Validity of Symptoms as Screening Tool for Dry Eye

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Purpose: To determine the role of symptoms in diagnosing dry eye among those aged 40 years and above, who attended the out patient department of Ophthalmology at Baqai Medical College Karachi.

Material and methods: This study was conducted from April 2001 to December 2002. 100 patients were selected on the basis of symptomatology proforma, consisting six most common symptoms of dry eye such as dryness, grittiness, burning, redness, crusting and sticking of eyelashes. Those patients suffering from any two of these six symptoms were screened and included in the study group. This group was then subjected to three diagnostic tests such as Schirmer's test, Rose Bengal staining of the ocular surfaces and tear film breakup time. The sensitivity and specificity of these tests was determined for the diagnosis of dry eye.

Result: 52 out of hundred patients were females and 48 were males. The most commonly reported symptoms of burning sensation and redness were present in 70 patients often or all of the time and 30 patients reported these symptoms to be present rarely or sometimes. 200 eyes which were subjected to the diagnostic tests, 168 eyes had positive result and 32 eyes had negative result. Taking Schirmer's test as the gold standard the sensitivity of Rose Bengal test is 92.85 % and Fluorescein break up time test is 21.42 %.

Conclusion: This study reveals that symptoms assessment plays an important role in diagnosing dry eye syndrome and as the age increases the tear secretion decreases. There is strong correlation between symptoms, Schirmer's test and Rose Bengal test. The Rose Bengal test is the second important test used for diagnosing dry eye syndrome among those aged above 40 years.

O ver fifty years ago Henrik Sjogren described a disease characterized by autoimmune damage to lacrimal gland tissue, decreased tear secretion and ocular surface disease called 'keratoconjunctivitis sicca' (KCS). It is now recognized that KCS or dry eye refers to, or is a component of variety of disorders. It is characterized by ocular surface disease that results from any condition or circumstance that decreases tear secretion or increases tear film evaporation[1]. The terms "dry eye" and "keratoconjunctivitis sicca" are synonymous [2].

The pre–ocular tear film–air interface is the principal refractive surface of the eye. The maintenance of stable quality tear film is of paramount importance with regard to good vision. Tear film consists of three layers. The most superficial layer of

tear film is lipid layer, 0.11μm thick produced by the meibomian glands. The middle layer the widest at 7.0μm is the aqueous layer produced by the main lacrimal gland as well as accessory lacrimal glands of Krause and Wolfring. Aqueous tear deficiency is the most common cause of dry eye[3]. Aqueous layer constitutes over 90 % of tear film[4]. The layer closest to the cornea is the mucin layer 0.02 – 0.05μm thick, produced by conjunctival goblet cells. Each layer of tear film can be affected by different diseases, each causing clinically dry eye or keratoconjunctivitis sicca[3].

Dry eye conditions have been classified into two major categories:
1. Tear deficient dry eye (TDDE), in which there is deficiency of lacrimal component of tears.
2. Evaporative dry eye (EDE), where the cause is excessive evaporation.

Tear deficient dry eye can further be separated into Sjogren Syndrome (SS) dry eye, an autoimmune disorder affecting the lacrimal and salivary glands and non Sjogren syndrome that encompasses the range of other causes of tear deficiency. Evaporative dry eye is caused by alteration or deficiency in lipid secretion by meibomian glands resulting in increased evaporation of aqueous tear from ocular surface. The leading cause is meibomian gland dysfunction[5].

Dry eye syndrome can lead to vision threatening complications therefore early diagnosis is important. Symptom assessment plays a large role in the diagnosis of dry eye[6]. Ocular fatigue has been described as a major symptom of dry eye[7]. Ocular irritation is one of the most common complaints of patients[8]. Other common symptoms of dry eye are burning sensation and sandy – gritty sensation etc. Symptoms tend to be worse secondary to environmental extreme during winter and on exposure to indoors heating system. Patient may complaint of excessive tearing due to reflex secretion [3]. Importance of multiple tests in evaluation of tear film disorder is acknowledged with patient history, dry eye questionnaire, tear film breakup time, ocular surface staining and Schirmer's test being the preferred diagnostic tools[9].

