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An assessment of tear production by Schirmer's test among contact lens wearer

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ABSTRACT:

Dry eyes syndrome characterized by evaporative tear film or deficiency in rate of tear production is a common problem especially among contact lens wearers. Over the years, many previous studies have proved the changes of tear film parameters due to contact lens wearing; yet, the quantification of tear production during contact lens wear has received limited attention. Thus, the purpose of this research is to determine effect of silicone hydrogel contact lens wear on tear production measurement among contact lens wearer. An experimental study was conducted involving contact lens wearer from age 19 to 29 years old in Shah Alam, Selangor. The tear production rate was measured using Schirmer's test II (with Alcaine), before and after two hours contact lens wearing. A total of 40 contact lens wearer were participated with 16 male (40%) and 24 female (60%). Mean tear production rate measurement for all subjects' shown 20.28 ± 6.89 mm. Paired T-test analysis shown no significant difference between pre tear production rate measurement (20.28 ± 6.89 mm) and post tear production rate measurement (20.08 ± 6.87 mm, $p = 0.54$). In this study, the mean of tear exchange shown no significant difference with gender (male = 0.43 ± 2.15 mm, female = 0.00 ± 2.06 mm, $p = 0.42$). As the conclusion, this study has supported that the main cause of dryness among contact lens wearers is not mainly due to lack of tears production.

Keywords: Schirmer's test, tear production, dry eye

Introduction

Dry eyes syndrome characterized by evaporative tear film or deficiency in rate of tear production is a common problem especially among contact lens wearers. Tear production can be measured by Schirmer's test; with or without anaesthetic, which represent the basal secretion or total secretion of basal tears and reflex tears respectively. The Schirmer's test is continuously being used for tear production measurement in primary eye care setting despite few shortcomings as it is simple, fast, least expensive, practical for screening purposes (Cho & Yap, 1993; Senchyna & Wax, 2008) and it is still generally accepted as it gives useful information (Tiffany, 2008).

Over the years, many previous studies have proved the changes of tear film parameters due to contact lens wearing; yet, the quantification of tear production during contact lens wear has received limited attention (Downie & Craig, 2017). When the contact lens is inserted, the tear film is split into two parts; the pre-lens and the post-lens films, and this affects the biophysical and biochemical properties of the film and causes additional complications. One of the biophysical

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concern is the change in volume the flow of fluid over the cornea. To our knowledge, there is limited and updated information on tears production after contact lens wearing by using Schirmer's test. Chen et al. (2009) has studied the tear volume by Optical Coherence Tomography (OCT) has conclude that with and without lenses in situ, tear volume among symptomatic contact lens wearer are lower than asymptomatic experienced and new contact lens wearers which predisposed dry eye sensation.

While in Malaysia, there are an increase of 21% new contact lens wearer according to International Contact Lens Prescribing in 2015 (Morgan et al. 2016), hence any studies related to contact lens are demanding to cater this expanding population. A small number of studies showed that tears assessment in normal Malay population derived lower value than other country (Mohidin, Bay, & Yap, 2002) while no information on tears production reported. Thus, there is a requirement in profiling the tear assessment specifically on tears production to create a baseline and to see the effect of tears production after contact lens wearing as it will provide additional insight about the effects of lenses on the tear system.

Methods

This experimental study was approved by the Institution Research and Ethics Committee.

The data of this study were collected among 40 identified contact lens wearer's users which written consent was obtained. The inclusion criteria include ages of 19 years to 29 years old, normal cornea and no degeneration or dystrophy after full eye examination, and contact lens wearer which more than six months of wearing.

The data collection of this research was obtained by performing full soft contact lens fitting procedure whereas every patient undergo full eye check-up at Management and Science University (MSU) Eye Center, Malaysia. After full eye check-up, patient's tear production was taken by using Schirmer's test for two different times. First, tear production reading is taken before insertion of soft contact lens on patient's eyes and second, tear production reading was taken immediately after removal soft contact lens after two hours wear.

The eye was gently dried of excess tears. Topical anaesthetic (Proparacaine Hydrocloride 0.5%) was used/ Then the filter paper is folded five mm from one end. Next, the folded tip is inserted into the lower lid, at the junction of the middle and outer thirds of the lower lid with avoid the cornea or lashes area. The patient is asked to keep their eyes closed for the duration of the test which is five minutes. After five minutes, the filter paper is removed and the amount of wetting from the fold is measure in mm.

Each of patients had been fitted with soft contact lens (Airsoft Maxvue Vision, material: Silicone Hydrogel, BOZR: 8.6 mm, diameter: 14 mm, power: -0.25 DS to -2.75 DS, water content: 45 %) according to their spherical equivalent eyes power after first tear production reading taken without contact lens. After two hours of contact lens wear, tear production measurement was taken for the second time after removal of contact lens from patient's eyes. Patients tear production reading pre and post measurement was tabulated for data analysis.

Results

Forty (40) subjects that been recruited from MSU Eye Centre were 16 (40%) male and 24 (60%) female, between age 19 to 29 years old (mean age = 20.89 ± 2.06 years old) and were contact lens wearer at least six months and above (mean duration of contact lens wear = 0.56 ± 2.06 years). Demographic data on distribution of age and duration on contact lens wearing are further presented in Table 1.

Table 1: Frequency (n) and percentage (%) of age and duration of CL wear distribution

Demographic	n (%)
Age (years)	
19-21	13 (32.5)
22-24	15 (37.5)
25-27	8 (20.0)
28-29	4 (10.0)
Duration of CL wear (months)	
6-24	18 (45.0)
25-48	10 (25.0)
49-72	7 (17.5)
73-96	5 (12.5)

The mean of tear production rate among contact lens wearer is 20.28 ± 6.89 mm in 5 minutes. Paired T-test analysis showed no significant difference between pre tear production measurement and post tear production measurement among the contact lens wearer (p=0.544) are illustrated in Figure 1.

