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Original Research Article

Clinical correlation between dry eye and pterygium: a study done at government medical college Jammu, Jammu and Kashmir, North India

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ABSTRACT

Background: To study the prevalence of dry eye among the patients of pterygium and to find the clinical correlation between dry eye and pterygium.
Methods: The study was conducted at postgraduate department of Ophthalmology of GMC Jammu over a period of one year. 90 pterygium patients and 180 age and sex matched controls presenting to the eye OPD of GMC Jammu were included in the study. The TBUT, Schirmer's test, basal tear secretion and Rose Bengal staining score were estimated in all patients. A TBUT of less than 10 seconds, a Schirmer's test of less than 10mm, basal tear secretion of less than 10mm, Rose Bengal staining score of more than 3 were considered abnormal.
Results: Redness 57 (63.33%) was the most frequently occurring symptom in pterygium patients followed by cosmosis 49 (54.44%). The mean TBUT, mean Schirmer's, mean basal secretion and mean Rose Bengal staining score values were 9.88±3.39 seconds, 13.17±4.57mm, 10.11±4.81mm and 3.27±1.85 in pterygium patients and 14.22±3.99 seconds, 16.40±5.21mm, 12.19±5.05mm and 2.49±1.86 in the control group respectively. There was a statistically significant difference in the dry eye results between the pterygium patients and control groups ($p<0.001$). The odd's ratio between dry eye and pterygium was 3.83, dry eye was present in 53 pterygium patients.
Conclusions: The prevalence of dry eye in pterygium patients was 58.89% which suggests that there is a strong positive clinical correlation between dry eye and pterygium.

Keywords: Dry eye, Pterygium, Schirmer test, Tear secretion, Tear film instability, Tear film break up time

INTRODUCTION

Pterygium is typically characterized by proliferation of the subconjunctival tissue as vascularized granulation tissue, which destroys the superficial layer of stroma and Bowman's membrane as it invades the cornea.[1] One of the theories is that the tear film abnormalities causes local drying of the cornea and conjunctiva which in turn predisposes to these new growths.[2] Generally, it is asymptomatic but may cause redness, lacrimation, photophobia, foreign body sensation and astigmatism. As it advances, it encroaches the pupillary area causing decrease in the visual acuity. It is a potentially blinding disease in the advanced stage when it encroaches visual axis, which can have significant impact on vision and require surgery for visual rehabilitation.[3]

Dry eye is a common disorder affecting a significant percentage of the population, particularly in those older than 40 years, throughout the world. In 1995 the National

Eye Institute/Industry Workshop published the definition of dry eye states and a new classification. It states that "Dry eye is a disorder of the tear film due to tear deficiency or excessive tear evaporation which causes damage to the interpalpebral ocular surface and is associated with symptoms of ocular discomfort. There are two main categories of dry eye states, an aqueous tear deficiency state and an evaporative state. The aqueous tear deficiency state is subdivided into Sjogren's syndrome-associated keratoconjunctivits sicca and non-Sjogren's KCS (non-SS-KCS).[4] The definition and classification of dry eye was updated in 2007 during the tear film and ocular surface (TFOS) dry eye work shop (DEWS). Dry eye is a 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.[5] Dry eye disease can decrease the performance of activities of daily living and is associated with an overall decrease in quality of life.[6] Several clinical tests are available to measure various aspects of the integrity of the tear film and ocular surface such as Schirmer test, tear film break up time (TBUT) and vital dye staining of the ocular surface.[7]

Dry eye can range from mild to severe; Risk factors of dry eye are increasing age, male sex, occupation, smoking and pterygium. It has been found that current history of smoking and pterygium are independent risk factors associated with dry eye.[8] Patients with decreased tear production are more prone to the damaging effects of UV rays in the sun.[9] This study was done to study the prevalence of dry eye among the patients of pterygium and to find the clinical correlation between dry eye and pterygium.

METHODS

The present study was conducted on 90 patients with primary pterygia and180 age and sex matched controls attending the out-patient department of upgraded department of ophthalmology, government medical college Jammu, Jammu and Kashmir, India over a period of one year from November 2014 to October 2015 after due clearance from Institutional ethics committee.

The informed consent from all the patients were undertaken before inclusion in the current study. All principal of bioethics was followed in totality as per ICMR and CDSCO advocated good clinical practice guidelines. The data was recorded by independent observer.

Inclusion criteria

- *Cases:* Patients presenting with pterygium during study period
- *Controls:* Age and sex matched normal healthy subjects presenting with refractive error.

