SRIWIJAYA JOURNAL OF MEDICINE

Correlation Between The Severity of Dry Eye Disease and Fluorescein Break-Up Patterns (FBUP)

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Abstract

Dry eye disease is a disorder of the eye surface characterized by instability of the tear film. The FBUP examination is one of the examinations used to determine the stability of the tear film. The various symptoms that occur in each type of dry eye indicate differences in break-up patterns (BUP). This study aims to determine the correlation between the severity of dry eye disease and the appearance of FBUP at RSUP dr. Mohammad Hoesin Palembang. A correlative analytical cross-sectional study was undertaken at the Eye Polyclinic, Infection- Immunology Subdivision, Dr. Mohammad Hoesin General Hospital Palembang from January to June 2022. There were 32 patient samples with 60 dry eye samples that met the inclusion criteria. The correlation between the Schirmer Test, TBUT and the severity of dry eye disease with the appearance FBUP was analyzed using the Spearman Rho's test. All data were analyzed with SPPS version 23.0. In this study, the results showed that there was a moderate and significant positive correlation between the degree of the Schirmer test and the appearance FBUP ($r = 0.482$; $p = 0.000$) and a moderate and significant positive correlation between the TBUT degree and the appearance FBUP ($r = 0.435$; $p = 0.001$) . In addition, the results showed that there was a moderate and significant positive correlation between the severity of dry eye disease and the appearance of FBUP ($r = 0.478$; $p = 0.000$). Using the multivariate test, it was concluded that the degree of dry eye was statistically significantly related to age ($p = 0.001$) and gender ($p = 0.001$). There is a correlation between the severity of the disease and the appearance FBUP of patients with dry eye disease.

Keywords: Correlation, Dry Eye Disease, FBUP, TBUT, Schirmer

1. Introduction

International Dry Eye Workshops (DEWS), defines dry eye disease as a multifactorial disorder of the surface of the eyeball and tears that causes discomfort, visual disturbances, and instability of the tear film which has the potential to damage the surface of the eye. [1-3] In 2017, the prevalence of the dry eye disease are reported to reach 10-30% of the entire population worldwide.[2-5]

The FBUP examination is one of the examinations used to determine the stability of the tear film. FBUP is the least invasive and most easily accessible medical examination and can be performed in daily practice. Diagnosis of the type of dry eye disease can be done only by examining the fluorescein break-up pattern (FBUP) which can help in determining the appropriate treatment for dry eye disease.[2,6,7]

The various symptoms that occur in each type of dry eye indicate different break-up patterns (BUP). Break-up patterns are divided into 5 patterns, namely, area break (AB), spot break (SB), line break (LB), dimple break (DB), and random break (RB).[2,6,7]

Dry eye disease caused by aqueous deficiency shows the dominant pattern that appears is LB or AB. Dry eye disease caused by increased evaporation shows an RB pattern. Meanwhile, dry eye disease due to decreased wettability will give a pattern in the form of SB or DB.[2,6,7,8]

This study aims to determine the correlation between the degree of dry eye disease and the appearance of FBUP at the Dr.

Mohammad Hoesin General Hospital Palembang.

2. Methods

A correlative analytical cross-sectional study was undertaken at the Eye Polyclinic, Infection-Immunology Subdivision, Dr. Mohammad Hoesin Central General Hospital, Palembang from January to June 2022.

The independent variable in this study was the variation in FBUP pattern with the dependent variable being the severity of dry eye disease. The research sample was 60 dry eye samples from 32 patients who met the inclusion criteria. The severity of dry eye is divided into degrees 1, and 3. The FBUP pattern consists of dimple break, random break, line break, spot break and area break.

The correlation between the Schirmer test, TBUT and the severity of dry eye disease with the FBUP was analyzed using the Spearman Rho' test. All data were analyzed with SPPS version 23.0.

Table 1. General Characteristics of the Sample

Characteristic	Total	Percentage
Age (years)	47.09 ± 16.98	
• Mean ± SD	44.5 (18 -88)	
• Median (Min-Max)		
Gender, n (%)	5	15.6
• Male	27	84.4
• Female		
Education, n (%)		
• Elementary School	3	9.4
• Junior High School	6	18.8
• Senior High School	13	40.6
• College	10	31.3
Occupation, n (%)	32	100
• Dalam ruangan	0	0
• Luar ruangan		
History of Systemic Disease, n (%)		
• Yes	31	96.9
• No	1	3.1
History of Family Disease, n (%)		
• Yes	0	0
• No	32	100
Surgical History, n (%)		
• Yes	0	0
• No	32	100

3. Results

3.1. General Characteristics of the Research Sample

In this study, the mean age of patients with dry eye disease was 47.09 ± 16.90 years with an age range of 18 to 88 years. The majority of patients are female, work indoors, have a high school education, and have a systemic history. None of the patients had a history of eye surgery or a family history of disease. (Table 1)

3.2. Ophtalmological Characteristics of the Study Sample

In this study, the majority of eyelids, conjunctiva, lenses, corneal staining, corneal sign and meibomian glands of patients with dry eye disease were normal (Table 2).

