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 ± 2.34% and temperature 20.72 ± 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 Workshop¹⁻², dry eye is a multifactorial 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 practice³⁻⁴, affecting between 15 and 40% of general population. Dry eye often provokes variable symptoms, from light ocular discomfort to incapacity in keeping the eyes open⁵⁻⁷. 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 used⁸⁻¹⁰.

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\textsubscript{I}) is a well-standardized test that measures the basal tear secretion with the conjunctival-lacrimal trigeminal reflex\textsuperscript{(7,11)}. Basal Schirmer test (ST\textsubscript{B}) is performed with anesthesia and measures the basal lacrimal secretion. Other variations of the ST are not frequently used\textsuperscript{(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\textsuperscript{(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\textsuperscript{(1)}.

The purpose of this study is to analyze the difference between measurements of ST\textsubscript{I} and ST\textsubscript{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\textsubscript{I} were performed with the individuals’ both eyes open and closed with an interval of 6 hours.

On the second day, ST\textsubscript{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\textsuperscript{a}, 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\textsubscript{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\textsubscript{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\textsubscript{V} (mm/min) of ST\textsubscript{I} and ST\textsubscript{B} with open and closed eyes (Chart 1).

Note that the average ST\textsubscript{V} measurements of ST\textsubscript{I} performed with closed eyes were statistically different from those performed with open eyes (p<0.0001) and measurements of ST\textsubscript{B} performed with closed eyes were statistically different from those performed with open eyes (p<0.0001).

Also note that the average ST\textsubscript{V} performed with closed eyes was reduced in ST\textsubscript{I} (54.64%) and ST\textsubscript{B} (60.42%) when compared to ST\textsubscript{I} 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\textsuperscript{(4,6,11)}. It was originally described with open eyes, allowing the patient to blink freely\textsuperscript{(4,6,7,11)}. Some authors affirm that the results of the test do not differ when carried out with open or closed eyes\textsuperscript{(6,8)}. However, most studies do not mention which method was used in the tests (open or closed eyes)\textsuperscript{(16-21)} and there are no studies comparing both methods. Many authors have published their results using the test with closed eyes\textsuperscript{(4,13-15)}.

In our study, we note that ST values with closed eyes reduced their value by 54.64% for ST\textsubscript{I} and 60.42% for ST\textsubscript{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\textsubscript{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\textsubscript{V} may have higher values in the first minutes and diminish gradually during the test\textsuperscript{(22-24)}. ST\textsubscript{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\textsuperscript{(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.

REFERENCES


Descritores: Síndromes do olho seco/diagnóstico; Lágrimas/segreção; Técnicas de diagnóstico oftalmológico; Córnea; Ceratite