How to Cite:
Alshaalan, S. M., & Alsahali, A. A. (2024). Effect of atmosphere on the tear film layer. *International Journal of Health Sciences*, *8*(S1), 1114–1126. https://doi.org/10.53730/ijhs.v8nS1.15117

Effect of atmosphere on the Tear film layer

Saud Mohammad Alshaalan
Optometrist, King Fahd Military Medical Complex
Corresponding author email: Saudshlln@yahoo.com

Areej Ahmad Alsahali
Optometrist, King Fahd Military Medical Complex

***Abstract*---**Aim: to demonstrate the effect of the atmosphere (heat and humidity) on the eye by comparing the outdoor and indoor workers. Method: 120 eyes of 60 subjects volunteers from the Saudi electrical company (SECO), their age range was 24 to 40 years. The Schirmer strips test and break up time test were used to evaluates tear film quantity and quality. Result: The results demonstrate that there is a statistical significant difference in tear film quantity and quality between the outdoor and indoor subjects using the Schirmer test and break up time test. Conclusion: This study show the effect of atmosphere heat and humidity on the tear film layer, and the results demonstrate that there significant difference in the tear film quantity and quality between the outdoor and the indoor subjects.

***Keywords*---**Effect of atmosphere, tear film layer.

Introduction

1.1 Tear film

Coating the outer surface of the cornea is a "pre-corneal tear film." People normally blink the eyelids of their eyes about every six seconds to replenish the tear film. Tears have four main functions on the eye which include, the wetting the corneal epithelium, thereby preventing it from being damaged due to dryness, creating a smooth optical surface on the front of the microscopically irregular corneal surface, acting as the main supplier of oxygen and other nutrients to the cornea, and containing an enzyme called "lysozyme" which destroys bacteria and prevents the growth of microcysts on the cornea. (Remington 1998).

1.2 Tear layers

They are three layers of the tear film which different in the structure, function and glands secretion. The most external layer of the tear film is the lipid or oil

layer, the lacrimal or aqueous layer of the tear film and mucoid or mucin layer, which is the inner layer. (Remington 1998).

1.2.1 Lipid layer

The most external layer of the tear film is the lipid or oil layer. This layer prevents the lacrimal layer beneath it from evaporating, as well as prevent-ing the tears from flowing over the edge of the lower eyelid ("epiphora"). The lipid component of the tear film is produced by sebaceous glands known as "Meibomian" glands and the glands of "Zeis". (Remington 1998).

1.2.2 Lacrimal or aqueous layer

This is below the lipid layer of the tear film. This middle layer is the thickest of the three tear layers, and it is formed primarily by the glands of "Krause" and "Wolfring" and secondarily by the "lacrimal" gland, all of which are located in the eyelids, The lacrimal fluid, containing salts, proteins, and lysozyme, has several functions include taking the main nutrients (such as oxygen) to the cornea, carrying waste products away from the cornea, helping to prevent corneal infection, and maintaining the tonicity of the tear film. (Remington 1998).

1.2.3 Mucoid or mucin layer

These is the inner most layer is adsorbed by the glycocalyx of the corneal surface and acts as an interface that facilitates adhesion of the aqueous layer of the tears to the corneal surface. It produced and secret by the conjunctival goblet cells. (Remington 1998).

1.3 Corneal epithelium

The outermost layer of stratified corneal epithelium is five to six cells thick and measures approximately 50 um. The epithelium thickens in the periphery and is continuous with the conjunctival epithelium at the limbus. The surface layer of corneal epithelium is two cells thick and displays a very smooth anterior surface. It consists of no keratinized squamous cells, each of which contains a flattened nucleus and fewer cellular organelles that do deeper cells. The plasma membrane of the surface epithelial cells is believed a glycocalyx component that adjoins the mucin layer of the tear film, changing a relatively hydrophobic surface to hydrophilic surface Much projection located on the apical surface of the outermost cells increase the surface area, thus enhancing the stability of the teat film The finger like projection is microvilli, and the ridgelike ones are microplione. (Remington 1998)

