Assessment of Different Wetting Time and Paper Strip Size of Schirmer Test in Dry Eye Patients

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Objective: *To evaluate the correlation between different wetting time and paper strip size of Schirmer test with anesthesia in dry eye patient. Finally the authors determined the agreement on using the Ocular Surface Disease Index (OSDI), index for evaluate the severity of the dry eye patient, compare to the standard Schirmer test with anesthesia.*
Material and Method: *A prospective study was performed in 140 eyes of 70 subjects. All subjects had symptoms of dry eye syndrome which was confirmed by Schirmer test with anesthesia before inclusion. The correlation between Schirmer test with anesthesia at 1, 2, 3 and 4 minutes and standard 5-minute test of both 3 mm and 5 mm width of paper strip was evaluated using intraclass correlation coefficient (ICC). The correlation between clinical questions and Schirmer test was documented in Kappa value.*
Results: *The ICCs were higher than 0.8 after 2 minutes in both 3-mm and 5-mm width of paper strip. Furthermore, it indicated that cut-off value for diagnosis of severe dry eye was 2.5 mm for 5-mm width of paper strip and 4.25 mm for 3-mm width of paper strip at 2-minute measurement. The association between data from the OSDI and objective data from Schirmer test were analyzed by Kappa statistic and showed poor agreement beyond chance (p = 0.591).*
Conclusion: *Our results suggested that shorter wetting time of 2-minute Schirmer test with anesthesia could be used instead of the standard 5-minute test. The authors found that the 3-mm width of paper strip could be used instead of the standard 5-mm width of paper strip as well.*

Keywords: *Dry eye, Schirmer test, ICC, Reliability*

J Med Assoc Thai 2012; 95 (Suppl. 5): S107-S110
Full text. e-Journal: *http://jmat.mat.or.th*

Dry eye syndrome is generally characterized by ocular symptoms related to abnormal tear production or evaporation. Diagnosis of dry eye syndrome is based on symptoms and diagnostic tests. The most common diagnostic tests[1] include Schirmer test[2], tear break-up time[3] and fluorescein or Rose Bengal staining[4,5]. Among these tests, Schirmer test is widely used. Generally, the test is performed for 5 minutes which may be impractical for some busy ophthalmological practices. So the authors evaluated the correlation between time of Schirmer test with anesthesia at 1, 2, 3 and 4 minutes compared to the standard 5-minute test in patients with dry eye symptoms. The authors also evaluated the correlation between using 3-mm compared to using 5-mm width of paper strip. Finally we evaluate the agreement on using OSDI questions compared to the standard Schirmer test with anesthesia.

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Material and Method

Subjects

A total of 140 eyes of 70 subjects were included in the present study. Subjects were eligible for the present study if they were older than 18 years with symptoms of dry eye including irritation, burning sensation or foreign body sensation and Schirmer test with anesthesia value less than 10 mm Subjects were excluded if they had ectropion, entropion, symblepharon or other pre-existing conditions that cause dry eye symptoms such as contact lens wearer, blepharitis, corneal abrasion or eyelids abnormalities.

Procedures

The Schirmer basal secretion test was performed with standard Whatman No. 41 filter paper

in the following steps. Topical anesthesia with 1% xylocaine was instilled to the eye. Conjunctival fornix was then dried with gauze. After 2-5 minutes, 5 x 35 mm paper strip was folded 5 mm at the tip and placed between lower eyelid and globe at the junction between lateral 1/3 and medial 2/3 of the eyelid. The room light was dimmed and blinking was allowed. Wetting of filter paper was measured at 1, 2, 3, 4 and 5 minutes then 10-15 minutes. Filter paper 3 x 35 mm was performed in the same step.

All subjects, demographic data and the OSDI questions were obtained. OSDI questions were compared to the standard Schirmer test for evaluation severity of dry eye[6]. The research protocol was reviewed and approved by Ethics Committee of the Royal Thai Army Medical Department. Written informed consents were obtained from the enrolled participants.

Statistical analysis

The demographic data of the subjects were analyzed in percentage. The severity of dry eye syndrome was considered between the OSDI questions and standard 5-minute Schirmer test by Kappa statistic. The intraclass correlation coefficient (ICC) was calculated to compare 1, 2, 3 and 4 minute value with the standard 5-minute and analyzed the cutting point for grading the degree of dry eye in both 3-mm and 5-mm width of paper strip. All computations were performed with SPSS for window program (SPSS Inc., Chicago, IL, USA). A p-value less than 0.005 were considered statistically significant.

