

## Changes in the appearance of tarsal conjunctiva in soft contact lens wearers in Kuala Lumpur

Bariah Mohd-Ali \*, Tan Poh Jing BOptom, Bashirah Ishak, Norhani Mohidin

*Optometry and Vision Science Program, School of Health Care Sciences, Faculty of Health Sciences, Universiti Kebangsaan Malaysia, Jalan Raja Abdul Aziz, 50300 Kuala Lumpur.*

- Study funded by UKM research grant (Industri 2013-018)

\* **Corresponding Author:** Dr. Bariah Mohd Ali  
Associate Professor; Optometry and Vision Science Program  
Faculty of Health Sciences, Universiti Kebangsaan Malaysia  
Jalan Raja Muda Abdul Aziz, 50300 Kuala Lumpur  
Tel: 603-92897495 | Fax: 603-26910488  
Email: [bariah@medic.ukm.my](mailto:bariah@medic.ukm.my)

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### Abstract

**Background:** Soft contact lens wear can induce changes in the appearance of tarsal conjunctiva. However, no studies have compared the appearance of tarsal conjunctiva between contact lens wearers and non contact lens wearers in a sample population.

**Aims and Objective:** To determine differences in the appearance of tarsal conjunctiva between contact lens and non contact lens wearers in a sample population in Kuala Lumpur.

**Methods:** This is a cross sectional study involving 80 subjects which consisted of 40 contact lenses wearers and 40 non-contact lenses wearers. All subjects were free from any ocular or systemic illnesses. The upper eyelid was everted and examined using slit lamp biomicroscope with camera attachment. Three photos were taken in each subject and the tarsal redness and roughness were graded following the IER grading scale.

**Results:** The gender distribution was 85% females and 15% males with mean age of  $22.15 \pm 1.28$  years. Mean of redness and roughness grades for contact lenses wearers were  $2.12 \pm 0.47$  units and  $1.34 \pm 0.43$  units respectively. Mean of redness and roughness grades for non-contact lenses wearers were  $1.40 \pm 0.41$  units and  $0.86 \pm 0.19$  units accordingly. There were significant differences in redness grades (Mann-Whitney,  $z = -6.030$ ;  $p < 0.05$ ) and roughness grades (Mann-Whitney,  $z = -6.429$ ;  $p < 0.05$ ) between both groups.

**Conclusion:** The results indicate that soft disposable contact lens wear causes changes in the appearance of tarsal conjunctiva. The findings emphasize the need for follow up examination to prevent worsening of the condition.

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**Key words:** tarsal, conjunctiva, contact lens, IER grading scale, soft contact lens

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## Introduction

Changes in tarsal conjunctiva tissue such as injection, loss of smoothness and transparency, papillae formation, neovascularization and the development of giant papillary conjunctivitis (GPC) can occur secondary to contact lens wear.<sup>1,2,3,4</sup> The condition can develop within weeks of beginning contact lens wear or following months or even years of successful wear.<sup>1</sup> Those conditions might accompany with discomfort, itching, mucus discharge, blurred vision and excessive lens movement and hence results in the patient discontinuing contact lens wear.<sup>2</sup>

The tarsal conjunctiva is a thin mucus membrane that lines the inner surface of upper eyelid. The tarsal conjunctiva may become inflamed because of infection or allergy, and everting the eyelid allows the observer to make a clinical judgment as to the health of this tissue. Papillary conjunctivitis is a common complication of contact lens wears that manifests as a hyperemic field of raised papillae that is described as a “cobblestone” appearance or known as “giant papillary conjunctivitis”.<sup>3,4</sup> Giant papillary conjunctivitis (GPC) was first noted by Spring.<sup>5</sup> This condition had been reported predominantly associated with soft contact lens wearers, but also reported in patients with rigid lenses, ocular prostheses, exposed sutures following ocular surgery, extruded scleral buckle, band keratopathy, corneal foreign bodies, and cyanoacrylate tissue adhesive.<sup>5</sup> This condition is also known as “contact lens-induced papillary conjunctivitis”. According to Efron<sup>3</sup>, this condition is thought to be an allergic reaction to deposits that build up on the anterior lens surface, or toxic reaction to contact lens solution preservatives and also mechanical irritation.

