IS THERE AN ASSOCIATION BETWEEN MYOPIA AND DRY EYE SYMPTOMS AMONG THE UNIVERSITY STUDENTS IN KUANTAN, MALAYSIA?

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ABSTRACT

Introduction: Refractive errors may contribute to dry eye disease especially in myopia with the possible alterations in the corneal curvature, thickness and endothelial density as the eyeball elongates. However, the association between refractive errors and dry eye symptoms has not been fully investigated and the prevalence of myopia has yet to be identified among the university students in Kuantan, Malaysia. **Methods:** Eighty-three first year Kulliyah of Allied Health Sciences (KAHS) students of either myopes or emmetropes responded to two questionnaires namely the refractive error questionnaire to determine the refractive status, apart from undergoing a physical subjective refraction, and Ocular Surface Disease Index (OSDI) to determine their dry eye status via email, QR code and online messaging platform. The OSDI scores were compared between myope and emmetropes using Independent T-test and Spearman's rank-order correlation analysis. **Results:** The prevalence of myopia among the first-year students was about 68%. In addition, 60.24% of year 1 KAHS students reported having dry eye symptoms but there was no significant association between refractive error and dry eye symptoms (p>0.05). However, OSDI scores were significantly higher in myopes compared to emmetropes (p<0.05). **Conclusion:** The estimated high prevalence of myopia among university students may be due to prolonged near work and usage of gadgets. OSDI score in myopia is higher compared to emmetrope which may be due to the changes that occur in the anterior surface of cornea.

KEYWORDS: Dry eye, myopia.

INTRODUCTION

According to Flitcroft et al., (2018), myopia is defined as "A *refractive error in which rays of light entering the eye parallel to the optic axis are brought to a focus in front of the retina when ocular accommodation is relaxed, which usually results from the eyeball being too long from front to back but can be caused by an overly curved cornea and/or a lens with increased optical power*". Based on this definition, the probability of anterior corneal changes is high in myopia since the eyeball elongation in myopia progression may also lead to a flatter corneal curvature, decreased corneal thickness, as well as decreased endothelial density (Chang et al.,2001). Evidently, changes in corneal parameters have been shown to result in dry eye (DE) (Satitpitakul et al., 2021, Fahmy and Aldarwesh, 2018). Corneal thickness for instance, together with

lacrimal gland, are affected by the parasympathetic nervous system which might determine the association between DE and myopia (Hazra et al., 2022). Furthermore, TBUT was also associated with corneal thickness, which is related to the axial length (Hazra et al., 2022). Ilhan et al., (2014) suggested that the pathologic myopia group has an average tear break-up time (TBUT) value of 7.2 seconds, with 66.6% of patients having a TBUT of less than 10 seconds and based on the OSDI scores, 60% of patients with high myopia experienced significant symptoms of DE, indicating that they experienced ocular surface irritation. In addition, in a recent study where the myopia-associated conjunctiva microbiota was explored, it was suggested that Proteobacteria, Actinobacteria and Acinetobacter may play roles in the high myopia associated ocular surface irritation (Xiao et., al 2023). The association between DE and myopia were also revealed regardless of age and gender (Wang et al., 2022, Ayaki et al., 2023).

The OSDI is one of the most widely used ocular symptom questionnaires in dry eye studies where it was designed to assess symptoms of ocular irritation and their impact on vision-related function and to grade the severity of dry eye (Guillemin et al 2012, Ozcura et al 2007). The OSDI was also able to show treatment benefits in dry eye (Chang et al 2009, Russo et al 2007, Stevenson et al 2000, Yüksel et al 2010) and the questionnaire has good reliability and validity.

Refractive Error Questionnaire from Gameiro Filho et al., (2013) was utilised to identify the prevalence of refractive errors in medical students at the State University of Londrina (UEL) as well as the most commonly used methods of visual correction. This respective questionnaire is suitable and applicable to university students and has been utilised in several related studies (Alhibshi et al., 2021, Ferial et al., 2020, Alqudah et al., 2023, Nkashama et al., 2023, Batool et al., 2022)

The association between refractive errors and DE symptoms has not been fully investigated in Malaysia, particularly among the university students in Kuantan, Pahang. Therefore, this study aimed to investigate the association between refractive error and DE symptoms and to compare DE scores between myopia and emmetropia students. In addition, the prevalence of refractive error and DE in Year 1 KAHS students is also identified.

