Tear break-up time in eyes with pterygia and pingueculae in Ibadan

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Summary

Background: **Ultraviolet (UV) rays and chronic irritation to dust have been implicated in the pathogenesis of degenerative conditions of the cornea and conjunctiva like pterygium and pinguecula. It has been postulated that exposure to these environmental factors cause corneal and conjunctival drying by disruption of the tear film. While some researchers have found tear film dysfunction in eyes with pterygia and pingueculae, others have found no such abnormalities. The differences in findings may be due to different methods of investigation, or differences based on geography and climate.**

Study design: **The tear film has been studied using tear break-up time (TBUT) in adults with pterygia and pingueculae disorders, TBUT was measured in 73 eyes with pterygia and 74 eyes with pinguecula and were compared to TBUT in 74 eyes of age and sex matched normal controls. Abnormal TBUT was defined as TBUT less than 15 secs. Unstable tear film was defined as TBUT less than 10 secs.**

Results: **The mean TBUT was lower in eyes with pterygia (17.90 secs) than in control eyes (19.86 secs), although the mean difference was not statistically significant. Abnormal TBUT, defined as TBUT less than 15 secs, was found in 29 eyes out of 73 eyes with pterygia (39.7%), compared with 13 eyes out of 74 eyes with pingueculae (17.6%) and in 17(23.0%) of 74 control eyes ($X^2 = 10.01$, df = 2, P = 0.0006).**

A TBUT of less than 15 secs was more significantly associated with eyes with pterygia compared to control eyes. Unstable tear film (TBUT less than 10 secs) was found in 12(16.4%) eyes with pterygia, compared to 4(5.4%) eyes with pingueculae and 4(5.4%) control eyes. Unstable tear film was significantly associated with eyes with pterygia (P = 0.027).

Conclusion: **Tear film abnormalities are associated with pterygium but not with pinguecula in the subjects studied. TBHT may vary in different populations.**

Key-words: ***Pterygium, Pinguecula, Tear break-up time.***

Résumé

Introduction: Rayons ultraviolets et irritation chronique à propos de la poussière ont été impliqués dans la pathogenése des maladie dégénératives de la cornée et conjonctivite comme un ptérygion et la pinguecula. Il a été postulé que l'exposition à ces facteurs de l'environnement provoque la cornée et la conjonctivite de se dessécher à travers le derangement de la taie de la larme. Quoique quelques chercheurs aient trouvé la taie de la larme insuffisant dans les yeux avec le ptérygion et la pingueculae, les autres n'avaient jamai trouvé aucune des anomalies semblables. Les différences à partir des résultats pourraient être attribuables à des méthodes d'investigation différentes, ou les différence basées sur la geographie et le climat.

Plan d'étude: On avait étudie la taie de la larme avec l'utilisation des temps de fondre en larmes (tear break-up time (TBUT) chez les adultes atteints des troubles du Ptérygion et de la pingueculae. TBUT a été mesuré chez 73 yeux atteints du ptérygion et 74 yeux atteints de la pingueculae et ont été comparés par rapport au TBUT des 74 yeux d'âgé et sexe assorti contrôle moyen. Le TBUT anormal était défini comme TBUT moins de 15 seconds. La taie de la larme instable était défini comme TBUT moins de 10 seconds.

Résultats: Le TBUT moyen était bas dans les yeux avec pterygion (17,90 seconds) plus que dans les yeux de contrôle (19,86 seconds), Quoique la différence moyenne n'etait pas statisquement sensible. Le TBUT anormal TBUT moins de 15 seconds, était trouvé dans 29 yeux entre 73 yeux atteints du pterygion (39,7%), par rapport aux 13 yeux, entre 74 yeux atteints de la pingueculae (17,6%) et en 17 (23,0%) de 74 yeux de contrôle (X^2=10,01, df=2, P=0,0006). Un TBUT de moins de 15 seconds est plus sensiblement associé aux yeux atteints de pterygion par rapport aux yeux de contrôle. La taie de larme instable (TBUT moins de 10 seconds) était trouvé en 12 (16,4%) yeux atteints du ptérygion, par rapport au 4 (5,4%) yeux avec la pingueculae et 4(5,4%) yeux de contrôle. La taie de la larme instable était sensiblement lié avec des yeux atteints du pterygion (P=0,027).

Conclusion: Les anormalies de la taie de la larme sont liées au ptérygion et moins encore avec la pingueculae chez les sujets étudies.

