Schirmer test performed with open and closed eyes: variations in normal individuals

Comparação entre os testes de Schirmer em olhos abertos e fechados em indivíduos normais

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ABSTRACT

Purpose: To analyze the difference between measurements of Schirmer test I (ST_I) and basal Schirmer test (ST_B) with open and closed eyes. **Methods:** Sixty eyes of 30 normal volunteers, 12 males and 18 females aged 28 ± 9 years were recruited for the study. All ST were carried out in a closed environment with the absence of airflow (humidity $60 \pm 2.34\%$ and temperature $20.72 \pm 1.52°C$). ST_I and ST_B were performed with the individuals' both eyes open and closed with an interval of 6 hours. All ST were conducted in 5 minutes. For statistical analysis, the ST strip's wetting velocity (ST_V) (in millimeters per minute) was calculated, dividing the ST values by its wetting time. If ST values were 35mm before 5 minutes, wetting time was recorded to obtain ST_V. **Results:** ST_V measurements of ST_I performed with closed eyes (10.30 ± 11.55) were statistically different from those performed with open eyes (18.85 ± 17.88) and ST_V measurements of ST_B performed with closed eyes (3.74 ± 3.14) were statistically different from those performed with open eyes (6.19 ± 5.86). **Conclusion:** ST performed with open or closed eyes can have an important influence in the results of ST_I and ST_B in normal individuals.

Keywords: Dry eye syndromes/diagnosis; Tears/secretion; Diagnostic techniques, ophthalmological; Cornea; Keratitis

INTRODUCTION

According to the International Dry Eye Workshop[1-2], dry eye is a multifatorial 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. According to many authors, dry eye is one of the most frequent conditions in ophthalmologic practice[3], affecting between 15 and 40% of general population. Dry eye often provokes variable symptoms, from light ocular discomfort to incapacity in keeping the eyes open[4-5]. Dry eye syndrome is included in the differential diagnosis of every patient presenting any of those symptoms.

Dry eye diagnosis is based on the clinical features and some diagnostic tests. Schirmer test (ST) is one of the most used diagnostic tools in evaluating ocular surface status. Other tests like red phenol thread, break-up-time, rose bengal, fluorescein, lissamine green, impression cytology, biochemist analysis of the tear, interferometry, meniscometry and osmolarity measurement are also used[6-10].

ST was first described by Otto Schirmer in 1903 and consists of the use of a Whatman number 41 special strip, with 5 mm width and 35 mm length

placed in lower eyelid. ST without anesthesia or Schirmer I (ST_I) is a well-standardized test that measures the basal tear secretion with the conjunctival-lacrimal trigeminal reflex[7,11]. Basal Schirmer test (ST_B) is performed with anesthesia and measures the basal lacrimal secretion. Other variations of the ST are not frequently used[6,10].

Schirmer originally described the test to be conducted with the patient seated, with open eyes, blinking freely. Various authors have published articles using the test with the patients remaining with closed eyes[12-15], however, no study found evidence that such results are equivalents to the originally described tests by Schirmer. Recently, according to the 2007 Report of the International Dry Eye Workshop (DEWS), suggested to perform the Schirmer test with the patient's eyes closed[1].

The purpose of this study is to analyze the difference between measurements of ST_I and ST_B with open and closed eyes.

METHODS

Sixty eyes of 30 normal volunteers, 12 males and 18 females aged 28 ± 9 years were used for the study. Informed consent was obtained from all subjects. Study methods conformed to the Declaration of Helsinki and the review board of our institution.

All individuals underwent a routine ocular evaluation. Individuals with previous eye surgery, any ocular (dry eye, lid abnormalities, chalasis, meibomitis, blepharitis, corneal scars) or systemic condition that could interfere in the stability of the lacrimal film were excluded from this study. Contact lens users or individuals undergoing any kind of ocular medication were also excluded.

All ST were carried out by the author (LGS) in a closed environment with the absence of airflow. The room was optimized with 60 ± 2.34% humidity and 20.72 ± 1.52ºC temperature to minimize variation. The examination was performed on two days.

On the first day, ST_I were performed with the individuals' both eyes open and closed with an interval of 6 hours.

On the second day, ST_B were also performed with the individuals' eyes open and closed with an interval of 6 hours. They were performed using one drop of 0.5% proxymetacaine chloride (Anestalcon®, Alcon) in both eyes, 5 minutes prior to the test. All ST were conducted in 5 minutes.

For statistical analysis, the ST strip's wetting velocity (ST_V) (mm/min) was calculated, dividing the ST values (mm) by its wetting time (min). If ST values were 35 mm before 5 minutes, wetting time was recorded to obtain ST_V.