Exclusion criteria

Subject with systemic diseases\syndromes associated with dry eye (e.g. Sjogren's syndrome), subject on systemic medication (e.g. diuretics, psychotropic, that leads to ocular drying), contact lens users, subjects having other adnexal disease, anterior or posterior segment disease which alters tear secretion and stability, patients having recent ocular surgery (e.g. cataract surgery), patients on topical antiglaucoma medications that leads to ocular drying, those who did not gave consent.

Both the groups (cases and controls) after meeting the inclusion and exclusion criteria were worked out in detail in the department of ophthalmology as under:

- Detailed history pertaining to symptoms was recorded-onset, duration, any aggravating factor
- The patients were subjected to a routine general physical examination
- Every patient underwent a detailed ophthalmic examination as:

  (a) external eye examination: includes examination of eyelids, conjunctiva, cornea, iris, pupil, lens,
  (b) visual acuity (both distance and near vision),
  (c) slit lamp examination: to visualize the anterior segment of the eye,
  (d) the following tests were performed as given below.

Tear film break up time (TBUT)

Because manipulation of the eyelid or instillation of the anaesthetic may affect the tear film break up time, the TBUT test was performed before other dry eye tests and recorded after fluorescein staining. Care was taken to avoid contact with the cornea to prevent an excessive reflex secretion of tear. The patient was examined on the slit lamp under red free illumination provided by blue filter. The time interval between the opening of the eye lids and appearance of the first dry spots on the tear film was recorded using a stop watch. Three recordings were taken and the average was recorded as the TBUT and considered positive if the average tear film break up time was less than 10 seconds.

Schirmer's test

- Without anesthesia (Schirmer's test- 1)
- After anesthesia (Basal Secretion/SCH-2).

The Schirmer's test was performed after a thorough slit-lamp examination so that ocular irritation by the test strip would not interfere with other examination results. The material used was commercially available Whatman no. 41 filter paper strips measuring 35x5 mm known as Schirmer's tear test filter strips and is folded 5mm from one end. The patient was made to sit in a dimly lit room,

the strip folded at the notch was placed gently over the lower palpebral conjunctiva at the junction of lateral 1/3 and medial 2/3. The patient was instructed to keep his eyes open and look straight ahead and blink normally. After 5 minutes, the strips were removed and the amount of wetting in millimeters was recorded. The Schirmer's-1 test (without anaesthesia) was considered positive if the length of the wetting was less than 10mm at the end of 5 minutes. The Schirmer's test after anesthesia (Basal secretion) was performed after the instillation of topical 4% xylocaine and wiping the lower fornix with cotton, in the same manner as the Schirmer's-1 test.

Rose Bengal Staining

The test was performed by applying a slightly moistened Rose Bengal filter paper strip to the inferior bulbar conjunctiva, preceded by a drop of topical anaesthetic and the excess washed out with saline. The patient was examined on the slit lamp under red free illumination provided by green filter. Van-Bijsterveld grading scale was used that divides the ocular surface into 3 zones: 1) Nasal bulbar conjunctiva 2) Temporal bulbar conjunctiva 3) The cornea. Each zone was evaluated for the density of staining in the range of 0-3. Each section was given a score of upto three points, so that a maximum score of nine could be obtained. The dots were counted as: single (1 point), scattered (2 points), confluent (3 points) and each part of the ocular surface was added up. An additive zone stain total of more than 3 in the eye constitute a positive test.

Statistical analysis

The data was analysed using statistical software MS Excel / SPSS version 17.0 for windows. Data presented as percentage (%) and mean (SD) as discussed appropriate for quantitative and qualitative variables. Relationship between dry eye and pterygium ascertained by calculating Odd's ratio with 95% confidence interval. Statistical significance between the groups was evaluated using student 't' test/chi square test. A p value <0.05 was considered as statistically significant and p value of <0.01 was considered statistically highly significant.

RESULTS

The present study was carried out on 90 pterygium patients with primary pterygia and 180 age and sex matched controls who attended eye OPD, GMC Hospital, Jammu over a period of one year. During the study following observations were made.

In the present study, the most frequently occurring symptom in pterygium patients were redness 5 7(63.33%), followed by cosmosis 49 (54.44%) (Table 1).

Tests for tear secretion and tear stability

Tear film break up time (TBUT)

The mean TBUT value was 9.88±3.39 seconds in pterygium patients and 14.22±3.99 seconds in control group. The mean difference was 4.34 seconds which was highly significant (p-value<0.001) (Table 2 and Figure 1).