Introduction

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[1, 2]. It is thought that UV light causes destruction of the tear film due to rapid evaporation[3-5]. Tear film dysfunction has been found in subjects with

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pterygium and other degenerative lesions of the bulbar conjunctiva[5,9] like pingueculae. In India, investigators have found abnormalities of tear function[7,10] in eyes with pterygia and pingueculae while others have found no such abnormalities[11,12]. The differences in findings might be related to the differences in methodology used, or the differences in geographical locations.

Such tear functions have been little studied in Ibadan, Nigeria. Nigeria is located between the latitudes four degrees to fourteen degrees North of the equator, where the incidence of pterygium is very high[1]. Ibadan is dry and dusty from November through March - with a very high exposure to UV light for at least nine months in a year.

A previous study in Ibadan using the Schirmer tests did not show any significant tear abnormality between eyes with pterygium and control eyes[13]. The Schirmer test investigates the quantitative aspect of tear volume however, a qualitative test has not been used. This study therefore, assesses tear film function in eyes with pterygia, pingueculae and a control group to determine the presence or absence of tear dysfunction.

Method

All subjects 30 years and over who had primary pterygium or pinguecula in either or both eyes were recruited into the study from three outpatient clinics: the University College Hospital (UCH) Ibadan; a private clinic and a mission hospital both within an hour's drive from the UCH. The patients were seen between July and December 1998, for a period of six months. The inclusion criteria were patients with pterygia, a fibrovascular growth in the palpebral fissure encroaching on the cornea or with pinguecula, a yellowish nodular lesion which does not encroach on the cornea. All the subjects studied had pterygia extending at least 2mm from the limbus to the cornea.

The patients in the control groups were group matched to the patients in the case study groups by age and gender; the control group did not have pterygia, pingueculae and had not used topical or systemic medications three months prior to the study.

Both case and control were selected from the three eye clinics. The control group was selected among subjects who presented with refractive errors and presbyopia. Only subjects with no evidence of eye disease after a complete eye examination were included as controls in the study.

The exclusion criteria included any subject with other degenerative eye conditions, dry eye syndrome, keratoconjunctivitis sicca, blepharoconjunctivitis and trachoma. Subjects who had received topical eye medications or systemic medications such as antihistamines, phenothiazines, diazepam and artane and such drugs that may affect tear film stability in the three months prior to the study were excluded.

Information was obtained by personal interview using a structured questionnaire that included sociodemographic data, occupational history, usual place of domicile, drug-use history, and family history.

Evaluation of the subjects, included, visual acuity testing, anterior segment evaluation with pen torch and a slit lamp biomicroscope to ensure strict compliance with the inclusion and exclusion criteria.

Tear film break-up time was measured by only one of the investigators. It was determined by positioning the patient for slit-lamp examination while a fluorescein strip slightly moistened with sterile water was applied to the unanaesthetized inferior temporal bulbar conjunctiva of the eye with pinguecula or pterygium or the control eye. After three blinks, the patient was asked to look straight ahead without blinking, and without holding the lids, using a cobalt-blue filter from the slit-lamp and broad beam of light, the corneal surface was scanned for the

Table 1 Age and sex distribution of subjects studied

	Control	Pinguecula	Pterygium	Total
Age Group (yrs)	**n %**	**n %**	**n %**	**n %**
30 – 39	14(18.9%)	14(18.9%)	12(16.3%)	40(18.1%)
40 - 49	16(21.6%)	15(20.3%)	18(24.3%)	49(22.35%)
50 - 59	15(20.3%)	17(23.0%)	16(23.0%)	48(21.7%)
60 - 69	14(18.9%)	13(17.6%)	14(18.9%)	41(18.6%)
70 and above	15(20.3%)	15(20.3%)	13(17.6%)	43(19.5%)
Total	74(100.0%)	74(100.0%)	73(100.0%)	221(100.0%)
$X^2 = 0.84$, df = 8, P = 0.99.				
	Control	**Pinguecula**	**Pterygium**	**Total**
Sex	**n %**	**n %**	**n %**	**n %**
Male	39(52.7%)	39(52.7%)	36(48.6%)	144(51.3%)
Female	35(47.3%)	35(47.3%)	37(51.4%)	107(48.7%)
Total	74(100.0%)	74(100.0%)	73(100.0%)	221(100.0%)
$X^2 = 0.22$, df = 2, P = 0.89.				

