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The Impact of Ocular Exercises on Headache Symptoms and Sleep Quality Among University Students with Refractive Errors

Kiruthika Selvakumar[1], Pea Wan Theng[1], Nurul Husna Binti Khairuddin[1]

[1]Department of Physiotherapy, M. Kandiah Faculty of Medicine and Health Sciences, Universiti Tunku Abdul Rahman, Selangor, Malaysia.

Corresponding author: Kiruthika Selvakumar

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ABSTRACT

Background and Objective: Refractive errors are prevalent ocular conditions within the general populations. It has been identified as one of a possible source of headaches and a detriment to sleep quality. The occurrence of refractive errors is particularly high among individuals who are at a higher level of education compared to the general population. Hence the objective of this study is to assess the impact of ocular exercises on headache characteristics and sleep quality and to investigate the correlation between refractive errors, quality of sleep and headache among university students with refractive errors.
Methods: 39 university students with refractive errors were recruited after screening. Based on the type of refractive corrections, they were assigned to 2 experimental and 1 control group. 4 weeks of ocular exercises were performed to investigate the effect of ocular exercises on headache symptoms and sleep quality. The data collected were then analyzed using Paired-sample T-test, One-way ANOVA and Pearson's correlation in IBM SPSS software statistics version 20.
Results: In experimental group 1 (with glasses), there was a significant improvement of headache characteristics (p=0.005) and sleep quality (p=0.010) compared to experimental group 2 (with contact lens) and group 3 (without wearing any glasses or contact lens). Fair to moderate correlation between refractive errors, headache (p<0.0001) (p=0.002), and sleep quality (p=0.018) were analyzed using Pearson analysis.
Conclusion: There is a significant impact of ocular exercises on headache symptoms and sleep quality among university students in experiment group. A fair to moderate association between refractive errors, headache and sleep quality.

Keywords: Ocular exercises, Refractive errors, Headache, Sleep quality, University students

INTRODUCTION

Refractive error (RE) stands as the prevailing ocular condition that has the potential to impact the population across various age groups and genders. Nearly 80% of the populations experienced visual impairment due to refractive error among aged 12 and older in the United States (Vitale et al., 2008). Individual with refractive error usually complaint of blurred vision for distant, nearby objects or both ("Refractive Errors", 2022). Eye fatigue or discomfort can be experienced among individual with refractive error especially after prolonged use of computer screen (Sheppard & Wolffsohn, 2018). Higher rate of refractive error among university students especially in medical fields was reported (Alruwaili et al., 2018). The high prevalence of REs among high educational population compared to general population was reported by Mirshahi in year 2014 (Mirshahi et al., 2014). Most of the factors are due to increase stress level and lack of outdoor activities (Alruwaili et al., 2018). The prolonged duration from electronic screen work played the much important risk factor (Alruwaili et al., 2018) on REs whereas there was a study reported there is no association between refractive errors and near work (Alsaif et al., 2019). 47.9% of student from Saudi college reported on myopia, which indicate the most prevalence of refractive errors (Alsaif et al., 2019). Study indicates that refractive error can result in headache symptoms. The exact relationship between refractive errors and headache was not formally established. Some researchers found that individual with uncorrected refractive errors will be more likely to develop headache symptoms (Akinci et al., 2008). Headache, which might in turn influence the quality of sleep. Clinical researchers correlate the relationship between headache and sleep disorder. Anatomically, sleep and pain share the same structures, such as thalamus, hypothalamus and the brainstem (Lovati et al., 2010). According to Lovati et al., sleep fragmentation, insomnia and hypersomnia having a significant relationship with headache (Lovati et al., 2010 as cited in kandnum & Jensen, 2002). Insomnia is the most common complaint among patients present of headache, especially migraine. Although the relationship between migraine and insomnia are still unclear (Lovati et al., 2010 as cited in Sahota et al., 1993). High myopia (near-sightedness) shown poor result on PSQI scores which indicates poor quality of sleep among children (Ayaki et al., 2016). Headache can significantly affect an individual's quality of life and psycho-social functioning (Lajmi et al., 2020). Other illnesses can develop if an individual is suffering chronic headache.