Results

Characteristics of the subjects

One hundred and forty eyes of 70 subjects were enrolled in the present study. Characteristics of these subjects are shown in Table 1. Majority of the enrolled subjects were female (90%). The most common age group was 41-60 years (50%). The common associated disease was pingeucula and pterygium (44.3%).

The association between data from the OSDI and objective data from Schirmer test were analyzed by Kappa statistic and showed poor agreement beyond chance of 0.051 (p = 0.591).

Schirmer test results

The wetting of filter papers was increased with time in both eyes as shown in Table 2. Schirmer's paper and the ICCs values were shown in Fig. 1. The ICC was more than 0.8 at 2 minutes with the value of 0.849, right eye (OD) and 0.854, left eye (OS) for 5-mm width of paper strip and 0.843 OD and 0.858 OS for 3-mm width of paper strip, respectively. Intraclass correlation coefficient for different wetting time of Schirmer test, the curve of 3-mm width of paper strip is similar to 5-

Table 1. Characteristics of the enrolled subjects

Characteristics	Number (n = 70)
Gender	
Male	7 (10%)
Female	63 (90%)
Age (year)	
< 20	1 (1.4%)
21-40	9 (12.9%)
41-60	35 (50%)
≥ 61	25 (35.7%)
Income (Baht/month)	
≤ 5,000	17 (24.3%)
5,001-20,000	37 (52.9%)
20,001-40,000	13 (18.6%)
≥ 40,001	3 (4.3%)
Occupation	
Housekeeper	33 (47.1%)
Accountant	5 (7.1%)
Government officer	9 (12.9%)
Merchant	6 (8.6%)
Others	17 (24.3%)
Disease	
Pingecula & Pterygium	31 (44.3%)
Hypertension	16 (22.9%)
Hyperlipidemia	13 (18.6%)
Diabetes mellitus	9 (12.9%)
Rheumatoid arthritis	10 (14.3%)
Allergy	7 (10%)
Others	5 (7.1%)

Table 2. Schirmer test value

Time	Eye	Mean (mm)	SD (mm)	Range (mm)
1 minute	OD	1.28	1.45	0-10
	OS	1.16	0.96	0-3
2 minutes	OD	2.44	1.84	0-12
	OS	2.21	1.46	0-6
3 minutes	OD	3.71	2.38	0-14
	OS	3.41	1.94	0-9
4 minutes	OD	4.59	2.78	0-16
	OS	4.14	2.21	0-10
5 minutes	OD	5.40	3.24	0.5-18
	OS	4.81	2.44	0.5-10

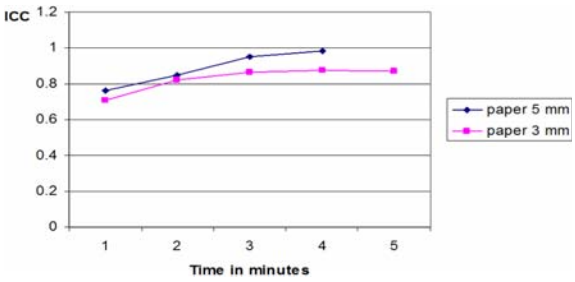

Fig. 1 Intraclass correlation coefficient for different wetting time of Schirmer test of both 3-mm and 5-mm width of paper strip

mm width of paper strip curve (Fig. 1). Furthermore, using ROC curve, the authors found the cutting value for diagnosis severe dry eye with value less than or equal to 2.5 mm for 5-mm width of paper strip and less than or equal to 4.25 mm for 3-mm width of paper strip at 2-minute measurement.

Discussion

Based on the questionnaire surveys, prevalence of dry eye ranged from 14.4% to 33%[7-10]. However, these questionnaire-based methods are rather subjective. Several laboratory tests including Schirmer test have been used for the diagnosis of dry eye. The accuracy of Schirmer test has been evaluated and demonstrated only modest sensitivity and specificity as a diagnostic test of dry eye syndrome[11,12]. In the present study, the authors found poor agreement beyond chance between the information assessed by the OSDI and Schirmer test. This indicates that the diagnosis of dry eye should base on clinical evaluation and the information from objective testing such as Schirmer test. Although Schirmer test is time-consuming test, it has been commonly used for the diagnosis of dry eye syndrome because of its simplicity as well as high specificity.