Table 1: Frequency of symptoms in pterygium cases.

Symptoms	No. of cases	%
Cosmosis	49	54.44
Redness	57	63.33
Foreign body sensation	12	13.33
Diminution of vision	30	33.33
Grittiness	35	38.89

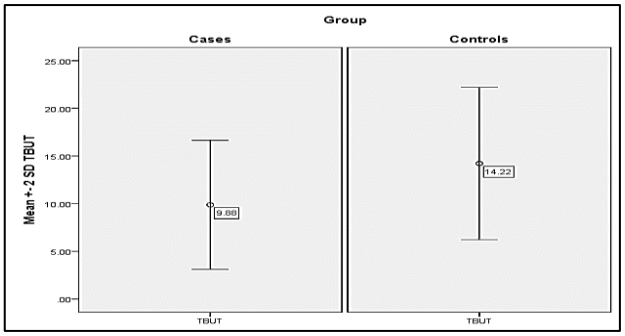

Figure 1: Error bar of mean(SD) TBUT scores in cases and controls.

Table 2: The mean TBUT, mean Schirmer's-1, mean basal secretion and mean Rose Bengal staining score values in cases and controls.

Tests	Cases(n=90)		Controls(n=180)		Statistical inference	
	Mean	SD	Mean	SD	Mean difference	®P -value
Mean TBUT	9.88	3.39	14.22	3.99	4.34	<0.001(H.S.)
Mean SCH-1	13.17	4.57	16.40	5.21	3.23	<0.001(H.S.)
Mean basal	10.11	4.81	12.19	5.05	2.08	<0.001(H.S.)
Mean Rose Bengal	3.27	1.85	2.49	1.86	0.78	<0.001(H.S.)

® T-test, H.S.=highly significant.

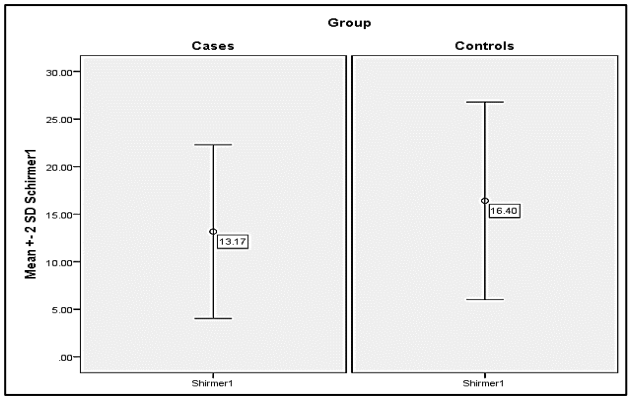

Figure 2: Error bar of mean(sd) Schirmer's 1 scores in cases and controls.

Schirmer 1 test

The mean Schirmer value was 13.17±4.57 mm in pterygium patients and 16.40±5.21 mm in control group. The mean difference was 3.23 mm which was highly significant (p-value < 0.001) (Table 2 and Figure 2).

Basal secretion values/Schirmer's test with anesthesia

The mean basal secretion value was 10.11±4.81 mm in pterygium patients and 12.16±5.05 mm in control group. The mean difference was 2.08 mm which was highly significant (p-value < 0.001) (Table 2 and Figure 3).

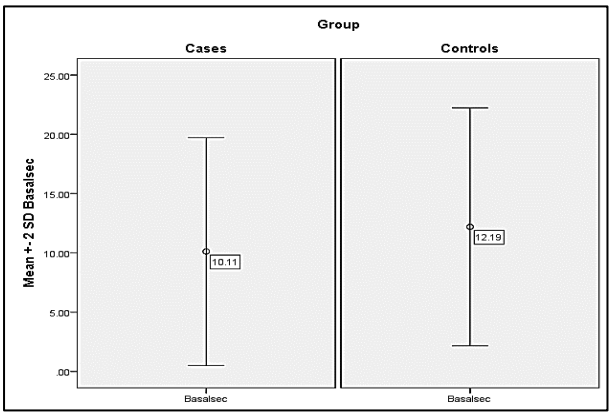

Figure 3: Error bar of mean(SD) Basal secretions scores in cases and controls.

Rose Bengal staining score

Mean Rose Bengal staining score in pterygium patients was 3.27±1.85 and in control group was 2.49±1.86. The mean difference was 0.78 i.e. increase of score was seen in cases which was significant (p value< 0.001) (Table 2 and Figure 4).