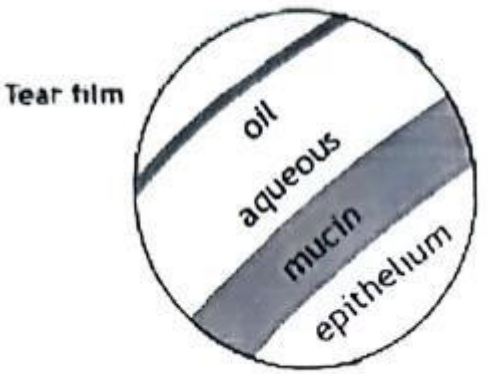

Figure 1.1 Tear layers

1.4 Tear glands

Their are three gland for the tear secretion every one is special for detect layer of the tear they are Maibomean gland, Zies gland, lacrimal gland.

1.4.1 Meibomian gland

This is the large sebaceous glands occupying the length of the tarsal plate Each consists of 10-15 lobes or acini attached to a single large central duct. The duct is arranged vertically such that the opining is located at the edge of the tarsal plate corresponding to the eye lid margin; it is secretion is produced by the decomposition of the entire cell. (Remington 1998).

1.4.2 Zeis glands

This is composed of just one or two acini and are associated with the eyelash follicle. Generally, two Zies glands are present per follicle. The release sebum into the follicle, thereby preventing the cilia from becoming dry and bright. (Remington 1998).

1.4.3 Moll glands

Glands of Moll are modified sweat glands and also are located near the eyelash follicle. They consist of a spiral that begins as a large cavity, the neck of which becomes narrow as it forms a duct. The Molls gland is an apocrine glands; its secretion is composed not of the whole cell but of parts of the cellular cytoplasm. The duct might empty into the duct of a Zies gland or it might open directly onto the lid margin between cilia. (Remington 1998).

1.4.4 Accessory lacrimal glands

There are group of secrtetory cells arranged in an oval around a central lumen. The acini are surround, sometimes incomepletely, by a row of myoepithil. (Remington 1998).

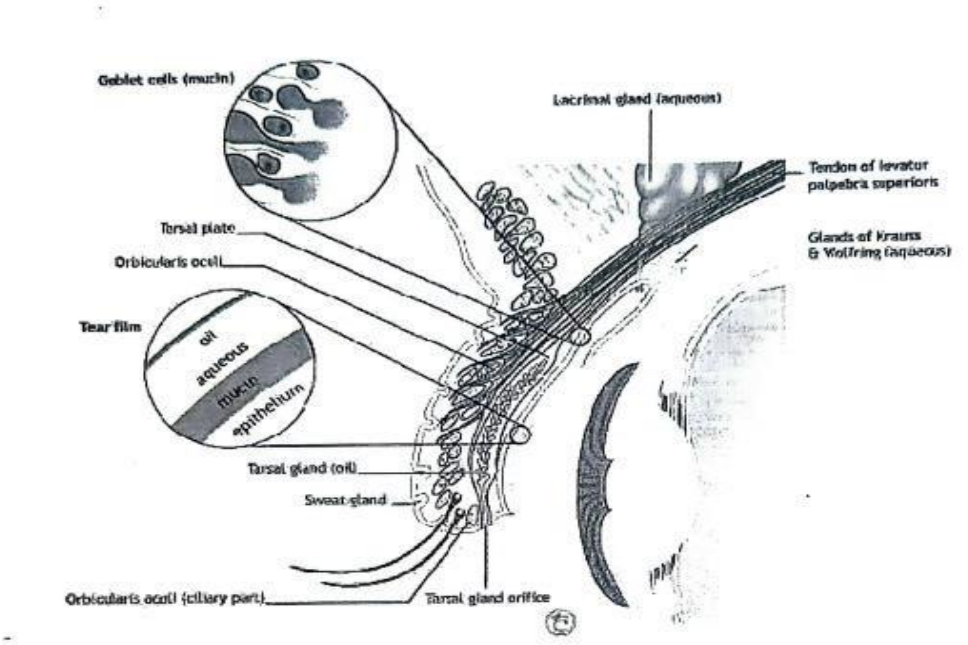

Figure 1.2 lacrimal gland

1.5 Tear Drainage

During closer the eyelids meet first at the temporal canthus, closure then moves. toward the medial canthus, where the tears pool in the lacrimal lake 'The tear menisci are pushed toward the lacrimal puncta into which they drain. (Remington 1998).

