examination chair with head against a headrest. Examination room lights should be dimmed. Subject was asked to look up and the rounded end of the strip was inserted into the lower temporal lid margin of the eye, making sure that the strip fits snugly. Volunteer was asked to blink normally. After 5 min the strip was removed and the length of the moistened area was recorded. [It was standardized in such a way that, the length of the moistened strip will be 25 – 30 mm for normal eyes, 15 – 10 mm for dry eyes, 06 – 10 mm for mild dry eye, 02 – 05 mm for moderate dryness and 00 – 01 mm for severe dry eye.15 mm was taken within normal limits.]<sup>5,6</sup> Results were analyzed by Student’s t test.  $p < 0.05$  was considered as significant.

**RESULTS**

Tear production was found to be increased significantly (supported by increased length of moistened area of Schirmer strip) during salivation especially in dry eye in all volunteers, 12.18 mm to 19.77 mm in right eye and 13.54 mm to 20.68 mm in left eye. Among the male volunteers length of the moistened area increased from 11.58 mm to 19.58 mm in right eye and 12.25 mm to 19.16 mm in left eye in association with the process of salivation. In case of female participants, length of the moistened area increased from 12.90 mm to 20.00 mm in right eye and 15.10 mm to 22.50 mm in left eye

in association with the process of salivation (Table-1). In both the sexes tear production was increased during salivation indicating no sex difference in this nerve mediated physiological phenomenon.

**DISCUSSION**

Dry eye is complex 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. Instability of the tear film may also cause an increased osmolarity of the tear film, thus triggering epithelial osmotic lesions and inflammation. The occurrence of such changes on the eye surface results in disturbances of homeostatic neurophysiologic mechanisms which further worsen the process and vicious pathophysiological cycles occur.<sup>7</sup>

High periocular relative humidity appears to protect the precorneal tear film against desiccation and sensory irritating pollutants and reduces the development of eye irritation symptoms. This is particularly relevant for intensive computer work, where precorneal tear film is altered resulting in dry spot formation and eye dryness in addition to enhanced susceptibility to sensory irritating pollutants. The workplace thermal condition and schedules (including breaks) should be planned in a way that help to maintain a normal eye blink frequency to minimize alteration of precorneal tear film. Multiple short breaks are justified by the beneficial effect on the precorneal tear film.<sup>8</sup>

Patients with dry eye syndrome have large optical aberrations compared with those in normal eyes, which may be the cause of blurred vision. Instillation of artificial tears reduces the problem and improves the optical quality of vision in these patients.<sup>9-11</sup>

It is not always feasible to instill eyes with artificial tears time to time to protect them from dryness. Rather to

**Table-1:** Alteration of lacrimal gland function induced by salivation.

Site of strip application.	Length of the moistened strip (in mm)			
	Right eye		Left eye	
Conditions	Without salivation (Mean±SD)	With salivation (Mean±SD)	Without salivation (Mean±SD)	With salivation (Mean±SD)
Volunteers irrespective of sex (n = 22)	12.18 ± 4.41	19.77 ± 5.80*	13.54 ± 4.69	20.68 ± 6.46*
Male volunteers (n = 12)	11.58 ± 4.37	19.58 ± 5.75*	12.25 ± 4.91	19.16 ± 5.60*
Female volunteers (n = 10)	12.90 ± 4.58	20.00 ± 6.16*	15.10 ± 4.12	22.50 ± 7.24*

\*  $p < 0.05$

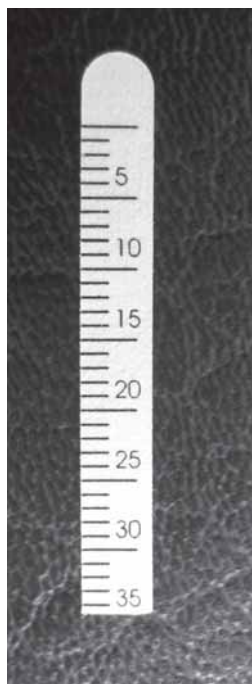


Fig. 2. Calibrated Schirmer strip

adopt any simple physiological process associated with optimum lacrimation is a better option to keep eyes moist during computer works.

The lacrimal gland is the major contributor to the aqueous layer of the tear film which consists of water, electrolytes and proteins. The amount and composition of this layer is critical for the health, maintenance, and protection of the cells of the cornea and conjunctiva (the ocular surface). Small changes in the concentration of tear electrolytes have been correlated with dry eye syndrome. The mechanisms of secretion of water, electrolytes

and proteins from the lacrimal gland are under tight neural control. Lacrimal gland cause secretion of water, electrolytes, and proteins from it onto the ocular surface.<sup>12</sup> Anticholinergic agents play an important role in ocular dryness because of hypo-secretion.<sup>13</sup>

The sensory root of facial nucleus contain efferent preganglionic parasympathetic fibers for submandibular and sublingual salivary gland and lacrimal gland.<sup>14</sup> The sensory root conveys gustatory fibers from the presulcul area (anterior two-third) of the tongue via the chorda tympani and via the palatine and greater petrosal nerve, taste fibers from the soft palate; it also carries preganglionic (secretomotor) innervation of the submandibular and sublingual salivary gland, lacrimal gland and gland of nasal and palatine mucosa.<sup>15</sup>

The taste sensation from the anterior two-third of the tongue is carried by the seventh cranial nerve. Seventh cranial nerve is parasympathetic in nature that contains efferent preganglionic fibers to lacrimal gland. Being stimulated, seventh cranial nerve helps in secretion of optimum quantity of tear from the lacrimal glands and gives a sense of relief to the persons facing the problem of mild dryness of eyes.

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