The TBUT test was conducted and analysed showed 43 (47.78%) unstable tear film, 37 (41.11%) borderline and 10 (11.11%) normal tear film in pterygium patients. Similarly, 37 (20.56%) showed unstable tear film, 29 (16.11%) borderline and 114 (63.33%) normal tear film in the control group (p<0.001) (Table 3).

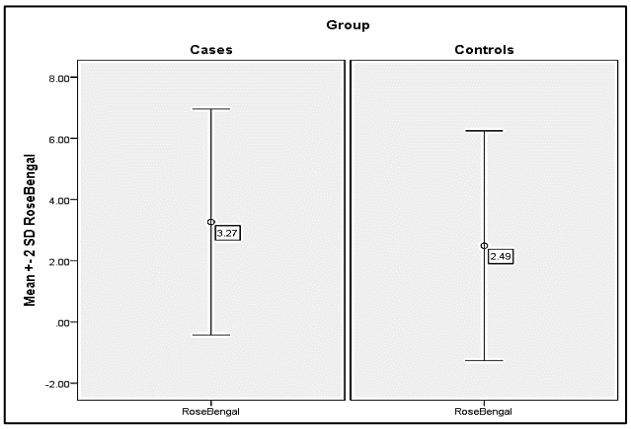

Figure 4: Error bar of mean(sd) Rose Bengal scores in cases and controls.

Table 3: Degree of tear instability (TBUT).

TBUT	<10sec (unstable)		10-15sec (borderline)		>15sec (normal)	
	No.	%	No.	%	No.	%
Cases	43	47.78	37	41.11	10	11.11
Controls	37	20.56	29	16.11	114	63.33

Chi square test 65.98, P value <0.001 (highly significant).

Table 4: Degree of dry eye, SCH-1, basal secretion in cases and controls.

SCH-1 (in mm)	Cases		Controls	
	no.	%	no.	%
<2	0	0	0	0
>2-6	8	8.89	5	2.78
>6-10	22	24.44	29	16.11
>10-15	18	20.00	21	11.67
>15	42	46.67	125	69.44
total	90	100	180	100
Basal secretion (in mm)	**Cases**		**Controls**	
	no.	**%**	**no.**	**%**
<2	2	2.22	2	1.11
>2-6	20	22.22	31	17.22
>6-10	23	25.56	27	15.00
>10-15	17	18.89	59	32.78
>15	28	31.11	61	33.89
total	90	100	180	100

Regarding the degree of dry eye, a Schirmer's test of ≤ 2 mm was not seen in both the pterygium patients and the control groups, whereas in pterygium patients, the Schirmer's test was >2-6mm in 8 (8.89%), >6-10mm in 22 (24.44%), >10-15mm in 18 (20%), >15mm in 42 (46.67%) whereas in the control group the Schirmer's test was >2-6mm in 5 (2.78%), >6-10mm in 29 (16.11%), >10-15mm in 21 (11.67%), >15mm in 125 (69.44%) (Table 4). Out of 90 cases basal secretion value of ≤ 2mm

was seen in 2 (2.22%), >2-6mm in 20 (22.22%), >6-10mm in 23 (25.56%), >10-15mm in 17 (18.89%) and 15 mm in 28 (31.11%) while out of 180 controls basal secretion value of ≤2mm in 2 (1.11%), >2-6mm in 31 (17.22%), >6-10mm in 27 (15.00%), >10-15mm in 59 (32.78%) and >15 mm in 61 (33.89%) (Table 4).

Table 5: Results of dry eye tests.

Tests	Cases (no.)	%age	Total	Controls	%	Total
Normal TBUT, Normal Schirmer's, Normal Rose Bengal	37	41.11	37 (41.11%)	131	72.78	131 (72.78%)
Normal TBUT, Abnormal Schirmer's, Abnormal Rose Bengal	6	6.67		8	4.44	
Normal TBUT, Normal Schirmer's, Abnormal Rose Bengal	0	0		0	0	
Normal TBUT, Abnormal Schirmer's, Normal Rose Bengal	4	4.44		4	2.22	
Abnormal TBUT, Normal Schirmer's, Normal Rose Bengal	5	5.56	53 (58.89%)	5	2.78	49 (27.22%)
Abnormal TBUT, Normal Schirmer's, Abnormal Rose Bengal	18	20		10	5.56	
Abnormal TBUT, Abnormal Schirmer's, Normal Rose Bengal	0	0		0	0	
Abnormal TBUT, Abnormal SCH-1, Abnormal Rose Bengal	20	22.22		22	12.22	
Total	90	100	90 (100%)	180	100	180 (100%)

Table 6: Relationship of cases and dry eye.

