

Schirmer's Test: Dim Room Vs Illuminated Room

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Abstract:-

Purpose: To compare the Schirmer's I test values and test time duration under two different (Dim and light) illumination and Correlation of test time duration with Schirmer's I value and level of illumination.

Method: 52 eyes in 26 patients, male (9) and female (17), age ranging between 18 to 20 years and free from ocular and systemic disease, were recruited for the research. The study was conducted in a controlled room, where temperature and humidity was constant. Illumination was measured using lux meter. With informed consent routine eye examination was performed. The Schirmer's I test was performed, first in dark room illumination and then after half an hour the same test was performed in an illuminated room. and Correlation of test time duration with Schirmer's I value and level of illumination.

Results: The mean age of the population participated in study was 18 ± 0.72 . The mean and standard deviation value of 56 eyes for the Schirmer's I test and test time duration (seconds) in dim illumination and light illumination are 33.17 ± 4.06 , 35 ± 0 and 209.71 ± 65.4 , 144.17 ± 71.2 respectively. There was a statistically significant difference in Schirmer's I test values ($P=0.0016$) and test time duration ($P<0.0001$) between dim and light room illumination. There was moderate positive correlation ($r=0.35$) is seen between Schirmer's I test duration with level of dim illumination. There was moderate positive correlation ($r=0.4$) is seen between Schirmer's I test duration with level of Light illumination.

Conclusion: the Schirmer's I value is less in dim illumination compared to light illumination because light induces reflex tear secretions. The test time duration to make Schirmer's strip wet is less in light illumination compared to dim illumination. Bright light illumination requires less test time duration to make the Schirmers strip wet.

Keywords:- Schirmer Tests; Illumination; Tear Break-Up Time; Tear Secretion.

I. INTRODUCTION

Dry eye syndrome is a group of disorders characterized by specific ocular symptoms in relation to abnormal tear production or evaporation. The diagnosis of this common disorder depends on clinical symptoms and simple office-based laboratory test. The most commonly used diagnostic tests include Schirmer I and Jones 2 tests; tear break-up time and fluorescein or rose Bengal staining (Bawazeer and Hodge 2003).¹ Schirmer's basal tear secretion test is one of the most common diagnostic tests for dry eye syndrome (Bawazeer and Hodge 2003). The details of which were first published in 1903. Jones later advised the use of topical anesthesia combined with a Schirmer's test strip for 5 minutes to decrease the stimulating effect of the filter paper strip – the 'basal' tear secretion test (Dr.V.Meenakshi MS 2017).² Inconsistencies in its application limit repeatability in DES (Dry Eye Syndrome), but it still enjoys widespread use because of the ease of technique (Dr.V.Meenakshi MS 2017) (Jordan and Baum 1980). Schirmer's investigated the extent of wetting of a 5x35 mm blotting paper strip after folding 5 mm from one end and placing it in the lower fornix, at the junction of outer one-third and inner two-thirds for 5 minutes (Dr.V.Meenakshi MS 2017) (Jordan and Baum 1980). It was found that the normal secretion varied from 0.50 to 0.67 ml of tears per day and more than 15 mm of wetting on 5 minutes, measured from the folded end, was normal (Dr.V.Meenakshi MS 2017) (Jordan and Baum 1980). Later, Whatman filter paper number 41 was standardized for this test. This test became popular as Schirmer's I (or simply Schirmer's) test and gives the value for both basic and reflex secretion of tears (Dr.V.Meenakshi MS 2017) (Jordan and Baum 1980). To know the reflex secretion of tears, a Schirmer's II test was explained (HOLLY and LEMP 1973). It is performed in the same way, after rubbing the unanesthetized nasal mucosa with dry cotton and note the wetting after 2 minutes (HOLLY and LEMP 1973).³

Schirmer's test is used to assess the functioning of the lacrimal gland. Conducting Schirmer's test in low room humidity can cause excessive evaporation from the wetted Schirmer's strip that can lead to an artificially short wetted length (Buckmaster and Ian Pearce 2016).⁴ This is in contrast to the wetted length measured in a high-humidity environment (Buckmaster and Ian Pearce 2016). Optometrists conduct the Schirmer's test in various settings. Some prefer it in a normal room, whereas some perform it in an illuminated room. There is no scientific evidence or research-based evidence that supports the setting that is most suitable for Schirmer's test to be carried out. In other words, there is no strong evidence to prove that whether a

Schirmer's test is best in a normal room or illuminated room. Hence, we decided to conduct this study to compare the Schirmer's test without anesthesia (Schirmer's I) in the Dim and illuminated room.