MATERIAL AND METHODS

This study was carried on 100 patients who attended the out patient department at Baqai Medical University Hospital. They aged 40 years or above and presented with any two symptoms mentioned in the dry eye questionnaire such as grittiness, redness, burning sensation, crusting on the eye lashes and morning stickiness. Each time the patient indicated the presence of a symptom he or she was asked whether the symptom was experienced rarely, sometimes, and often or all of the time. Additional factors regarding severity and exacerbating conditions (e.g. season, wind, time of the day) were also asked. History of any previous illness such as Rheumatoid arthritis, Sjogren syndrome, and Diabetes mellitus was recorded. Use of any drugs or hormone replacement therapy was also taken into account. Those patients aged below 40 years and having conjunctival and corneal infection were excluded from the study.

The clinical examination included visual acuity recording, Schirmer's test, slit lamp examination of anterior segment, examination of cornea after fluorescein staining, tear film breakup time test and rose Bengal staining. The sequence of examination was as follow:

1. Visual acuity assessment by Snellen's chart.
2. Schirmer's test. Test was performed by using sterile Schirmer's (filter paper) strips which are 5mm x 35mm (Figure 1). The test results were considered positive if length of wetting obtained was less than 5 mm or less in 5 minutes.
3. Slit lamp examination of anterior segment. To see the presence of conjunctival congestion, conjunctival discharge, mucus filaments and dryness of bulbar conjunctiva.
4. Fluorescein staining. Fluorescein strips (Figure 1) were used, staining was recorded and tear meniscus was measured. 1mm height of meniscus was taken as normal.
5. Tear film breakup time test. It was recorded after fluorescein staining. The test was considered positive if average tear film breakup time was less than 6 seconds.
6. Rose Bengal staining. It was performed by using sterile Rose Bengal paper strips from which it was released by drop of saline (Figure 1). The Oxford grading scheme was used for grading ocular surface damage. The grading chart is made up of five panels, each of which represents typical gradations of stain on either cornea or conjunctiva. Grading is done as 0, I, II, III, IV and V depending on number of dots per panel. Minimum being grade 0 and maximum score is V. (Figure 2).

RESULTS

Between April 2001 and December 2002, 100 patients 40 years of age or older were evaluated for dry eye at the out patient department of Ophthalmology at Baqai Medical University Hospital. 200 eyes of these patients were subjected to Schirmer's test; Rose Bengal test and Tear breakup time test. 30 patients presented with any two symptoms from the dry eye questionnaire to be present rarely or sometimes, 70 patients had had any two symptoms to be present often or all of the time. 18 patients aged 60 – 69 years reported two or more symptoms to be present rarely or sometimes and 42 patients reported two or more symptoms to be present often or all of the time. Out of those patients aged between 50 – 59 years 08 patients reported the symptoms to be present rarely and sometimes and 18 patients had them often or all of the time. Among patients belonging to age group 40 – 49 years 04 had symptoms rarely and sometimes and 10 had them often or all of the time (Table 1).
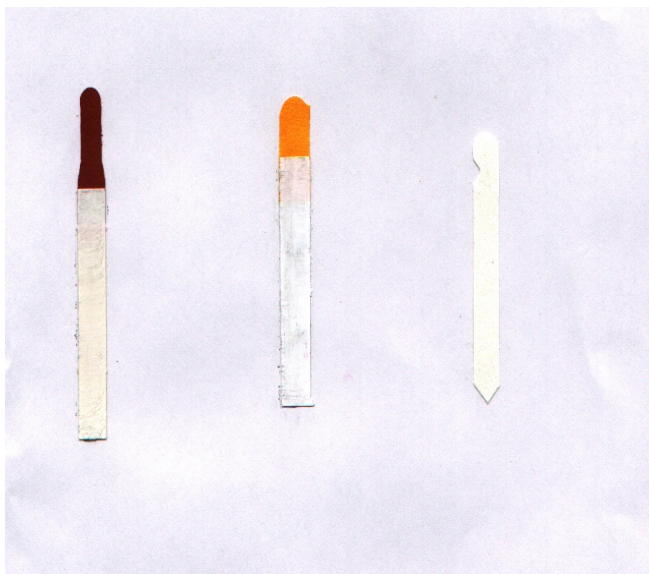