The results were analyzed using Wilcoxon statistical test (95% interval and p<0.05).

RESULTS

Chart 1 shows the mean and standard deviation of ST_V (mm/min) of ST_I and ST_B, with open and closed eyes (Chart 1).

Chart 1. Mean and standard deviation (SD) of ST_V (mm/min) of ST_I and ST_B, with open and closed eyes

	ST_V (mm/min)			
	ST_I		ST_B	
	Open eyes	Closed eyes	Open eyes	Closed eyes
Mean	18.85	10.30	6.19	3.74
SD	17.88	11.55	5.86	3.14
	P<0.0001		P<0.0001	

SD= standard deviation; ST_V= Schirmer test velocity; ST_I= Schirmer test I; ST_B= Basal Schirmer test
Wilcoxon statistical test (95% interval and p<0.05)

Note that the average ST_V measurements of ST_I performed with closed eyes were statistically different from those performed with open eyes (p<0.0001) and measurements of ST_B performed with closed eyes were statistically different from those performed with open eyes (p<0.0001).

Also note that the average ST_V performed with closed eyes was reduced in ST_I (54.64%) and ST_B (60.42%) when compared to ST_V performed with open eyes.

DISCUSSION

Some authors, including Otto Schirmer, suggested ST normal wetting length values greater than 15 mm and abnormal when values were less than 6 mm. However, it is not mentioned if test is performed with open or closed eyes[4,6,11]. It was originally described with open eyes, allowing the patient to blink freely[4,6-7,11]. Some authors affirm that the results of the test do not differ when carried out with open or closed eyes[7-8]. However, most studies do not mention which method was used in the tests (open or closed eyes)[16-21] and there are no studies comparing both methods. Many authors have published their results using the test with closed eyes[4,13-15].

In our study, we note that ST values with closed eyes reduced their value by 54.64% for ST_I and 60.42% for ST_B. Therefore, it is necessary to accomplish other comparative studies in patients with dry eye, to determine values without the influence of open or closed eyes. There may be a possibility of increasing false-positive rates of dry eye syndrome.

ST_V was used in this study to allow comparison of values greater that 35 mm and to decrease the possibility of a statistical error. ST_V may have higher values in the first minutes and diminish gradually during the tests[22-24]. ST_V can also be a parameter for tear volume in humans, but further research should be carried out.

ST has been found to give poor reproducibility for detecting aqueous tear deficiency because it is directly influenced by temperature, humidity, evaporation, reflex tearing. However, it is one of the most common diagnostic tests used worldwide to diagnose aqueous deficiency because it is easy to perform[6-7,11,21,24-25].

CONCLUSION

Schirmer wetting values with open eyes showed significantly higher values when compared to closed eyes. This could probably be explained by the influence of the strip on reflex tearing during blinking. So ST performed with closed eye could diminish variations of humidity, evaporation and specially reflex tearing. Other factors that could have an influence on the ST results, such as head positioning, illumination, position of the strip, corneal condition, humidity and temperature must be analyzed to accomplish standardization of this important diagnostic tool.

The authors believe that the Schirmer test performed with closed eyes could eliminate environmental factors like evaporation and humidity. Therefore, it might be more reproducible, however, other studies are being carried out to clarify such facts.

RESUMO

Objetivo: Analisar a diferença das medidas dos testes de Schirmer I e Schirmer basal realizados com os olhos abertos e olhos fechados. **Métodos:** Foram analisados 60 olhos de 30 indivíduos normais com idade média de 28 ± 9 anos. A umidade média do ar foi de 60 ± 2,34% e a temperatura média de 20,72 ± 1,52°C. No primeiro dia, foi feito o teste de Schirmer I com os olhos abertos. Após um intervalo de 6 horas, foi realizado o teste de Schirmer I com os olhos fechados. No segundo dia, foi realizado o mesmo procedimento com o teste de Schirmer basal. Para fins de comparação, as medidas das tiras de papel foram divididas pelo tempo de umedecimento das tiras (velocidade) para análise estatística. **Resultados:** No teste de Schirmer I realizado com os olhos abertos, a medida de umedecimento das tiras mostrou ser estatisticamente maior quando comparado com a medida do mesmo teste realizado com olhos fechados (p<0,0001). No teste de Schirmer basal realizado com os olhos abertos, a medida de umedecimento das tiras mostrou ser estatisticamente maior quando comparado com a medida do mesmo teste realizado com olhos fechados (p<0,0001). **Conclusões:** As medidas do teste de Schirmer I com olhos fechados foram estatisticamente diferentes do realizado com olhos abertos. As medidas do teste de Schirmer basal com olhos fechados foram estatisticamente diferentes do realizado com olhos abertos.

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