II. METHODS

A. Study Design and Methodology:

Prospective cross-sectional quantitative study over a period 7 months was conducted through post test design. 26 participants were selected through convenient sampling. The data was collected from A.J institute of Allied Health Sciences, Mangalore. Two different illumination used, dim and light illumination. A dim illumination of average 15.6 lux and light illumination of average 156.19 lux are maintained, humidity kept constant and Schirmer's I value and time duration of test was recorded. Correlation of test time duration with Schirmer's I value and level of illumination. Materials used are lux meter, Schirmer's strips, stopwatch, Slit lamp, Snellen chart. Inclusion criteria: The age group is from 18 to 20 years, Paramedical students of A.J Institute of Allied Health Science College and exclusion criteria are the participant having any ocular or systemic diseases, Contact lens users and under any long-term lubricant medication term medication.

B. Data Collection Method & Analysis:

Participants were enrolled in the study after receiving a written informed consent. Initial screening and their verbal consent was taken & they were asked to respond to predefined questionnaires. Vision assessment using the Snellen chart was done at the college clinic followed by slit lamp examination. Tear break up time in normal and illumination was performed. Schirmer's test was performed both in Dim and illuminated room for a period of

5minutes. Duration of half an hour break was maintained between normal and illuminated room. Brightness of room and temperature was also calculated. Demographic data was analyzed using descriptive statistics such as mean, and standard deviation and inferential statistics was done by paired' test and correlation was analyzed with Pearson's correlation.

III. RESULTS

A total of 26 subjects, 9 males and 17 females participated in the study with mean age of 18 ± 0.72 and Schirmer's I test conducted in 56 eyes in two different illuminations. The mean and standard deviation value of Schirmer's I test in dim illumination of right and left eye are 33.46 ± 3.65 and 32.88 ± 4.4 respectively. The mean and standard deviation value of Schirmer's I test in dim illumination for 56 eyes is 33.17 ± 4.06 . The mean and standard deviation value of Schirmer's I test in Light illumination of right and left eye are 35 ± 0 and 35 ± 0 respectively. The mean and standard deviation value of Schirmer's I test for 56 eyes in light illumination is 35 ± 0 . There was a statistically significant difference ($P = 0.0016$) in Schirmer's I test values between dim and light room illumination. The mean and standard deviation of time duration for the Schirmer's I test in dim illumination of right and left eye are 202.57 ± 64.7 and 216.84 ± 66.4 respectively. The mean and standard deviation time of duration of Schirmer's I test in dim illumination for 56 eyes is 209.71 ± 65.4 . The mean and standard deviation Time of duration of Schirmer's I test in Light illumination of right and left eye are 132.96 ± 67.98 and 155.38 ± 73.91 respectively. There was a statistically significant difference ($P < 0.0001$) in time of duration of Schirmer's I test between dim and light room illumination.

Table1: Comparison of Schirmer's I test results: Values and time duration between dim and light illumination.

Parameter	Dim illumination	Light illumination	P value
Right eye	33.46 ± 3.65	35 ± 0	
Left eye	32.88 ± 4.4	35 ± 0	
Schirmer's I (R&L)	33.17 ± 4.06	35 ± 0	0.0016
Right eye time duration	202.57 ± 64.7	132.96 ± 67.98	
Left eye time duration	216.84 ± 66.4	155.38 ± 73.91	
Time duration (R&L)	209.71 ± 65.4	144.17 ± 71.2	<0.0001

- Schirmer’s I test values in mm and Time duration is in seconds.