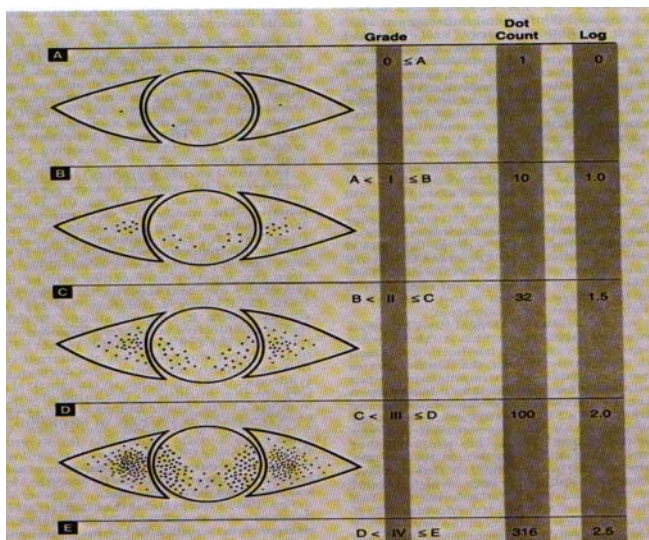**Fig. 1.** Rose bengal strip, fluorescein strip and scherimer tear test strip.

Fig. 2. Grading of corneal and conjunctival staining (Oxford scheme) (Bron A.J. The Doyne Lecture Reflection on the tears Eye 1997, 11, 592)

Out of 200 eyes, which were subjected to three diagnostic tests, 168 eyes had positive results and 32 eyes had negative results (Table 2).

Among those aged 60 – 69 years 78.6 % had Schirmer's test positive, 73.6 % had Rose Bengal tests positive and 50 % had tear film breakup time tests positive, patient aged 50 – 59 years, 17.8 % had Schirmer's test positive, 13.2 % had Rose Bengal tests positive and 16.6 % had Tear breakup time tests positive and patient aged 40 – 49 years 3.6 % had Schirmer's test positive, 13.2 % had Rose Bengal tests positive and 33.4 % had tear film breakup time tests positive (Table 3).

Table 1: Symptoms Age Wise

Age	Rarely or sometimes	Often or all of the time	Total
40 – 49	04	10	14
50 – 59	08	18	26
60 – 69	18	42	60
Total	30	70	100

Table 2: Eyes With Diagnostic Tests

Total eyes	Positive diagnostic test	Negative diagnostic test
200	168	32

Table 3: Positive Diagnostic Tests Age Wise

Age	Schirmer's Test	Rose Bengal Test	Tear Break up Time Test
	No. (%)	No. (%)	No. (%)
40 – 49	04 (03.6)	20 (13.2)	08 (33.4)
50 – 59	20 (17.8)	20 (13.2)	04 (16.6)
60 – 69	88 (78.6)	112 (73.6)	12 (50.0)
Total	112	152	24

Grading of Rose Bengal staining was done following Oxford scheme and it was found that 20 % of eyes had grade 0 on staining, 46 % had graded I, 0.5 % had grade II, 1.0 % had grade IV and 0.5 % grade V. (Table 4).

Taking Schirmer's test as gold standard, screen test analysis showed that the sensitivity of Rose Bengal was 92.85 % and specificity was 14.28 % (Table 5).

Sensitivity of tear film break up time test was 21.42 % and specificity was 78.57 % (Table 6).

Table 4: Grading of Rose Bengal Staining According to Oxford Scheme

No. of eyes n (%)	Grading
40 (20.0)	0
92 (46.0)	I
17 (8.5)	II
02 (1.0)	IV
01 (0.5)	V

Table 5: Sensitivity And Specificity Of Rose Bengal Test.

	Schirmer's +Ve		Schirmer's– Ve	
Rose Bengal +Ve	104	a	48	b
Rose Bengal – Ve	08……..c		08	d

Sensitivity= a/(a+c) x 100
Specificity= d/(d+b) x 100

Table 6: Sensitivity and Specificity of Tear Break up Time Test

	Schirmer's +Ve		Schirmer's – Ve	
Tbut +Ve	24	a	12	b
Tbut – Ve	88	c	44	d

Sensitivity= a/(a+c) x 100
Specificity= d/(d+b) x 100

DISCUSSION

Dry eye is a major tear deficiency disorder that affects millions of people world wide[10]. It is a distressing problem which is often overlooked and under diagnosed. The patient presents for the assessment and treatment when the condition is moderate to severe and symptoms become intolerable[11].