Table 2 Distribution of participants by level of skilled work and work place

	Control		Pinguecula		Pterygiumn		Total	
	n	%	n	%	n	%	n	%
Skilled	21(28.4%)		10(13.5%)		6(8.2%)		37(16.7%)	
Semi-skilled	24(32.4%)		19(25.7%)		19(26.0%)		62(28.0%)	
Unskilled	29(39.2%)		45(60.8%)		48(65.8%)		122(55.3%)	
TOTAL	74(100.0%)		74(100.0%)		73(100.0%)		221(100.0%)	
X^2 = 15.71, df = 4, P = 0.003.								
	Control		**Pinguecula**		**Pterygiumn**		**Total**	
Place	n	%	n	%	n	%	n	%
Indoor	48(64.9%)		32(43.8%)		32(43.8%)		112(50.9%)	
Outdoor	26(35.1%)		41(56.2%)		41(56.2%)		108(49.1%)	
Total	74(100.0%)		74(100.0%)		73(100.0%)		220(100.0%)	
X^2 = 8.69, df = 2, P = 0.013.								

appearance of dark spots or streaks on the cornea. The time from the last blink to the appearance of these spots was measured in seconds with a stopwatch to determine the tear film break-up time. Three readings were taken and an average value was determined. Values between 15-45 seconds were taken as normal, less than 15 secs was considered abnormal and values less than 10 seconds were suggestive of unstable tear film, as previously categorized by Lemp[14].

The frequency distribution of each variable was produced. The mean TBUT were compared using Student's t-test. The statistical significance of the differences between mean tear film break-up time was assessed. To obtain qualitative variables, the chi square test was used to examine the level of significance of associations. All statistical significance tests were at 5% probability level.

Results

A total of 221 subjects were studied, comprising of 73 subjects with pterygium, 74 subjects with pinguecula and a control group of 74 subjects. In subjects with bilateral pterygia pingueculae, one of the eyes was chosen at random. In unilateral disease the affected eyes were studied. The age and sex distribution of the subjects are shown in table 1.

There was no significant difference in age in the three groups of subjects studied (X^2 = 0.84, df = 8, P = 0.99); nor were there differences in the sex distribution of the three groups of subjects studied (X^2 = 0.22, df = 2, P = 0.89)

The major differences between the groups studied were those pertaining to occupation and work place, a greater number 41(56.2%) subjects with pterygium worked outdoors in unskilled job than the controls 26(35.1%),

Table 3 The distribution of abnormal and unstable TBUT in the three groups of subjects

		Subjects group		
		Control	**Pinguecula**	**Pterygiumn**
1.	**TBUT**	n %	n %	n %
	Below 15 sec.	17(23.0%)	13(17.6%)	29(39.7%)
	15–45 sec	57(77.0%)	61(82.4%)	44(60.3%)
	Total	74(100.0%)	74(100.0%)	74(100.0%)
	X^2 = 10.01, df = 2, P =0.006			
		Control	**Pinguecula**	**Pterygiumn**
		n %	n %	n %
2.	Below 10 secs.	4(5.4%)	4(5.4%)	12(16.4%)
	10 – 45 secs.	70(94.6%)	70(94.6%)	61(83.6%)
	Total	74(100.0%)	74(100.0%)	73(100.0%)
	X^2 = 7.23, df = 2, P =0.027			

but similar number of subjects with pingueculae worked outdoors (table 2).

The mean tear film break-up time (TBUT) in subjects with pinguecula was 20.66 secs (SD ≅7.81), for the pterygium group it was (17.90 secs (SD≅ 8.03) and for the normal control group it was 19.86 secs (SD ≅ 7.33). There was no statistical significant difference in the mean TBUT in the 3 groups (P = 0.084), but the proportion of subjects with TBUT less than 15 secs (abnormal TBUT) was different in the 3 groups (table 3).

Twenty-nine of the 73 eyes (39.7%) with pterygium had a TBUT of less than 15 secs compared to 13 out of 74 eyes with pinguecula (17.6%) and 17 out of 74 eyes (23.0%) in the normal controls. The difference was statistically significant ($X^2 = 10.01$ df = 2, P = 0.006) Furthermore, eyes with unstable tear film (a TBUT of less than 10 secs) were greater in the group with pterygium (12 eyes, compared with 4 eyes with pinguecula and 4 eyes in the control group. ($X^2 = 7.23$, df = 2, P = 0.027). This is presented in panel 2 of table 3.