Clinical grading system is the most useful way to record the changes or severity of clinical signs. There are several grading scales available but most widely used are the one from Institute of Eye Research (IER), Sydney, Australia (1996) and Efron grading scale.<sup>6</sup> Both of these scales use the familiar zero to four-unit scale and have photographs and drawings respectively that illustrate the appearance at each grade. Unlike the Efron grading scale that grades the tarsal conjunctiva redness and roughness as a whole, the IER grading scale rates the redness and roughness of tarsal conjunctiva separately.<sup>7</sup> A study done by Mackinven and colleagues<sup>8</sup> in a population with no history of ocular disease and contact lens wear by measuring the prevalence of tarsal conjunctival redness and roughness had shown that the mean redness and roughness was approximately 1.25 units, with five per cent out of a total 96 subjects having redness or roughness greater than 2.0 units.

Small papillae can be found on non-contact lens wearers.<sup>9</sup> However, it happens more frequent among those contact lens wearers.<sup>10</sup> Allansmith and coworkers<sup>1</sup> quantified the distribution of normal findings and reported that in non-contact lens wearers 24% of subjects had a tarsal conjunctiva with satin appearance, 69% had a uniform papillary appearance, and 7% had a non-uniform appearance.

Korb et al<sup>11</sup> reported that a small number (0.6% from 500) of normal individuals who do not wear contact lenses have a papillary reaction of 0.3mm on the upper tarsal conjunctiva. On the basis of these findings, a papillary reaction greater than 0.3mm is generally considered abnormal. Ishak et al<sup>7</sup> reported that from 416 non-contact lens wearers in Malaysia, 2% of them have the redness and roughness of tarsal conjunctiva of more than 2.0 units.

Forister et al<sup>12</sup> conducted a study on ocular complications due to contact lens wear and found that out of 572 contact lens wearers and 50% of them had at least one of the contact

lens complications. The most common complication was the Giant Papillary Conjunctivitis (GPC) with the prevalence of 0.79.

Previous studies have shown that prevalence and normal grading of tarsal conjunctiva redness and roughness among contact lens wearers and non-contact lens wearers. However, no studies have actually compared the differences in the appearance of tarsal conjunctiva between contact lens wearers and non-contact lens wearers. This is a cross-sectional study assessing redness and roughness of tarsal conjunctiva of contact lens and non-contact lens wearers using the IER grading scale. The IER grading scale is commonly used among Optometrists in Malaysia. Therefore it is justifiable for us to use it in this study. Our study compares the average grading of tarsal conjunctiva between contact lens wearers and non-contact lens wearers in a sample population in Kuala Lumpur. Results of the present study might help improve the awareness for proper contact lens care and eye health among Malaysians.

## **Methodology**

A total of 80 subjects aged between 20 and 25 years participated in this study. Informed consent was obtained from each subject prior to data collection. This study is approved by the Medical Ethics Committee of Universiti Kebangsaan Malaysia.

From the total number of subjects, 40 of them were asymptomatic soft disposable contact lens wearers with at least 3 months duration of contact lens wear. Another 40 of them were non-contact lens wearers and acted as the control group. All subjects were free from ocular and systemic illnesses. The examination and grading of the upper tarsal conjunctiva was carried out on both right and left eyes using the IER grading scale and slit lamp biomicroscope (Topcon, Tokyo, Japan). Initially, the upper eyelid was everted using a cotton bud and the redness and roughness of tarsal conjunctiva was examined with the slitlamp under white light. Photos of conditions of tarsal conjunctiva were then taken using Nikon Coolpix 4500 Camera (Nikon, Tokyo, Japan), which was attached to the slit lamp. Three photographs of tarsal conjunctiva were taken on each eye.