3.3. Characteristics of Dry Eye Disease

In this study, it was found that the majority of OSDI scores of patients with dry eye disease were mild - moderate (53.3); the majority of Schirmer test results were normal (43.3%) and

the majority of TBUT results were mild (51.7%). (Table 3)

3.4. Variations in FBUP Pattern

The most common feature of the FBUP pattern of patients with dry eye disease is dimple break (38.3%); followed by a random break pattern (33.3%); line breaks (20.0%); spot break (5%) and area break (3.3%). (Table 4)

3.5. Correlation between the Schirmer Test and the appearance of FBUP

In this study, a moderate and significant positive correlation was found between the degree of the Schirmer test and the appearance FBUP (r = 0.482; p = 0.000). Sequentially, the appearance FBUP patterns that tend to have smaller Schirmer test values are dimple break, line break, random break, spot break and area break. (Table 5)

Table 2. Ophthalmological Characteristics of the Sample

Characteristic	Total	Percentage
Eyelids, n (%)		
• Normal	53	88.3
• Hyperemis,Crusta	2	3.3
• *Meibom Clogged*	5	8.3
Conjungtiva, n (%)		
• Normal	31	51.7
• Hyperemis	9	15.0
• Conjunctival Injection	20	33.3
Lenses, n (%)		
• Clear	47	78.3
• Cloudy	13	21.7
Corneal Staining, n (%)		
• Normal	39	65.0
• **Colored at Central**	2	3.3
• **Severe Punctate Erosion**	7	11.7
• Mild Punctate Erosion	12	20.0
Corneal Sign, n (%)		
• Normal	46	76.7
• Mild Debris, Meniscus 0.2 m	14	23.3
Meibomian Glands, n (%)		
• Normal	30	50.0
• MGD Grade I	19	31.7
• MGD Grade II	11	18.3

3.6. Correlation between TBUT Test and Appearance of FBUP

In this study, a moderate and significant positive correlation was found between the degree of TBUT and the appearance FBUP (r = 0.435; p = 0.001). Sequentially, the FBUP patterns that tend to get faster TBUT times are dimple break, line break, area break,spot break and random break. (Table 6)

3.7. Correlation between Severity of Dry Eye Disease and Appearance of FBUP

In this study, a moderate and significant positive correlation was found between the severity of dry eye disease and the appearance of FBUP (r = 0.478; p = 0.000). Sequentially, the FBUP picture patterns that tend to increase in severity are dimple break,line break, random break, spot break and area break ˆ (Table 7).

From the table 8, it can be seen that the degree of dry eye is statistically significantly related to age, p value = 0.001 and gender, with p value = 0.001. The systemic disease variable did not have a significant relationship with the degree of dry eye, with p value = 0.233.

4. Discussion

In this study, the mean age of patients with dry eye disease was 46.95 ± 17.30 years with an age range of 18 to 88 years. These results are in line with research conducted by Shanti et al., (2020) which reported the

average age of patients with dry eye disease was 43.61 ± 18.57 years and research by Alshamrani et al., (2017) which reported the age range of patients with dry eye disease was 39 .3 ± 14.1 years.[9,10]

Table 4. Characteristics of Dry Eye Disease

	FBUP Pattern	Total	Percentage
•	*Dimple Break*	23	38.3
•	*Random Break*	20	33.3
•	*Line Break*	12	20.0
•	*Spot Break*	3	5.0
	Area Break	2	3.3

Table 5. Correlation between Schirmer Test and the Appearance of FBUP

Characteristic	Test *Schirmer*				r	P value
	Normal	Mild	Moderate	Severe		
Dimple Break	17 (73.9)	2 (8.7)	4 (17.4)	0 (0)	**0.482**	**0.000***
Line Break	5 (41.7)	5 (41.7)	2 (16.7)	0 (0)		
Random Break	4 (20.0)	9 (45.0)	6 (30.0)	1 (5.0)		
Spot Break	0 (0)	2 (66.7)	1 (33.3)	0 (0)		
Area Break	0 (0)	0 (0)	2 (100)	0 (0)		