Figure 1: The mean difference of tear production rate between pre tear production and post tear production measurement.

Paired T-test analysis indicated no significant difference between pre tear production and post tear production measurement between the genders as shown on Figure 2 below.

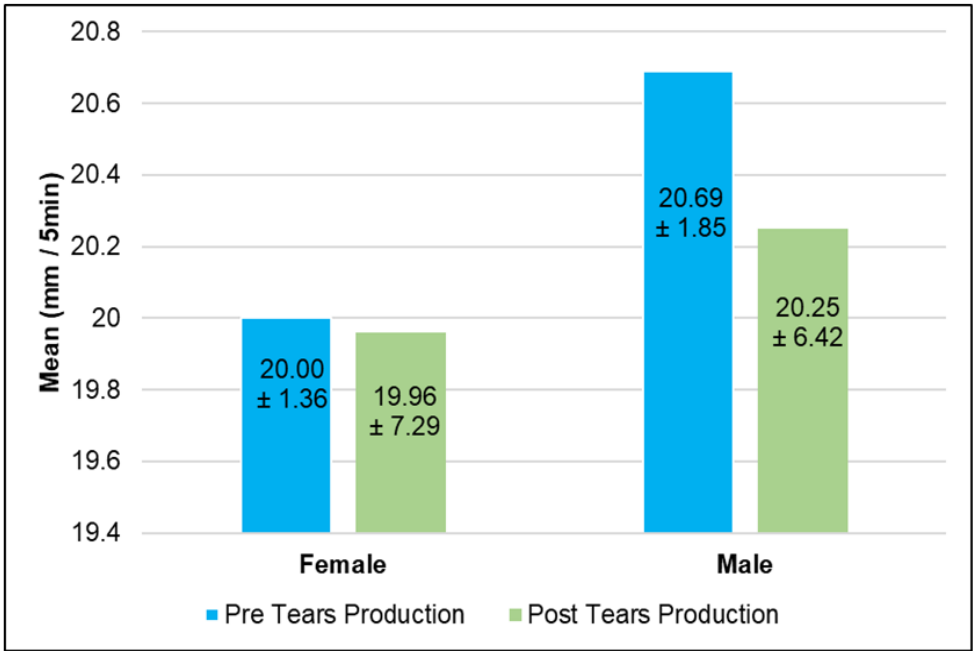

Figure 2: The mean difference between pre tear production and post tear production measurement between genders.

An independent T-test was used to compare the difference of tear production rate exchange showed no significance difference between genders (male = 0.43 ± 2.15 mm, female = 0.00 mm ± 2.06 mm, p = 0.428).

Discussion

In this study, the Schirmer's test that been used are with topical anaesthetic to eliminate reflex tearing and to assist comfortness during tears measurement. The mean tear production measurement using Schirmer's test II reported in this study was 20.28 ± 6.89 mm, is much larger than reported by Su, Ho, Lu, Chang, & Chiang, (2015) on wider age group (21-67 years old) and Ozdemir & Temizdemir, (2010) on comparable age group. When comparing to contact lens wearer group, the mean is comparable to Arita et al., (2009) (20.4 ± 10.1 mm), however the Schirmer is tested without alcaine on larger mean age group and two types of contact lens were used which are hydrogel and rigid gas permeable (RGP) lens. However, Schirmer's test with alcaine have been questioned to influence basal secretion only as no significance influence of anaesthetic or non-anaesthetic on tears secretion measurement, suggested significant tears flow with alcaine resulted from reflex tearing (Cho & Yap, 1993).

According to the result have been obtained, silicon hydrogel soft contact lens significantly not affect the tear production rate measurement by using Schirmer's test II. Study conducted by Wang, Cox, & Reindel, (2009) have showed that the tear volume increased immediately after lens insertion had achieved baseline value after 20 minutes of insertion was due to reflex tearing upon lens insertion and resume to baseline after short adaptation period time. This is also in agreement with his study which concluded that the decrement of tears meniscus of normal subjects after four hours silicon hydrogel contact lens wearing were not significant.

Previous study also had demonstrated that there is no significance difference of Schirmer's test between contact lens wearers and non-wearers

(Arita et al., 2009) however the type of contact lens were hydrogel lens and RGP lens. They conclude that dry eye resulting from increased evaporation of the tear film is more prevalent in contact lens wearer than in non-wearers which similar with previous studies. In contrast by study done by Chen et al, (2009), the Schirmer's test results in contact lens wearer group regardless symptomatic and asymptomatic dry eye, were significantly lower than normal non–lens wearers. There is significant decreased tear volume with or without hydrogel contact lens wearing among contact lens wearer which cause significant role in dry eye sensation.

Few studies demonstrated that there is changes or reduction in tear production rate throughout the day (Craig et al., 2013). The tear flow rate varies according to the level of sensory stimulation, in response to the demands of the external environment. The overnight tear production rate is significantly lower than that during the day. Hence it might be beneficial in the future to take the measurement at specific time. Significant differences in tear production have been reported between contact lens wearers described as either tolerant or intolerant based on their ability to tolerate lens wear for a period of at least 2 hours. For improvement the rate of tear production measurement should take at 2 hours, 5 hours and 8 hours for comparison with the same contact lens materials.

In conclusion, there is no significant difference between pre and post tear production measurement using Schirmer's test II among silicone hydrogel soft contact lens wearer. This study has supported that the main cause of dryness among contact lens wearers is not mainly due to lack of tears production rate. Further study need to be done among different types of contact lens and longer duration of contact lens wear to observe the effect on the tears production.

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