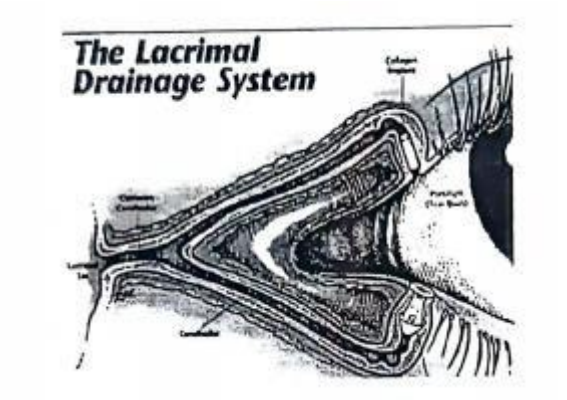

Figure1.3 drainage system

1.6 Dry eye:

Dry eye syndrome is a chronic lack of sufficient lubrication and moisture in the eye. Its consequences range from subtle but constant irritation to ocular inflammation of the anterior (front) tissues of the eye.

1.6.1 Dry Eye syndrome, symptoms and signs

Persistent dryness, scratching and burning in your eyes are signs of dry eye syndrome. Some people also experience a "foreign body sensation," the feeling that something is in the eye. And it may seem odd, but sometimes-watery eyes can result from dry eye syndrome, because the excessive dryness works to overstimulate production of the watery component of your eye's tears.

1.6.2 Causes Dry Eyes

Tears bathe the eye, washing out dust and debris and keeping the eye moist. They also contain enzymes that neutralize the microorganisms that colonize the eye. Tears are essential for good eye health. In dry eye syndrome, the eye doesn't produce enough tears, or the tears have a chemical composition that causes them to evaporate too quickly.

Dry eye syndrome has several causes. It occurs as a part of the natural aging process, especially during menopause; as a side effect of many medications, such as antihistamines, antidepressants, certain blood pressure medicines, Parkinson's medications, and birth control pills; or because you live in a dry, dusty or windy climate. If your home or office has air conditioning or a dry heating system, that too can dry out your eyes. Another cause is insufficient blinking, such as when you're staring at a computer screen all day. Dry eyes are also a symptom of systemic diseases such as lupus, rheumatoid arthritis, diaptic (a triad of dry eyes, dry mouth, and rheumatoid arthritis or lupus).

Long-term contact lens wear is another cause; in fact, dry eyes are the most common complaint among contact lens wearers. Recent research indicates that contact lens wear and dry eyes can be a vicious cycle. Dry eye syndrome makes

contact lenses feel uncomfortable, and the rubbing of the lenses against the conjunctiva seems to be a cause of dry eyes. Incomplete closure of the eyelids, eyelid disease and a deficiency of the tear- producing glands are other causes. (Whitcher 2003)

1.7 Schirmer Test

This is useful when aqueous deficiency is suspected in the absence of slit-lamp signs of Keratoconjunctivitis sicca KCS. The test involve measuring the amount of wetting of a special filter, 5 mm wide and 35 mm long, The test can be performed with or without topical anesthesia. In theory, when performed without an anesthetic (Schirmer) it measure total secretion, basic and reflex. In practice, however, topical anastiesia reduces reflex secretion but does not abolish it completely. The test is performed as follows: the eye is gently dried, the filter paper is folded 5mm from one end and inserted at the junction of the middle and outer third of the lower lid, taking care not to touch the cornea, the patient ask to keep the eyes open and to blink normally, after fife minute the filter paper is removed and the amount of wetting measured. A normal result is over 15mm without anesthesia and slightly less with anesthesia. Between 6 and 10 mm is borderline and less than 6 mm indicates impaired secretion. (Whitcher 2003 & Remington 1998).