Ocular exercises claim to improve visual system, two-eye coordination, and refractive error (Gupta & Aparna, 2020). When the eyes muscles work and contract too hard can lead to eye fatigue which can trigger eye strain headache (Nunez, 2020). Ocular exercises also resulted in significant decrease in eye fatigue among medical students with refractive error (Gupta & Aparna, 2020, as cited in Kumar et al., 2014). According to research, oculomotor training showed significant positive result by reducing their anxiety, improving their self-efficacy and bring the individual to a relaxed environment which can improve the quality of sleep (Hu et al., 2021). As there has been no previous study conducted in Malaysia, it is imperative to evaluate the influence of refractive errors on headache and sleep quality in order to confront this issue at its early stages. Furthermore, there is a complete absence of evidence regarding the efficacy of ocular exercises in alleviating headache symptoms and improving sleep quality. Thus, it is crucial to investigate whether ocular exercises can truly alleviate headache symptoms and enhance sleep quality among university students with refractive error. The primary objective of this study is to examine the impact of ocular exercises on headache symptoms and sleep quality among university students who have refractive error.

METHODOLOGY

The study design was Quasi experimental design with pre and post-test experimental group. Participants will be assigned to 3 groups with 2 experimental groups and 1 control group. Group 1: Refractive error with contact lens and headache, Group 2: Refractive error with glasses and headache and Group 3: Refractive error without glasses and contact lens but with headache. The independent variable in this study is ocular exercises, shifting the gaze in eight directions, gazed at the candles flame and palming. The dependent variable in this study is headache symptoms and sleep quality among university students with refractive error. This study was carried out at Physiotherapy Centre in Universiti Tunku Abdul Rahman, Sungai Long campus. Data collection was gathered starting from 14 November 2022 till 9 December 2022 after obtaining ethical approval from UTAR Scientific and Ethical Review Committee (U/SERC/224/2022). Simple random sampling was employed as the sampling technique to recruit the subject who present with headache. The sample size is calculated using G-power 3.1.9.4 software and the estimated sample size is 90.

UTAR students from Sungai Long campus, users with contact lenses, eyeglasses or without eyeglasses but with headache with minimum 1 year and participants without any hearing abnormalities were included. Participants who present of any eye's diseases such as uveitis, heterophoria, optic neuritis, acute glaucoma, which are known to be associated with ocular pain or headache, participant who currently undergoing any kind of vison therapy, participants with neck pain were excluded.

For the eligible participants, first, a small briefing on the purpose of the research is given to the participant. A demographic data was collected using a google form. For participants who met the inclusion criteria, the informed consent was provided that explained the possible risk and benefits of this study. The Personal Data Protection Notice was explained to each participant about their personal data will not be disclose to public and all information was under protection. The participant who met the inclusion criteria was given two questionnaires which are the Headache Questionnaire and Pittsburgh Sleep Quality Index (PSQI) for pre-test record.

One the first day of intervention, the subjects are kept in a quiet and relaxed environment. A Headache Diary was distributed to each participant before starting the intervention. Each component on Headache Diary was explained to the participants. The three types of ocular exercise were demonstrated and explained to the participant. The exercise group performed: 1. Shifting the gaze in eight directions, 2. Gazed at the candles flame, 3. Palming (Ashok Kumar et al., 2014). The frequency of exercise is performing 3 times per week with a total of 4 weeks. On the last day of training (12^{th} sessions), the set of ocular exercise is performed again, following with the post-test measurements using a headache questionnaire and Pittsburgh Sleep Quality Index (PSQI) is assessed to measure the effectiveness of ocular exercises on headache symptoms and sleep quality.

RESULT

Of the total of 60 participants filled the demographic data and screening tool. Only 44 of them meet the inclusion criteria and 16 of them fall into the exclusion criteria. 5 of the participant dropouts at the mid stage of the study. Therefore, the response was removed from the data analysis process. Only 44 participants were processed in the final stage of the study.