Dry eye	Cases no. (%)	Controls no. (%)	Total no. (%)	OR (95%CI)
Yes	53 (58.89%)	49 (27.22%)	102 (37.78)	3.83 (2.24-6.52)
No	37 (41.11%)	131 (72.78%)	168 (62.22%)	
Total	90 (100%)	180 (100%)	270 (100)	

Chi square test 25.6, p value <0.001 highly significant.

As seen in Table 5, dry eye tests were normal in 37 (41.11%) pterygium patients and 131 (72.78%) control group whereas abnormal dry tests were found in 53 (58.89%) pterygium patients and 49 (27.22%) of the control group.

The prevalence of dry eye in pterygium patients was 58.89% with 95% CI (48.5-68.7). The relationship between dry eye and pterygium was found to be highly significant (p<0.001) (Table 6).

DISCUSSION

Pterygium is an ocular degenerative condition that has been attributed to environmental factors. It is found in areas of bright sunlight and may be linked to ultraviolet (UV) light. It is thought that UV light causes destruction of the tear film due to rapid evaporation. Tear film dysfunction has been found in subjects with pterygium. In India investigators have found abnormalities of tear function in eyes with pterygia while others have found no abnormalities. The differences in findings might be related to the differences in methodology used, or the differences in geographical locations.[10]

In the present study, maximum number of pterygium patients present with redness 57 (63.33%), followed by cosmosis 49 (54.44%), grittiness 35 (38.89%). Roka N et al also found that redness was the most common symptom of pterygium patients followed by grittiness and burning sensation.[4] Ganeshpuri AS et al also found that burning sensation, grittiness and redness were the common symptoms of pterygium patients.[11]

Tear film break up time (TBUT)

In this study, the mean TBUT value was 9.88±3.39 in pterygium patients and 14.22±3.99 in control group. The mean difference was 4.34 which was highly significant. The composition of tear film, including the lipid, aqueous and hydrodynamic factors, are extremely critical in tear film stability. The reduced TBUT can be caused by several mechanisms such as normal eyelid blinking may be compromised in the eyes with pterygium, that may lead to desiccated epithelium, and may result in less ability and shorter TBUT, furthermore, the presence of irregularity in the surface epithelium in the case of pterygium can compromise the surface tension and stability of tears. The marked abnormality of TBUT, which was found more frequently in association in eyes with pterygia than eyes without pterygia also suggests that there may be an abnormality of mucin which may be a predisposing factor for pathogenesis of pterygium, or that pterygium itself causing abnormalities of mucin.[12] Rajiv et al found that mean TBUT in normal healthy eyes was 10.4 seconds and in eyes with pterygium was 5.6 seconds. When compared with normal subjects the TBUT was markedly reduced in patients with pterygium.[13] Moreno JC et al found that TBUT value were significantly reduced in the eyes with pterygium.[14] Wang S et al found that TBUT in the eyes with pterygium when compared with the opposite healthy eyes were significantly different ($p < 0.05$).[15] Rajab AY had found that mean TBUT in pterygium patients was 11.4±6 seconds while in control group the mean TBUT was 15±4.5 seconds. There was significant difference between the mean TBUT of the two groups.[12] Roka N et al had also found that the mean TBUT was 10.56 seconds in pterygium patients and 16.52 seconds in the control group and also there was statistical significant difference between the two groups ($p<0.05$).4 El-Sersy TH found that the mean TBUT was 11.70±2.16 s in normal healthy eyes with a range from 8.5 to 16.0 s. However, in eyes with pterygium this value was markedly reduced to 5.91±1.95 s. TBUT was statistically significantly different between the patients and controls ($P < 0.0001$).[16]