MATERIALS AND METHODS

Study design

This cross-sectional study enrolled the year 1 KAHS students of the 2022/2033 session. All 83 participants were requested to complete the Refractive Error Questionnaire from Gameiro Filho et al. (2013) (Appendix 1) and the Ocular Surface Disease Index (OSDI) Questionnaire from Outcomes Research Group at Allergan Inc (Irvine, Calif). The questionnaires were distributed via email, QR code and online messaging platform (WhatsApp). Apart from filling up the refractive error questionnaire, the participantS were also present for physical subjective refraction at the optometry clinic of KAHS to identify their actual dioptric values of myopia if any.

Statistical analysis

The OSDI scores of myopia and emmetropia students were compared using independent T-test and Spearman's rank-order correlation analysis was applied to determine the association between refractive errors and dry eye symptoms. The informed consent form was given to the subjects prior to answering the refractive error and OSDI questionnaires. The ethical approval for this study was acquired from IIUM Research Ethics Committee. All data collected was analysed using the Statistical Package for Social Science Software (SPSS) (version 29 for Windows, SPSS, Inc., Chicago, IL, USA).

RESULTS AND DISCUSSIONS

Prevalence of refractive error and dry eye in year 1 KAHS students

Eighty-three students participated in this study. The prevalence of myopia in year 1 KAHS students was 68% and another 31% were discovered to be emmetrope. Myopic subjects were divided into low myope (-0.50DS to -2.75DS), moderate (-3.00DS to -4.75DS), and high myope (-5.00DS or higher) groups based on their relative prevalence of 49%, 28%, and 23% respectively.
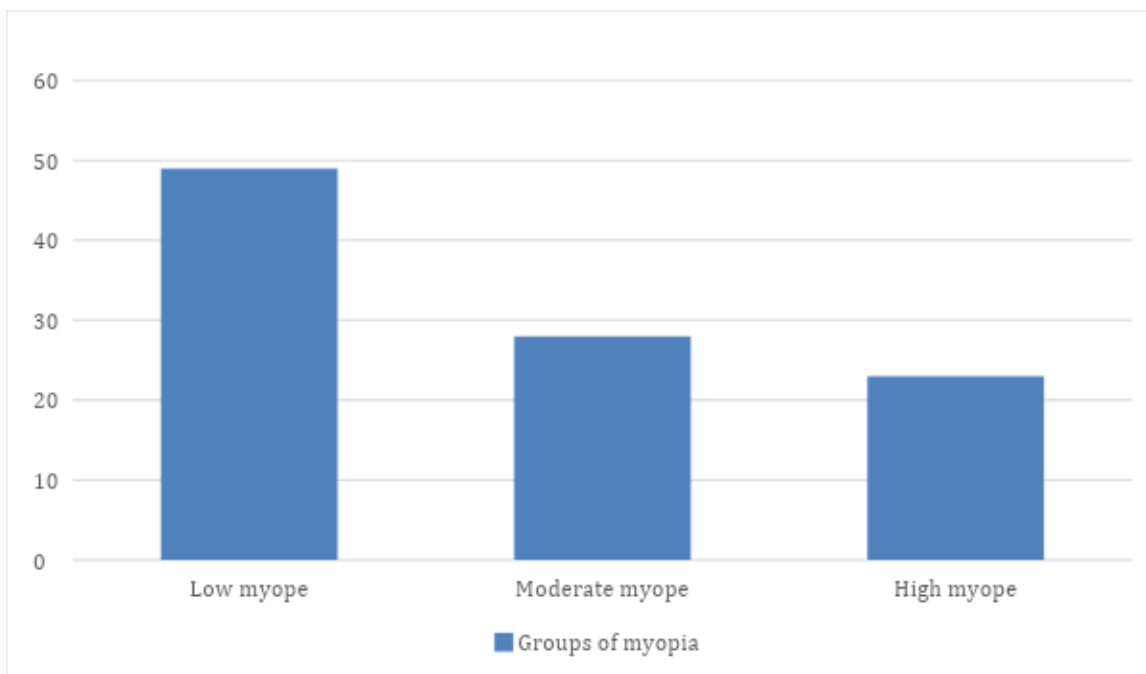
Figure 1: Groups of myopia