Each photograph of the tarsal conjunctiva was divided into three zones (Figure 1). Zone 1 is the area along the tarsal border, zone 3 is the area along the lid margin, and zone 2 is the central area of the tarsal plate. The zones were selected differentiate the tarsal conjunctiva from the junctional conjunctiva because larger papillae and follicles were found at the fold near zone 1 but seems not contact lens related. The area along the medial and temporal aspects of the tarsal plate and the area along the superior border of plate have been called transitional zone because papillary reaction often seem in normal individuals in this area and not considered pathologic. They should be disregarded in assessing the condition of the upper tarsal conjunctiva.

Two different Optometrists using IER grading scale from grade zero to grade four with 0.1 increments graded redness and roughness of each zone on tarsal conjunctiva. Reliability between 2 observers was monitored throughout the study using analysis suggested by Bland and Altman.<sup>14</sup> The redness grade and roughness grade in the three different zones in each subject was averaged to give an overall score for each eyelid. The overall scores for all subjects were then averaged. The same procedures were carried out for both groups of

subjects. In addition, the overall score of redness and roughness of tarsal conjunctiva for both groups were also compared.

## **Results**

The subjects comprised of 85% females and 15% males. Table 1 depicts the distribution of subjects according to race and gender. The mean age of the subjects was  $22.15 \pm 1.28$  years.

The subjects were categorized into two groups; contact lens wearers and non-contact lens wearers. The analysis showed that the average redness for the contact lens wearers was  $2.12 \pm 0.47$  units and for non-contact lens wearers was  $1.40 \pm 0.41$  units. Significant difference in redness was found between the three differences zones for contact lens wearers (Kruskal Wallis,  $df = 2$ ,  $N = 120$ ,  $p = 0.029$ ,  $p < 0.05$ ) but no significant difference was noted in the non-contact lens wearers (Kruskal Wallis,  $df = 2$ ,  $N = 120$ ,  $p = 0.063$ ,  $p > 0.05$ ).

The average conjunctival roughness for contact lens wearers was  $1.34 \pm 0.43$  units and for non-contact lens wearers was  $0.86 \pm 0.19$  units. Significant difference for roughness was found between the three difference zones for contact lens wearers (Kruskal-Wallis,  $df = 2$ ,  $N = 120$ ,  $p = 0.027$ ,  $p < 0.05$ ) and non-contact lens wearers (Kruskal-Wallis,  $df = 2$ ,  $N = 120$ ,  $p = 0.008$ ,  $p < 0.05$ ). Table 2 shows the average redness and roughness for contact lens wearers and non-contact lens wearers, with zone 1 having higher grades in both redness and roughness among contact lens and non-contact lens wearers.

A significant association was noted between redness and roughness of the tarsal conjunctiva (Spearman  $\rho = 0.484$ ,  $p = 000$ ). Further analysis of the results show that there is significant difference in redness (Mann-Whitney U,  $z = -6.030$ ,  $p < 0.05$ ) and roughness (Mann-whitney U,  $z = -6.429$ ,  $p < 0.05$ ) of tarsal conjunctival between contact lens wearers and non-contact lens wearers. Both Figures 4 and 5 showed the intra-observer agreement between the two observers for the redness and roughness grades of tarsal conjunctiva. An intra-observer reliability analysis was performed to determine consistency between the two observers. The results showed that intra-observer agreement had a kappa value of 0.76 and 0.69 (Table 4). According to Altman<sup>15</sup>, a kappa value between 0.61-0.80 is interpreted as having a good strength of agreement.

## **Discussion**

Changes in the tarsal conjunctiva are a major complication of contact lens wear.<sup>16</sup> It is considered primarily to be a consequence of allergenic stimuli, contact lens solutions and mechanical irritation.<sup>17,18</sup> Better knowledge of the characteristics of the background appearance of tarsal conjunctiva in contact lens wearers will improve the management of contact lens-induced complications.