Schirmer's test

In this study, the mean Schirmer-1 value was 13.17±4.57 in pterygium patients and 16.40±5.21 in control group. The mean difference was 3.23 which was highly significant. Rajiv et al found that mean SCH 1 in normal healthy eyes was 12.6 mm and in eyes with pterygium was 5.2mm.When compared with normal subjects the SCH 1 was markedly reduced in patients with pterygium.[13] Moreno JC et al found that Schirmer's test value were significantly reduced in the eyes with pterygium.[14] Roka N et al had also found statistically significant difference between mean Schirmer test value of pterygium patients and control group.4 El-Sersy TH had also found that the mean wetting length of the filter paper in the Schirmer-l test was 13.76 ± 2.06 mm (range 11-17 mm/5 min) in normal healthy eyes and 5.85±1.86 mm (range 3-9.5 mm/5 min) in the eyes of patients with pterygium. The difference was statistically significant between the patients and controls ($P < 0.0001$). In this study, the mean basal secretion value was 10.11±4.81 mm in pterygium patients and 12.16±5.05 mm in control group. The mean difference was 2.08 mm which was highly significant.[16] Ishioka M et al found that the Schirmer's test with anesthesia was shortened in the eye with pterygium with significance.[17] Chaidaroon W and Pongmoragot N had found mean Schirmer's test value with anesthesia was 11.6±0.4 mm in eyes with pterygium and 12.4±0.4 mm in eyes without pterygium which revealed that Schirmer's test value with anesthesia was decreased significantly in eyes with pterygium when compared with a healthy eye.[18] Roka N et al had also found that the mean basal secretion was 10.01 mm in pterygium patients and 13.25 mm in the control group and also there was statistical significant difference between the two groups ($p<0.05$).[4]

Rose Bengal test

In this study, the mean Rose Bengal staining value was 3.27±1.85 in pterygium patients and 2.49± 1.86 in control group. There was increase of 0.78 in mean Rose Bengal staining score of pterygium patients when compared to control group which was highly significant. Oh, HJ et al found that Rose Bengal staining score was increased significantly ($P<0.01$) in pterygium patients.[19]

Prevalence of dry eye in patients of pterygium: Out of 90 pterygium patients, 53 had dry eye. The prevalence of dry eye in pterygium patients was 58.89% with 95% CI (48.5-68.7). Roka N et al had also found that dry eye tests were abnormal in 54 % of pterygium patients.[4]

Clinical correlation of dry eye and pterygium

The environmental factors associated with dry eye, such as ultraviolet light quantities and dusty polluted environment, have also been implicated in pterygium formation.[20] Moreover pterygium is independently associated with Schirmer's test (≤5 mm), tear breakup time (≤10 s) and a positive association between pterygium and dry eye exists.[21] In this study mean TBUT, Schirmer's-1 and basal secretion were decreased while mean Rose Bengal staining score was increased in patients of pterygium when compared to control group which indicates instability of tear film in pterygium patients. This study found a strong positive clinical correlation between dry eye and pterygium ($p<0.001$). Goldberg L and David R had found no correlation between dry eye and pterygium.[22] Ishioka M et al found an association between pterygium and a shortened tear break-up time and Schirmer's test in the case-control study. They concluded that there is a correlation between pterygium formation and unstable tear film.[17] Saleem M et al had found positive correlation between dry eye and pterygium.[9] Lekhanont K et al found that the presence of pterygium was significantly associated with positive dry

eye tests.[23] Oh HJ et al performed a study to evaluate the parameters of tear function and ocular surface in patients with pinguecula and pterygium and found that there is close correlation between the severity of pterygium and dry eye condition.[19] Li M et al conducted a study to evaluate the short-term effect of pterygium excision on tear function and conjunctival goblet cell density and found tear function in patients with primary pterygium improves after pterygium excision, which indicates that pterygium has a close relationship with dry eye.[29] Lu J et al had found a positive association between pterygium and dry eye symptoms.[25] Anguria P et al had found no association between unstable tear film (dry eye) and pterygium.[26] Moreno JC et al found that Schirmer's test and TBUT value were significantly reduced in the eyes with pterygium and significant clinical correlation exists between pterygium and dry eye.[14] Roka N et al conducted a study on assessment of tear secretion and tear film instability in cases with pterygium and normal subjects and found that there is strong relationship between dry eye and pterygium.

According to this study, the risk of having pterygium in dry eye patients is 3.28 times higher than in patients who do not have dry eye.[4] Ganeshpuri AS et al in India had found strong relationship between dry eye, diabetes and pterygium.[11]

CONCLUSION

This study has clearly demonstrated that there is a strong clinical correlation between dry eye and pterygium. Thus, treatment of dry eye should also be part of pterygium management. All the tests of dry eye should be performed in pterygium patients and appropriate tear substitutes should be prescribed based on these results. Appropriate precautions should be taken by patients such as use of UV protective glasses, hats and umbrellas to protect their eyes. They should also avoid exposure of their eyes to strong winds and heat from open flamesation. Schirmer's test considered abnormal when both SCH-1&SCH-2 were abnormal (Table 5), this is because not much significant difference seen between individual value of both tests in same patient.

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