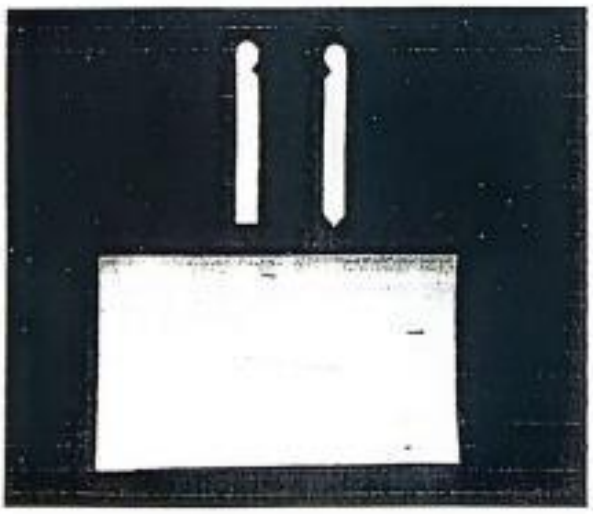

Figure 1.4 Schirmer test

1.8 Break up Time

Fluoroscine dye is instilled into the lower cul-de-sac and spreads throughout the tear film. After a blink, the thin, lipid upper layer begins to break down, and dry spots appear. The time between the complication of the blink and the first appearance of a dry spot is termed the tear film break up time. Normally, the TBUT is greater than 10 seconds and usually is longer than the time between blinks. A short TBUT can occur if irregularities or disturbances in the corneal

surface prevent complete tear film adherence or as a result of abnormality in the lipid layer. (Whitcher2003 & Remington 1998).

Figure1.5 Floursine

2.1 Object

This study to demonstrate the effect of the atmosphere (beat and humodity) on the eye by comparing the outdoor and indoor workers

2.2 Subjects

They subjects where volunteers recruited from Saudi Electrical Company in Dhahran city. Sixteen subjects of male, range age was from 23 to 40years wear included thirty workers of outdoor and thirty workers of indoor

Subjects of outdoor were worked from 8 to 2 o'clock at moming daily, the temperature was between 38-48C with humidity 85%, Range age was (24-40) years, Subjects of indoor were worked also from 8 to 2 o'clock moming. with temperature was between (23 to 26C) and humidity 45%, Range age was (23-37) years.

Exclusion criteria include subject with systemic disease (diabetic, high blood pressure), contact lenses wearing, age over than 40, Incomplete closure of the eyelids, eyelid disease and a deficiency of the tear-producing glands are other causes.

2.3 Method

Dry eye was tested by using Break up Time and Schirmer test. Break up time reading wear taken by the hand held magnifier with the floursine. The subject sat comfortably and look in front to the magnifier, instructed, the room lighting was dimmed. Three measurements wear taken for each eye when the dark spot

appeared; the patient was instructed no blink until the spot appear then full blink between each measurement. Then the average of the three reading was recorded. The normal reading more than ten seconds.

Schirmer test did by used strips, subject sat comfortably and ask to look up then put the head of strip in the lower margin of the eyelid and keep it for fife minute then measure the tear on the strip by the ruler in mm. the normal reading is more than fifteen mm in fife minutes.

3.1 Result

Sixty subjects were both eye tested by Schirmer and Break up Time test. They were divided into two groups, group A and group B representing outdoors and indoor respectively. Each group consist of thirty subjects The subject's age mean and stander deviation for group A and B respectively are with the range (23-40).

Table 3.1 The mean and standard deviation of the subjects age

Subjects groups	Mean +SD
Group A	31.73 +4.91
Group B	30.06+4.46

The results of mean and stander deviation (SD) for group A and group B with using Schirmer test and the break up time test (table 3.2).