The development of dry eye is based on changes in composition of tear film which consists of the outermost lipid layer from the meibomian glands, the middle aqueous layer from the lacrimal gland, and the inner most mucinous layer from the goblet cells of the conjunctiva. A large variety of diseases associated with dry eye includes blink disorders, disorders of eyelids, autoimmune diseases, blephritis[12], which cause dysfunction of the meibomian glands[13] and trachoma causing obliteration of the lacrimal ducts in the superior conjunctival fornices there by blocking secretion[14]. Dry eye is a significant feature of diabetes mellitus, which may be attributed to decrease corneal sensitivity, neuropathy involving innervations of lacrimal gland and loss of goblet cells[15].

Clinically dry eye can be divided into three stages. In the first stage the patient has symptoms but no signs are present, in the second stage the symptoms of stage I, along with reversible signs such as small erosions and ulcers in the corneal epithelium, mucous secretion, and hyperemia of the nasal and temporal bulbar conjunctiva are present and the third stage which has the symptoms and signs of first and second stages, along with irreversible signs such as corneal leucomas, and ulcerations[12] which can lead to sight threatening corneal complication[14].

Diagnosis of dry eye is often difficult, a number of diagnostic tests have been performed to establish the diagnosis of dry eye. The two tests used most frequently in clinical practice are Schirmer's test and Rose Bengal test. According to European Study Group criteria, the presence of symptoms and either an abnormal Rose Bengal test or Schirmer's test is required to diagnose dry eye syndrome. These

diagnostic tests have limited value if performed individually or in the absence of symptoms[11].

In the study performed in Australia by Mc Carty et al reported that most of the patients presented with the symptoms of foreign body sensation, discomfort, itching, tearing and photophobia[11]. Toda et al reported patients complaining of itchy feeling[16], where as Adolfo et al stated that ocular irritation being the most common complaint of the patient presenting to the ophthalmologists[8]. Most of our patients presented with redness and burning sensation which were either present often or all of the time. 60% of the patients experiencing these symptoms were between 60 – 69 years of age. Schein and associates have reported that 15% of individuals older than 65 years presented with complaint of irritation[17]. According to Mc Carty et al as the age increases the tear secretion decreases[11]. Environmental factor such as poor quality of air and prolonged work at video display terminal can cause eye irritation[8]. In our set up most of the patients came from the villages around Baqai Medical University Hospital, so exposure to heat, dust and air pollution may be attributed towards the symptoms of redness and burning sensation. The patients suffering from dry eye often complaint of ocular fatigue and heavy eye sensation[10], but no such complaint was reported in our patients.

Among the three diagnostic tests performed which were Schirmer's test, Rose Bengal test and tear film breakup time, it was found that among those aged 60 – 69 years, 78.6 % had Schirmer's test positive, 73.6 % had Rose Bengal test positive and 50.0 % had decreased tear film breakup time. The Schirmer's test is the most popular test performed for dry eye and to perform this test there is no need for any additional equipment[18]. It measures the aqueous layer of the tear film produced by the lacrimal gland. Schirmer's test has high specificity as shown by study done by Fareis et al[11] so taking it as the gold standard. The sensitivity of Rose Bengal test is found to be 92.85 % and that of tear film breakup time test is 21.42 %, this shows that Rose Bengal test has high sensitivity as also indicated in the study[11]. Rose Bengal staining reflects the epithelial cell deprived mucin[6], whereas tear film breakup time test indicates the stability of the lipid layer of tear film[9].

Among patients who had positive Rose Bengal test, grading was done according to Oxford Scheme[19]. Most of the eyes had Grade 0 and Grade I staining pattern which indicates that most of the cases were borderline and were detected early on the basis of

symptomatology, so this shows that symptoms play an important role in diagnosing dry eye.

It has been shown previously that there is lack of corelation between symptoms, Schirmer's test and Rose Bengal test[17], but our study reveals that there is a strong relationship between symptoms and diagnostic tests such as Rose Bengal test and Schirmer's test.

CONCLUSION

This study reveals that symptom assessment is an important tool for dry eye diagnosis and as the age increases the tear secretion decreases. Schirmer's test is more specific so taking it as standard the sensitivity of Rose Bengal is found to be 92.85 % indicating that it is the second most important test in establishing the diagnosis of dry eye syndrome.

There is strong correlation between symptoms, Schirmer's test and Rose Bengal test and the tear film breakup time test is least discriminating among the three diagnostic tests (Schirmer's test, Rose Bengal test and tear breakup time test) performed.

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