To the best of our knowledge this is the first study that evaluates the differences in the appearance of tarsal conjunctiva between contact lens wearers and non-contact lens wearers in Malaysia. Results from the present study showed that there are differences between both groups where higher grades of conjunctival redness and roughness were noted among soft contact lens wearers than non-contact lens wearing group. The redness and roughness of the

tarsal conjunctiva were significantly associated. The IER grading scale suggestion that the tarsal conjunctiva surface with up to 2.0 units is considered normal was reaffirmed in this study because the tarsal conjunctiva of the majority of non-contact lens wearers was graded at 2.0 units or less. An earlier study showed that the median grades for redness and roughness were 0.90 and 0.86 units among 416 normal subjects aged 19 to 24 years old and only 2.2 percent of them had grades for redness and roughness greater than 2.0 units.<sup>7</sup> Another study shown that the median grades for redness and roughness were both 1.25 units among 96 normal subjects aged between 18 to 75 years, while only approximately five per cent of subjects had grades than 2.0 units.<sup>8</sup> Our study found a higher percentage (about seven percent) of tarsal conjunctival with redness and roughness higher than 2.0 units among non-contact lens wearers. The differences in the number of subjects and age distribution were probably the factors that contributed to this difference.

Results from the present study also showed that more than half of the contact lens wearers (60 percent) had grade of tarsal conjunctival redness higher than 2 units while 12.5 percent of them had grade of tarsal conjunctival roughness higher than 2 units. An earlier study<sup>16</sup> showed a higher percentage of soft contact lens wearers having papillae condition which is 21.27 percent from 47 wearers. Donshik et al<sup>17</sup> showed that 85% from 220 contact lens wearers, which have abnormal appearance of tarsal conjunctiva, are soft contact lens wearers. The abnormal appearance of tarsal conjunctiva is believed caused by mechanical irritation and allergic<sup>18</sup> or contact lenses solution, which contains preservative<sup>10</sup>.

### **Limitations of study**

Small number of subjects is the main limitation of this study. Future studies with larger sample size are needed to confirm our findings and should include impression cytology technique to further understand the impact of wearing soft contact lens on the ocular surface.

### **Conclusion**

This study concludes that there are changes in appearance of tarsal conjunctiva in soft contact lens wearers. The findings emphasize the importance of follow up examination for all contact lens wearers to prevent worsening of the condition. The results also might be beneficial to clinical trials using other material or design contact lenses where changes in the tarsal conjunctiva are commonly used as an outcome measure.

### **List of abbreviations**

IER: Institute of Eye Research

### **IRB permissions**

This study was approved by the Medical ethics committee of Universiti Kebangsaan Malaysia (UKM 1.5.3.5/244/NN-001-2013).

### **Grant registration number**

UKM Research grant (Industri 2013-018)

**Competing interest:** None to declare

**Author's information:** The second author of this manuscript was a B Optom candidate at Universiti Kebangsaan Malaysia. The manuscript was part of her final year dissertation. The rest of the authors are academic staff of Faculty of Health Science, Universiti Kebangsaan Malaysia.

**Acknowledgement**

We wish to acknowledge financial support from UKM research grant (Industri 2013-018) for this study.