In addition, 60% of year 1 KAHS students reported having dry eye symptoms, which were further divided into mild (13 to 22 score), moderate (23 to 32 score), and severe (more than 32 score) dry eye, with the prevalence of 38%, 36%, and 26%, respectively.
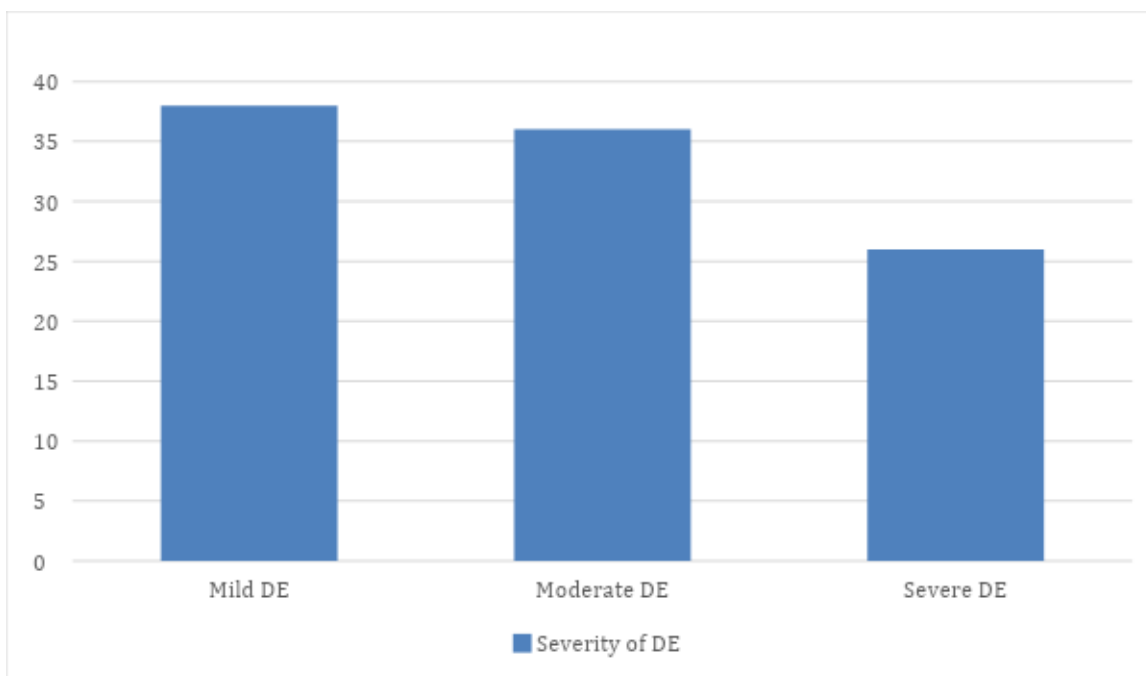

Figure 2: Severity of dry eye symptoms

Association between refractive error and dry eye symptoms

The association between spherical equivalent and OSDI score for each eye was investigated using Spearman's rank-order correlation. There was no significant association between them for either eye, RE ($p=0.120$) and LE ($p=0.057$).

Comparison of OSDI score between emmetropic and myopic students.

OSDI scores were significantly higher ($p<0.05$) in myopia with the mean score of 19.95 compared to emmetropia students with the mean score of 10.82 as shown in table 1.

Variable	Emmetropic (n = 26)		Myopic (n = 26)		p-value
	Mean	SD	Mean	SD	
OSDI score	10.82	9.392	19.95	16.554	0.019

Table 1: Comparing OSDI score between emmetropic and myopic.