Spearman Rho's, *p < 0.05

Table 6. Correlation between TBUT and the Appearance of FBUP

Characteristic	TBUT			r	P value
	Normal	Mild	Moderate		
Dimple Break	11 (47.8)	8 (34.8)	4 (17.4)	**0.435**	**0.001**
Line Break	3 (25.0)	7 (58.3)	2 (16.7)		
Area Break	0 (0)	2 (100)	0 (0)		
Spot Break	0 (0)	2 (66.7)	1 (33.3)		
Random Break	0 (0)	12 (60.0)	8 (40.0)		

Spearman Rho's, *p < 0.05

Table 7. Correlation between Severity of Dry Eye Disease and the Appearance of FBUP

Characteristic	Severity of Dry Eye Disease			r	P value
	Degree 1	Degree 2	Degree 3		
Dimple Break	10 (43.5)	9 (39.1)	4 (17.4)	**0.478**	**0.000**
Line Break	3 (25.0)	9 (75.0)	0 (0)		
Random Break	0 (0)	2 (66.7)	1 (33.3)		
Spot Break	0 (0)	12 (60.0)	8 (40.0)		
Area Break	0 (0)	0 (0)	2 (100)		

Spearman Rho's, *p < 0.05

Table 8 Multivariate Analysis of Variables That Influence the Degree of Dry Eyes

Variable	B	P value
Age	0.315	0.001
Gender	-0.649	0.001
Systemic Diseases	0.419	0.233

The lacrimal gland changes significantly with aging. Various histopathological changes were observed in human primary lacrimal glands such as acinar atrophy; periacinar fibrosis; periductal fibrosis; dilatation of interlobular ducts; proliferation of interlobular ducts; lymphocytic infiltration; and fatty infiltration. Decreased tear production due to lacrimal gland dysfunction,changes in lacrimal gland secretion, reduced corneal sensation, or lacrimal gland inflammation causes tear deficiency which is the main cause of dry eyes.[11]

In this study, it was reported that the majority of patients with dry eye disease had mild TBUT results (6–10 seconds) as many as 51.7%, but the majority of Schirmer test results were normal ((≥11 mm/5 minutes) as many as 43.3%. In line with this research, research by Kyei et al., in 2018 reported that patients with dry eye disease had a mean TBUT of 6.77 (mild) and a Schirmer mean of 19.36 (normal). Meanwhile, another study conducted by Yu et al., reported patients with the disease Dry eye has a TBUT mean of 3.1 (moderate) and a Schirmer mean of 9.6 (mild).[12,13]

The degree of dry eye disease most commonly found in this study is degree 2, namely if there are symptoms of eye discomfort with moderate severity and frequency that occur due to stress or no stress, symptoms of disturbing vision or episodes of limited activity, no or mild conjunctival injection, conjunctival staining may or may not be present, corneal staining may be present or not, corneal signs namely mild debris and meniscus reduction (≤ 0.2 mm), meibomian gland abnormalities may be present or not, TBUT value (6- 10 seconds), and Schirmer (6- 10 mm/5 minutes).

In this study, it was found that the most common FBUP pattern of patients with dry eye disease was dimple break (38.3%). Dimple break is an FBUP pattern characterized by line-like broken areas around relatively central parts of the cornea that appear after the spread of the tear lipid layer across this region. This is due to a decrease in the wettability of the corneal surface.

Based on theory, it is stated that the break area has a heavier degree compared to the linebreak which has a mild-moderate degree. In spot breaks and dimple breaks, there is a decrease in the wettability of the corneal surface, where spot breaks have a more severe degree than dimple breaks which have a mild-moderate degree. In random break, break-up occurs when the eyes remain open andpossibly occurs as a result of evaporation of tears which mainly occurs in meibomian glanddysfunction.[2,6-8]

In line with the theory above, this research found that the break area had the highest degree of severity compared to the four FBUP patterns. This research also obtained results that are in accordance with theory where spot breaks have a heavier degree than dimple breaks. There is a significant correlation between the severity of dry eye disease and the appearance of FBUP where sequentially the patterns that tend to have a severity level are area break, spot break, random break, line break and dimple break, where dimple break and line break have a severity of degree 1 and 2; random break and spot break have severity of degree 2 and 3; the break area has a severity of degree 3.[2.6-8]

5. Conclusion

It can be concluded that there is a correlation between the severity of the disease and the appearance of FBUP of patients with dry eye disease. Dimple break and line break have a severity of degree 1 and 2; random break and spot break have severity of degree 2 and 3; the break area has a severity of degree.

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