**Conflict of interest**

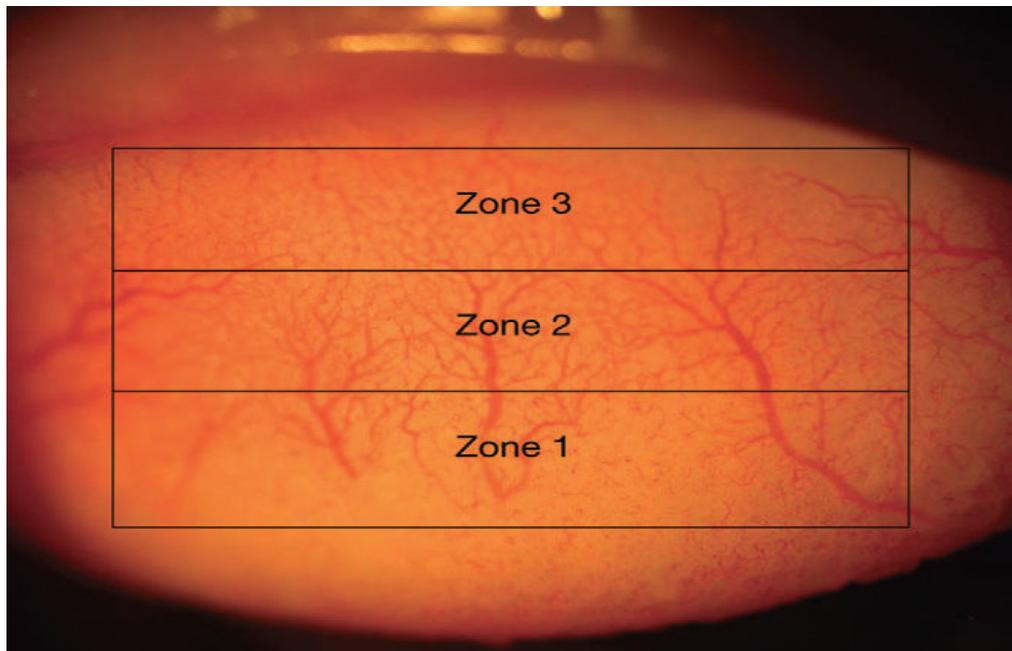
None to declare

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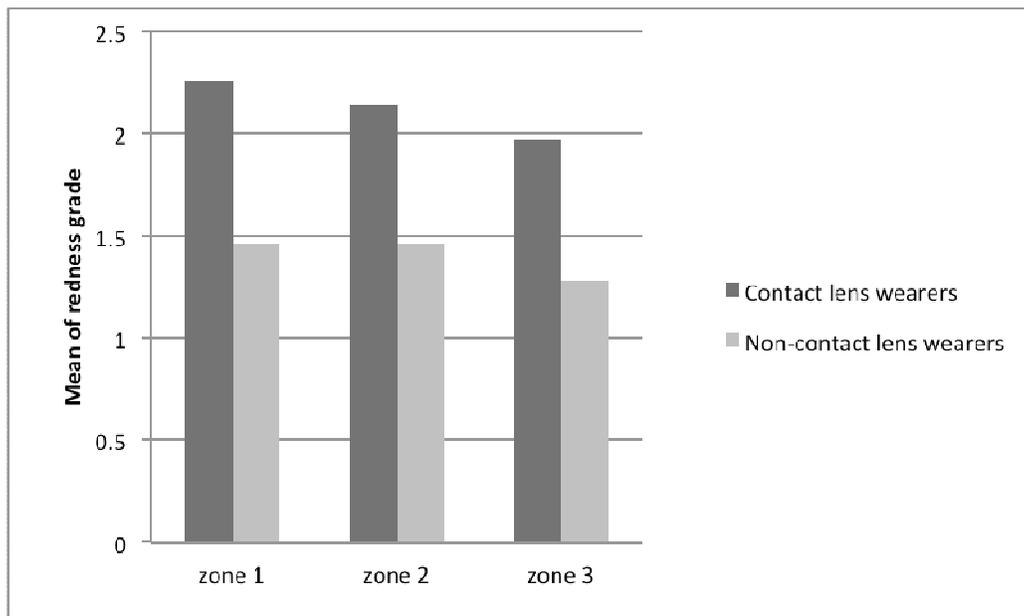
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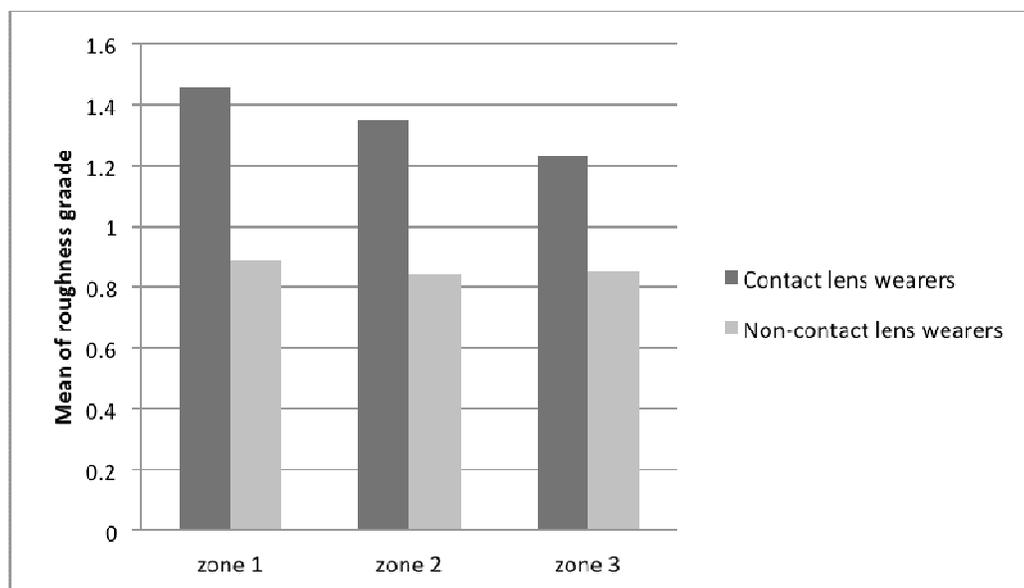