Normally, 5-mm width of paper strip has been used for Schirmer test; however, the present study indicates that 3-mm width of paper strip can be used as well. Our findings showed a good correlation between the value of 2 minute and the standard timing, 5 minute for both 3-mm and 5-mm width of paper strip. This would be more practical for the eye clinics since this new timing is less than half of the standard time. The present study supports a recent study by Bawazeer and Hodge (2003) showing that shorter time can be performed for Schirmer test[13]. Using ROC curve, the cut-off point for 3-mm and 5-mm width of paper strip was 2.5 and 4.25 mm respectively to diagnose severe dry eye.

Conclusion

Our results indicate that shorter wetting time of 2-minute Schirmer test with anesthesia could be used instead of the standard 5-minute test. The authors found that the 3-mm width of paper strip could be used instead of the standard 5-mm width of paper strip as well. Taken together, our findings would make the Schirmer test with anesthesia more practical and cost-saving.

Acknowledgments

The authors would like to thank all participants in the present study and staff of the Dry Eye Clinic, Department of Ophthalmology, Phramongkutklao Hospital.

Potential conflicts of interest

Phramongkutklao Hospital's Foundation under Her Royal Highness Princess Maha Chakri Sirindhorn's Patronage.

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การประเมินระยะเวลาและขนาดของกระดาษสำหรับ Schirmer test ในผู้ป่วยตาแห้ง

สุรวุฒิ ศุภเกษม, มานะพล เล็กสกุล, ราม รังสินธุ์

วัตถุประสงค์*: เพื่อหาความสัมพันธ์ระหว่างการทำ Schirmer test แบบใช้ยาชา ที่เวลา 1, 2, 3 และ 4 นาที เปรียบเทียบกับการทดสอบที่ 5 นาที ในผู้ป่วยตาแห้ง เพื่อทดสอบเปรียบเทียบขนาดกระดาษ 3 มิลลิเมตร กับ 5 มิลลิเมตร ในการทำ Schirmer test แบบใช้ยาชา และเปรียบเทียบค่าที่ได้จาก Ocular Surface Disease Index (OSDI) และ Schirmer test แบบใช้ยาชา*

วัสดุและวิธีการ*: การศึกษาครั้งนี้ทำในผู้ป่วยตาแห้ง 70 คน 140 ตา ซึ่งได้รับการวินิจฉัยโดย Schirmer test แบบใช้ยาชา โดยทำการหาความสัมพันธ์ของค่าที่ได้จาก Schirmer test เมื่อวัดที่ 1, 2, 3 และ 4 นาที เปรียบเทียบกับค่าที่วัดที่ 5 นาที ด้วยกระดาษขนาด 3 มิลลิเมตร และ 5 มิลลิเมตร ค่า Intraclass correlation coefficient (ICC) และความสัมพันธ์ระหว่างค่าที่ได้จาก OSDI และ Schirmer test แบบใช้ยาชาถูกคำนวณโดย Kappa test*

ผลการศึกษา*: ค่า ICC สูงกว่า 0.8 หลัง 2 นาที ทั้งเมื่อใช้กระดาษ 3 มิลลิเมตร และ 5 มิลลิเมตร ค่า cut-off เพื่อวินิจฉัยตาแห้งรุนแรงคือ 2.5 มิลลิเมตร เมื่อใช้กระดาษขนาด 5 มิลลิเมตร และ 4.25 มิลลิเมตร เมื่อใช้กระดาษขนาด 3 มิลลิเมตร เมื่อวัดค่าที่ 2 นาที และผลที่ได้จาก OSDI และ Schirmer test ไม่มีความสอดคล้องกันระหว่างเครื่องมือ (p = 0.591)*

สรุป*: ผลการศึกษาพบว่าการทำ Schirmer test แบบใช้ยาชาสามารถทำได้ที่ระยะเวลา 2 นาที แทนการทำตามมาตราฐานเดิมที่ 5 นาที และสามารถใช้กระดาษกรองขนาด 3 มิลลิเมตรแทนการใช้ขนาด 5 มิลลิเมตรตามมาตราฐานเดิม ซึ่งทำให้การทดสอบนี้สะดวกและประหยัดมากขึ้น*