Table 3.2 The mean and standard deviation outdoor and indoor subjects

Subjects groups	Test	Outdoor (mean ± SD)	Indoor (mean ± SD)
Group A	Schirmer test	27.8+14.58	41.833 + 15.38
Group B	break up time	11.16+5,93	17.3+6.39

The result of unpaired test (nonparametric) for group A and B using Shirmer test show that the two-tailed P value was <0,0001, which considered extremely significant.

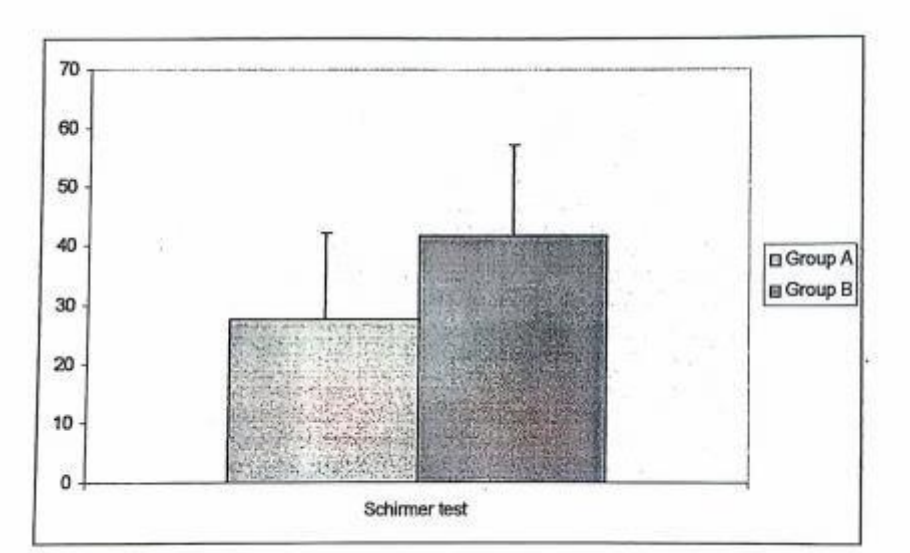

Figure 3.1 Mean and SD of group A and B by using the Schirmer test

The result of unpaired test (nonparametric) for group A and B using break up time test show that the two-tailed P value was < 0.0001, which considered extremely significant.

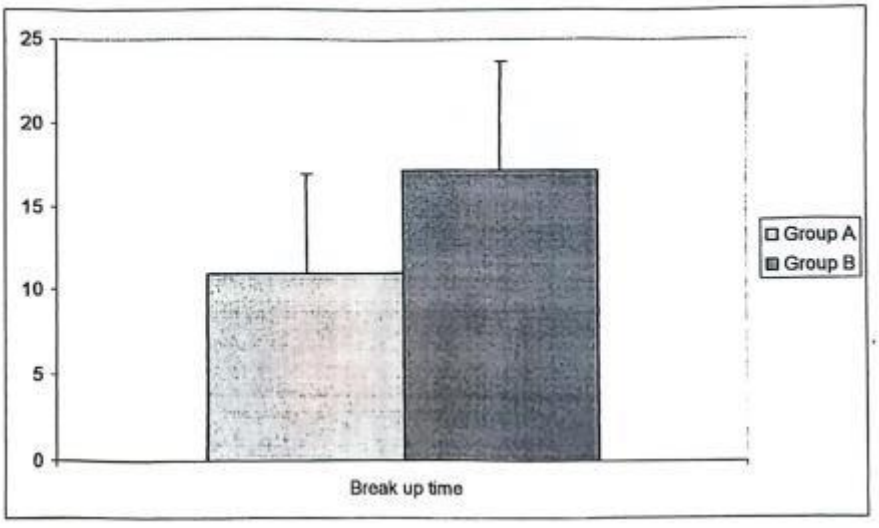

Figure 3.1 Mean and SD of group A and B by using break up time

4.1 Discussion

With aging, the eye naturally produce less tears, However, some time the lipid and mucin layer produced by the eye are of such decrease quality that tears cannot remain on the eye long enough to keep it lubricate, which that is consider the

main factor of dry eye in the elderly. Several studies document that tear film decrease significantly with aging (Scot E et al. 2004 and Schein OD, HMC. et al. 1999).