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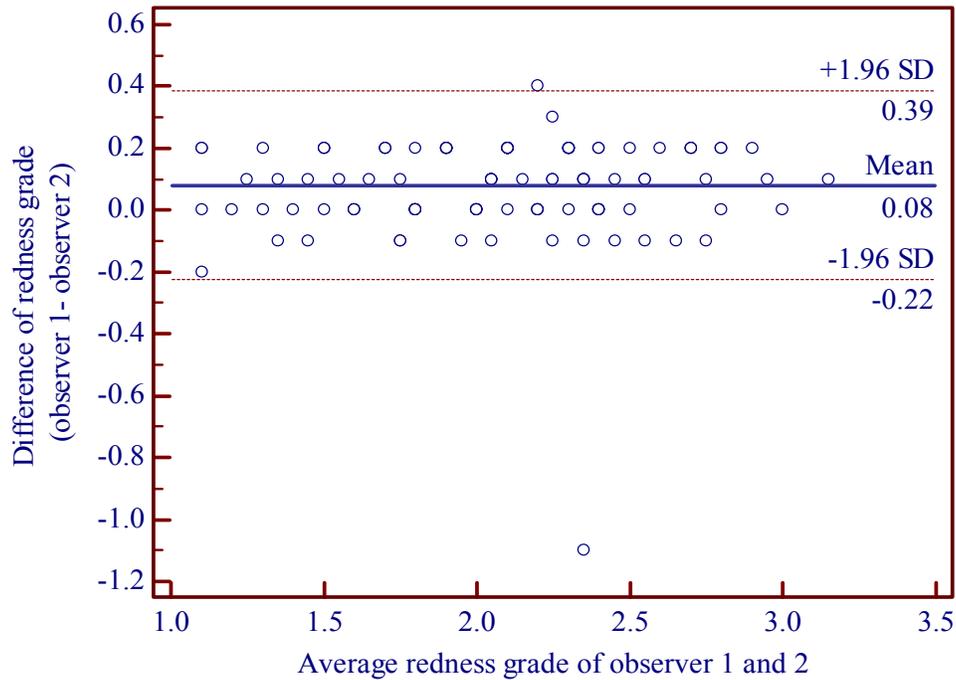
**Figure 1:** Zones of superior tarsal conjunctiva. (from Ishak et al.2011. *Grading of tarsal conjunctiva of young adults in Malaysia*. Clinical and Experimental Optometry. 94(5): p. 458-463.)