DISCUSSION

Prevalence of refractive error and dry eye in year 1 KAHS students

Refractive error is caused by an optical imperfection in the eye that prevents the eye from correctly focusing light onto the retina, resulting in blurred vision (Abdul Khalid., 2016). Based on the current study, there is a high prevalence of myopia among KAHS year 1 university students as 69% of the subjects were discovered to be myopia with low myopia recorded the highest prevalence (49%) followed by 28% of moderate myopia and 23% of high myopia. According to Kumar et.al. (2018), insufficient light, extended reading hours, watching television, and long-term smartphone usage were all determined to be statistically significant risk factors for refractive error. Thus, the extensive near work and prolonged usage of gadgets such as smartphones and laptops might have contributed to the high prevalence of refractive errors among the participants in the current study.

Surprisingly, there is also a high prevalence of dry eye (60%) among year 1 KAHS students, which were further divided into mild (38%), moderate (36%), and severe dry eye (26%) respectively. According to the retrospective study conducted by Aljarousha et al. (2018), the total prevalence of dry eye disease (DED) at Jalan Hospital Eye Care, International Islamic University Malaysia (IIUM), Kuantan, Malaysia was 48.8%, which was also higher than the global prevalence estimates of 7% to 34%.

Association between refractive error and DE symptoms

Ilhan et al. (2014) suggested that the pathological myopia group has an average TBUT value of 7.2 seconds, with 66.6% of patients having a TBUT of less than 10 seconds and based on the OSDI scores, 60% of patients with high myopia experienced significant symptoms of dry eye, indicating that they had ocular surface irritation. Furthermore, according to Hirayama et al, (2022), those with high myopia reported significantly more dryness compared with the subjects with no myopia. The possible physiological change to the choroidal thickness takes place when someone performs prolonged near work who in return has a greater increased risk of evaporative DE, which directly affects the TBUT (Hazra et., 2022). However, in the current study, there is no significant association between refractive error and dry eye symptoms among the year 1 KAHS students. This could be due to only 23% of them were high myopic while the majority of them were in the range of low to medium class of myopia severity. In addition, dry eye may also occur with the absence of symptoms (Nichols et al., 2004) even with the presence of ocular surface parameter changes, which however, have not been investigated in the current study.

Comparing OSDI score between emmetropic and myopic students.

The significant difference in terms of OSDI scores between emmetropic and myopic in year 1 KAHS suggests that myope has a higher dry eye score compared to emmetrope. A comparison study between a group of 50 young female subjects (20.3 ± 1.1 years) with refractive error of (−0.25 to −6.00D) and a control group of emmetropias also identified a significant higher OSDI score and hence suggested that refractive error has a risk factor for dry eye (Mana A. et al., 2021). Furthermore, the median scores from the OSDI measurements were higher in myopic and hyperopic eyes than those recorded for emmetropes (Fagehi et al., 2022).

According to Chang et al., (2001), there are changes that occur in the anterior surface of the cornea as the eyeball elongates in myopia progression which include flatter corneal curvature, decreased corneal thickness, as well as decreased endothelial density. Clinically, as the eyeball elongates in myopia, alterations in the anterior corneal surface may lead to an increased risk of dry eye (Fahmy and

Aldarwesh., 2018). Furthermore, the extension of the axial length was identified to be significantly associated with corneal thickness and tear breakup time since the parasympathetic nervous system may be the determining factor for the relationship between dry eye disease and myopia as it affects the lacrimal glands and corneal thickness (Hazra et al. 2022). This further supports that myope may be having higher dry eye score compared to emmetrope in relation to changes that occur in the anterior surface of cornea.

Limitation

This study did not exclude contact lens wearers as participants which may have affected the OSDI scores obtained since this is an exploratory study. However, based on the feedback from the Refractive Error Questionnaire, only 7% of them were contact lens wearers. Related clinical measurements were not included in the analysis which may help to identify the associations between DE symptoms and signs among these newly enrolled university students.

CONCLUSION

There is a high prevalence of myopia among university students which may be due to prolonged near work and excessive use of gadgets. The OSDI score in myopia is also higher compared to emmetrope which might be due to the changes in the anterior surface of cornea. Therefore, further research which includes the detail investigation involving ocular surface biometry and tear functions measurements is recommended to allow us to investigate the changes that occur in the anterior surface of the cornea in myopia among the new university students.

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Appendix 1