Generally, humidity and temperature will effect the tear film layers. The lipid layer of the tear film significantly will change following alterations in humidity. For example, increasing periocular humidity results in an increase in tear film lipid layer thickness, possibly by providing an environmental that is more conducive to the spreading of Meibomian lipid and its incorporation into the tear film. Several studies document that incidence of evaporation of tear film decrease with increases humidity.. Aronowicz JD et al. in 2006, and Korb Dr. GreinerJV et al in 1996, and P. Wolkoff et al in 2006.

Exposure to high temperature can effect the tear film layer by increasing evaporation of the tear layer leading to dry eye. The result of this study shows that there is significant difference in tear film results using Shirmer test and tear break up time between the outdoor and indoor subjects. Our result was confirmed by pervious studied, Khurana AK et al in 1991, Craig Jp. et al. in 2000.

4.2 Conclusion

This study show the effect of atmosphere on the tear film layer, and the results demonstrate that there significant difference in the tear film quantity and quality between the outdoor and the indoor subjects.

4.3 Recommendations

- Dry eye syndrome has no cure, yet symptoms can be managed.
- The main management are over-the-counter artificial tears and lubricate such as Viscotear that can be used day or night to lubricate the eye.
- Avoiding or reducing exposure to high temperature and low humidity, direct air condition of the car for long periods

Appendix

Tear film layer reading tested by using Schirmer test and TBUT
Of OUTDOOR

	SHT in 5min		TBUT	
	OD	OS	OD	OS
Subject 1	8	22	7	13
Subject 2	40	6	19	4
Subject 3	40	22	12	5
Subject 4	10	14	7	9
Subject 5	68	62	30	25
Subject 6	6	8	5	5
Subject 7	26	52	11	14
Subject 8	34	22	15	8
Subject 9	30	24	13	15
Subject 10	10	14	6	8
Subject 11	10	12	3	4
Subject 12	40	40	19	21
Subject 13	14	10	6	3
Subject 14	44	40	17	10
Subject 15	22	14	7	6
Subject 16	46	40	16	12
Subject 17	26	20	8	7
Subject 18	38	50	15	20
Subject 19	12	26	5	9
Subject 20	40	26	13	8
Subject 21	40	22	14	7
Subject 22	14	18	12	7
Subject 23	12	24	7	9
Subject 24	28	24	9	12
Subject 25	24	32	9	17
Subject 26	30	22	8	12
Subject 27	60	50	25	23
Subject 28	30	26	12	8
Subject 29	30	34	11	13
Subject 30	32	26	10	9

Tear film layer reading tested by using Schirmer test and TBUT
INDOOR

	Shirmer in 5min		TB	UT
	OD	OS	OD	OS
Subject 1	24	32	9	12
Subject 2	18	40	8	22
Subject 3	46	40	19	16
Subject 4	60	64	26	2
Subject 5	22	18	8	8
Subject 6	34	28	10	5
Subject 7	36	40	12	7
Subject 8	44	48	19	25
Subject 9	54	28	28	24
Subject 10	22	28	13	18
Subject 11	54	46	23	17
Subject 12	14	18	8	13
Subject 13	56	60	23	22
Subject 14	52	50	14	20
Subject 15	60	60	15	21
Subject 16	54	48	28	23
Subject 17	46	50	13	26
Subject 18	62	60	19	22
Subject 19	22	30	6	16
Subject 20	24	24	5	10
Subject 21	23	36	28	20
Subject 22	40	44	22	7
Subject 23	48	45	24	24
Subject 24	28	22	18	18
Subject 25	46	54	17	17
Subject 26	18	14	13	11
Subject 27	58	68	22	17
Subject 28	56	60	20	11
Subject 29	52	50	21	17
Subject 30	60	60	23	24

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