Discussion

Environmental factors, i.e. dry and dusty weather conditions and long periods of UV light exposure are being suggested as the major predisposing factors for the high incidence of pterygia and pingueculae seen in Ibadan, Nigeria. Chronic irritation from wind and dust is also implicated. One theory suggests that these abnormalities cause corneal and conjunctival drying which predisposes the eye to pterygium[1,2,3]. Others feel that UVR induces tear dysfunction, or that pterygium itself causes tear dysfunction[15]. If factors other than environmental conditions play a role in the aetiology of pterygium, then tear studies in pterygium may not yield different results in different geographic locations.

In this study, mean tear film break up time was lower in eyes with pinguecula compared to the control eyes but higher in eyes with pingueculae. However, eyes with a TBUT of less than 15 secs, [abnormal values] were found more frequently in association with eyes with pterygia and pingueculae. The difference in TBUT could not be due to age or gender as there were no significant differences in these factors within the three groups studied. It could, however, be due to differences in the prevalence of subclinical diseases like conjunctival xerosis of vitamin A deficiency, conjunctivitis or subclinical trachoma. This is possible because subjects with pterygia were mainly unskilled workers and therefore had lower socioeconomic status, the group in which vitamin A deficiency diseases (VADD) and trachoma are prevalent[15]. However, none of the subjects studied had detectable clinical forms of trachoma or VADD. Serum levels of vitamin A would have been more informative in the latter condition. It is unlikely anyone had either of these two diseases in their gross forms in the absence of clinical signs.

Although TBUT is expected to be less in hot climates, a comparison of results done in other geographic location suggests otherwise[6,10], TBUT had no correlation with humidity and temperature. If the environment is a causative factor in pterygium, it may be the effect of UV light rather than temperature and humidity. All the subjects in this study were from the same geographic location (Ibadan) however their daily exposure to UV light was different, since more subjects with pingueculae and pterygia worked outdoors than those in the control group..

Other unlikely factors which might have influenced the results obtained in this study were the performance of the test. The test was conducted by only one of the authors (MB) using the same technique after a pretest. Three readings were taken and an average value was calculated, to ensure reliability. The test has been found to be reproduceable and has a sensitivity as high as 82% and specificity of 86%[14]. Although MB was not masked to the disease status, she was masked to the value of TBUT considered to be abnormal.

Studies measuring TBUT have found that it is influenced by various factors like the holding up of lids during the test, blinking rates, age and sex[15]. None of these factors play a major role in the results obtained in this study.

Goldberg[11], in a study of 59 eyes with pterygia, found 32.2% eyes had normal tear function compared to 32.6% of the 46 control eyes. He concluded that there was no association between tear film abnormalities and pterygium. In his study, however, those with a TBUT of less than 30 secs were considered abnormal, and the population studied had a high prevalence of trachoma[11]. A TBUT of less than 15 secs was considered abnormal in this study because population studies in normal eyes have defined the range of normal values to be 15 secs and above[14]. Clinical trachoma was absent in this study population. This may explain the differences in the findings of the Goldberg study and the present one.

In this study although the mean TBUT was not statistically different in eyes with pterygia, pingueculae and controls, a TBUT of less than 15 secs was associated with eyes with pterygium and pinguecula (P = 0.006), furthermore a TBUT of less than 10 secs was associated with eyes with pterygia (P=0.027). Lemp[16] and coworkers found that a TBUT of less than 10 secs occurs in mucin deficient dry eyes. This finding has been supported by conjunctival biopsies, while TBUT is variable in aqueous deficient dry eyes[15].

In other conditions associated with mucin deficiencies, eye discomforts such as burning sensation, foreign body sensation, and redness are experienced in ways similar to subjects with pterygium[6]. The marked abnormality of TBUT, which was found more frequently in association in eyes with pterygia than eyes without pterygia, also suggests that either there may be an abnormality of mucin[7,9], which may be a predisposing factor for the pathogenesis of pterygium (UV light may initiate the abnormality), or the presence of pterygium causes abnormalities of mucin[7,8,9].

Whether tear dysfunction is a precursor to pterygium growth or pterygium causes tear dysfunction is still not clear. Research and clinical evidence, however, suggest there is a relationship between the two. Such observations include the position of pterygium in the exposed part of the eye - the medial position is more frequent than the temporal position[13]. The bulbar conjunctival temporal to the cornea is situated below the lacrimal gland and may be less prone to drying and freshest tears and hence the relative rarity of pterygium in the temporal position[13]. Tear abundance of the aqueous part may explain the rarity of temporal pterygium, but does not explain the association with mucin deficiency. A longitudinal study may provide more information on the sequence of events between tear film dysfunction and pterygium formation.
Tear abnormalities were associated with pterygium and less so with pinguecular in the subjects studied.

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