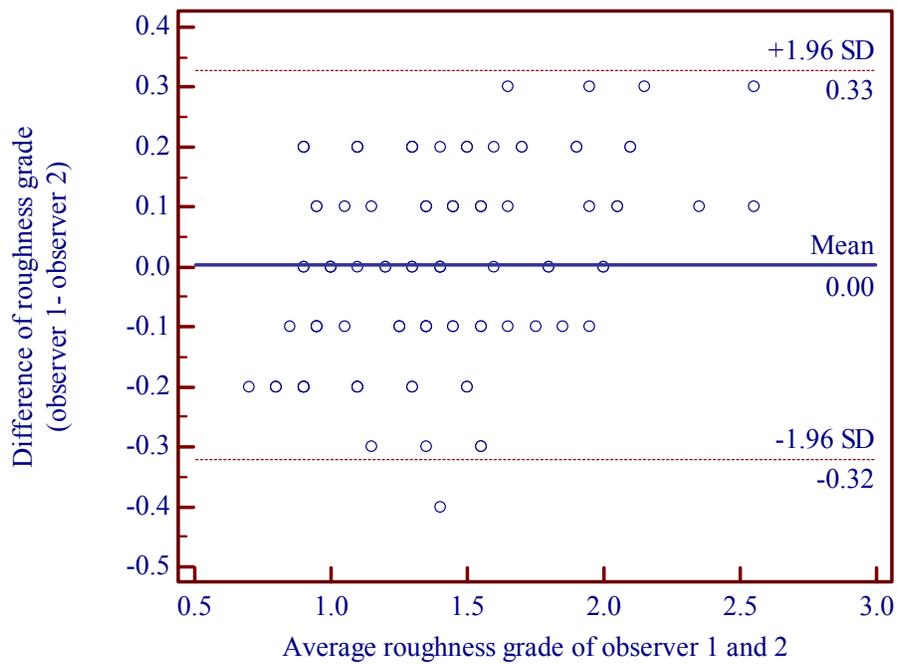
**Figure 2:** Mean of redness grades for three zone between contact lens wearers and non-contact lens wearers



**Figure 3:** Mean of roughness grade for three zone between contact lens wearers and non-contact lens wearers.



**Figure 4:** Intra-observer agreement for redness grades



**Figure 5:** Intra-observer agreement for roughness grades

**Table 1:** Distrubution of subjects according to race and gender

	<b>Male</b>	<b>Female</b>	<b>Total</b>
<b>Malay (%)</b>	2 (2.50)	31 (38.75)	33 (41.25)
<b>Chinese (%)</b>	10 (12.50)	37 (46.25)	47 (58.75)
<b>Total (%)</b>	12 (15.00)	68 (85.00)	80 (100.00)

**Table 2:** Average grades for the redness and roughness for three different zones of contact lens wearers.

	<b>Redness (n = 40 for each zone)</b>	<b>Roughness (n = 40 for each zone)</b>
<b>Zone 1</b>	2.26 ± 0.45	1.46 ± 0.41
<b>Zone 2</b>	2.14 ± 0.45	1.35 ± 0.49
<b>Zone 3</b>	1.97 ± 0.46	1.23 ± 0.38
<b>Mean ± SD</b>	2.12 ± 0.47	1.34 ± 0.43

**Table 3:** Average grades for the redness and roughness for three different zones of non-contact lens wearer.

	<b>Redness (n = 40 for each zone)</b>	<b>Roughness (n = 40 for each zone)</b>
<b>Zone 1</b>	1.46 ± 0.39	0.89 ± 0.13
<b>Zone 2</b>	1.46 ± 0.40	0.84 ± 0.22
<b>Zone 3</b>	1.28 ± 0.43	0.85 ± 0.21
<b>Mean ± SD</b>	1.40 ± 0.41	0.86 ± 0.19

**Table 4:** Kappa value intra-observer agreement

	<b>Kappa value</b>
<b>Redness</b>	0.761
<b>Roughness</b>	0.687