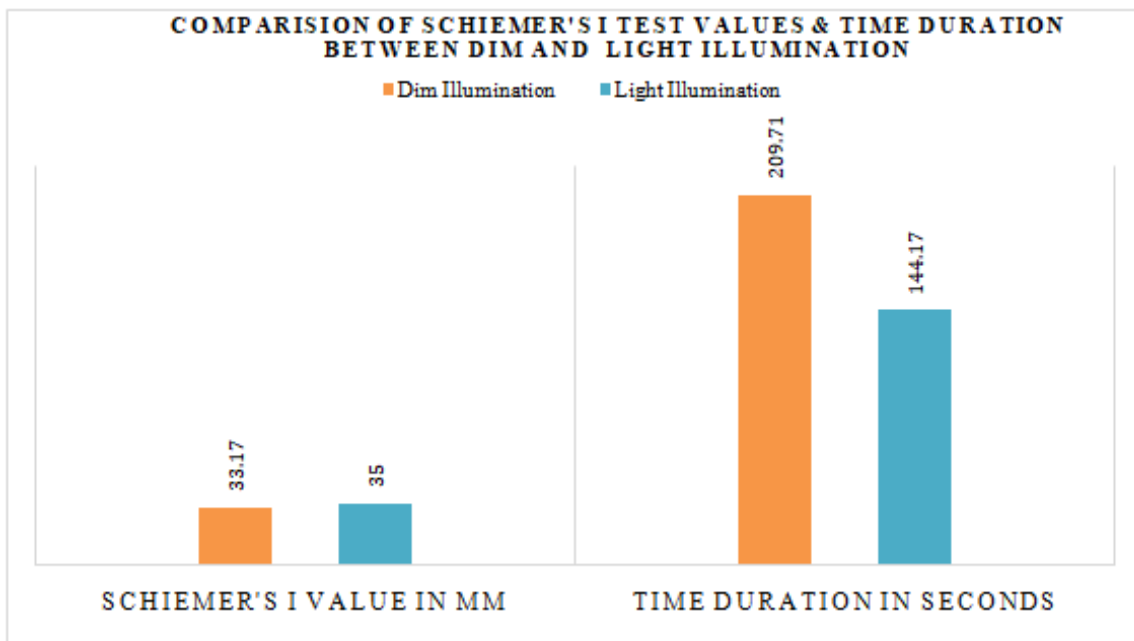


Figure1: Comparison of Schirmer’s I test values & time duration between dim and light illumination.

There was moderate positive correlation ($r=0.35$) is seen between Schirmer’s I test duration and level of dim illumination and there was no negligible relationship seen between Schirmer’s I test duration with Schirmer’s I value ($- 0.19$) and Schirmer’s I test values with Dim illumination ($- 0.135$).

Table 2: correlation of time of duration with Schirmer’s I test values and dim illumination, Correlation between Schirmer’s I and dim illumination.

	Variable	R value
Time of duration	Dim illumination	0.35
	Schirmer’s I value	- 0.19
Schirmer’s value	Dim illumination	- 0.135

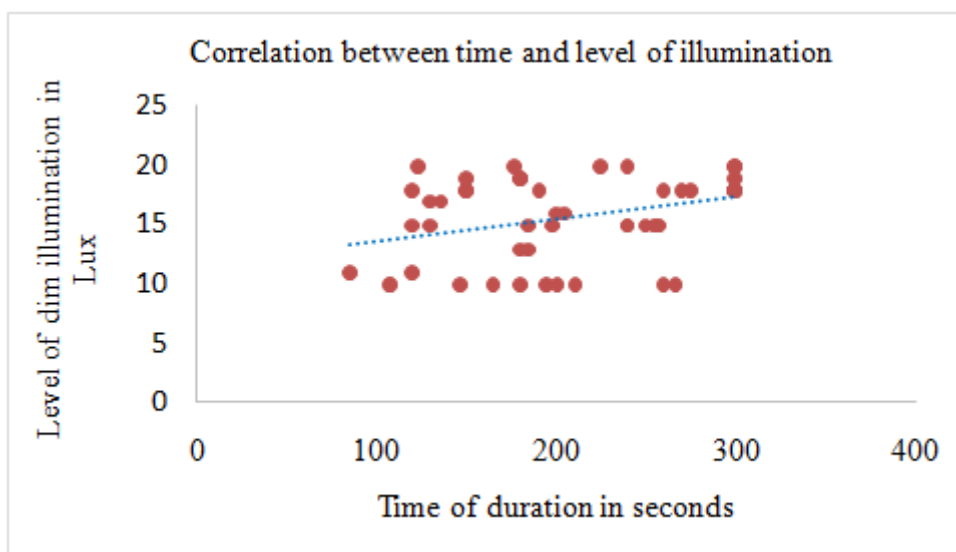


Figure 2: Correlation between time of duration and level of dim illumination.

There was moderate positive correlation ($r=0.4$) is seen between Schirmer’s I test duration and Light illumination and could not able find out the correlation with Schirmer’s T test values between time of duration and light illumination due to constant Schirmer’s I test values in light illumination

Table 3: Correlation of time of duration with level of light illumination:

	Variable	R value
Time of duration	Light illumination	0.41

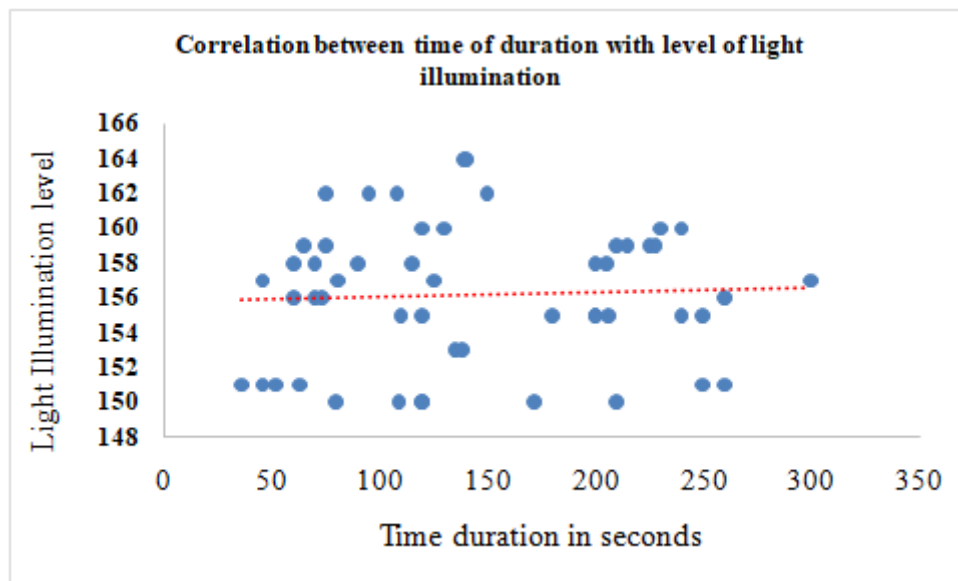


Figure 3: Correlation between time of duration and light illumination level

IV. DISCUSSION & CONCLUSION

The main aim of the study was to compare Schirmer’s I test value, time of duration between dim and light illumination. The review of Schirmer’s by Jordan and Baum 1980 say that a wide range of sensitivity and specificity values has been reported for the Schirmer’s test (Jordan and Baum 1980).⁵ This variability is thought to derive from the paper’s contact with the eyelashes for a long period (5 minutes), which elicits reflex tearing that cannot be suppressed by topical anesthetics (Savini 2008).⁶ In addition Nichols, Mitchell, et al 2004 say the change in light, humidity and temperature and patient anxiety may interfere with the tear reflex (Nichols, Mitchell, and Zadnik 2004).⁷ The present study which was conducted in a controlled room setting with temperature and humidity constant, with two different illuminations found that the time taken in illuminated room is less compared to that of normal room, and the tear secretion in dim room illumination is less compared to that of illuminated room. This may be because of high illumination which enters the eye and irritates nasal mucosa and due to which there is more reflex tear secretion, due to which the time taken will be less in an illuminated room than in a normal room. When performed without anesthesia, the Schirmer I test measures the basal tear secretion and the function of the main lacrimal gland whose secretory activity is stimulated by the irritating nature of the filter paper (Li, Deng, and He 2012).⁸ Schirmer’s II test could give an accurate effect of illumination on tears secretion because in here we can eliminate the irritable sensations in eye and can easily evaluate the effect of illumination. Shaobo lei et al, 2017 evidence that the chromatic characteristics and intensity-response of light-induced lacrimation are highly consistent

with the features of melanopsin photo transduction (Lei et al. 2017)⁹ and supporting the hypothesis that light-induced reflex lacrimation is mediated primarily by melanopsin photo activity. Though the current in the melanopsin photo transduction is not studied it is believed that bright light illumination induces reflex tears production. Shih-Bin Su et al, 2006 evidence that the excess risk of tear secretion dysfunction in LCD workers in comparison with LCM workers, who had higher illumination in the work environment, did not reach statistical significance, we observed high prevalence of tear secretion dysfunction in both groups of workers, and in both groups the illumination was far under the lower limit of the range (200 to 500 Lux) generally recommended (Su et al. 2006).¹⁰ In our study the bright light illumination produces reflex tears and with less test duration but after working at bright illumination for long-term may cause tears secretion dysfunctions. There was moderate positive correlation ($r=0.35$) is seen between Schirmer’s I test duration and dim illumination and there was no negligible relationship seen between Schirmer’s I test duration with Schirmer’s I value (- 0.19) and Schirmer’s I test values with Dim illumination (- 0.135).

The illumination affects the tear. As the level of dim illumination is decreasing the time duration is increasing to achieve the maximum wet in Schirmer’s I test. The correlation between time of duration and light illumination level is moderately positive, but the scatter plot is not matching with correlation value. From the time duration and light illumination levels what we understood is as the illumination level increases and time will decrease to make the Schirmer’s strip wet. Many studies have to be conducted on Schirmer’s test even with children to see how the result varies from one individual to another and need to conduct a

study on how different levels of illumination induces tears production with varying intensities and wavelengths.

The Schirmer's I value is less in dim illumination compared to light illumination because light induces reflex tear secretions. The test time duration to make Schirmer's strip wet is less in light illumination compared to dim illumination. Bright light illumination requires less test time duration to make the Schirmer's strip wet.

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