Characteristic of Subjects

The demographic data of the subjects was collected and analyzed to get their mean and standard deviation. For age group, the mean and standard deviation are 20.66 and 0.713 years respectively. The largest group of participants are 21-year-old, which contain of 23 participants (59.0%). There are 35 female participants recruited which is 76.9% and only 9 male participants which is 23.1%.

Normality test for demographic data

Shapiro-Wilk Test is used to find out the normality of the demographic data of the participants. SPSS statistical analysis was used to check the normality of data to investigate whether the data is equally distributed. The p-value for age ($p<0.0001$) and gender ($p<0.0001$) which is lesser than ($p<0.05$). From the analysis, it can be concluded that the sample is equally distributed. Thus, Pearson analysis is used based on the normal distribution of data to investigate the association between refractive errors, headache, and sleep quality.

Comparison of Pre and Post-test of headache within group

Table 1: Pre and post-test on the characteristics of headache for Group 1

Variables	**Time of Test**		**Mean (SD)**	**p-value**
	Pre-test	**Post-test**		
	Mean (SD)	**Mean (SD)**		
Duration of headache	2.07 (0.997)	1.44 (0.641)	0.630 (0.208)	0.005*
Headache awake patient	1.89 (0.320)	1.93 (0.267)	-0.037 (0.084)	0.663
Headaches relieve after sleep	1.11 (0.320)	1.04 (0.192)	0.074 (0.367)	0.161
Headache affect daily activity	1.52 (0.509)	1.74 (0.447)	-0.222 (0.698)	0.110
Causes of headache	8.84 (4.443)	8.34 (4.586)	0.400 (0.591)	0.500

***Significant between pre and post-test scores Note: SD=standard deviation**

Table 1 showed the pre-test and post-test score on headache symptoms for Group 1 experimental group (Glasses). First, for the duration of headache, the mean level of pre-test is 2.07 and post-test is 1.44. The standard deviation for both pre and post-test is 0.997 and 0.641. The p-value is 0.005 after using the paired sample T-test. Thus, there is significant difference between pre-test and post-test scores on duration of headache. Whereas for the other components analysed there is no significant difference between pre-test and post-test scores.

Table 2: Pre and post-test on the characteristics of headache for Group 2

Variables	**Time of Test**		**Mean (SD)**	**p-value**
	Pre-test	**Post-test**		
	Mean (SD)	**Mean (SD)**		
Duration of headache	1.75 (0.886)	1.50 (0.756)	0.250 (1.389)	0.626
Headache awake patient	2.00 (0.000)	2.00 (0.000)	-0.125 (0.354)	0.351
Headaches relieve after sleep	1.00 (0.000)	1.13 (0.354)	-0.125 (0.354)	0.351
Headache affect daily activity	1.75 (0.463)	1.88 (0.354)	-0.125 (0.641)	0.598
Causes of headache	8.76 (4.068)	8.66 (4.169)	0.103 (6.961)	0.937

***significant between pre and post-test scores Note: SD=standard deviation**

Table 2 showed the pre-test and post-test score on headache symptoms for Group 2 experimental group (Contact Lens). There is no significant difference between pre and post-test components analysed.

Table 3: Pre and post-test on the characteristics of headache for Group 3

Variables	**Time of Test**		**Mean (SD)**	**p-value**
	Pre-test	**Post-test**		
	Mean (SD)	**Mean (SD)**		
Duration of headache	2.00 (0.816)	2.00 (0.816)	0.000 (0.816)	1.000
Headache awake patient	1.75 (0.500)	2.00 (0.000)	-0.250 (0.500)	0.391
Headaches relieve after sleep	1.25 (0.500)	1.25 (0.500)	0.000 (0.816)	1.000
Headache affect daily activity	1.25 (0.500)	1.75 (0.500)	-0.500 (1.000)	0.391
Causes of headache	7.46 (3.799)	9.46 (4.807)	-2.000 (5.774)	0.235

***significant between pre and post-test scores Note: SD=standard deviation**

Table 3 showed the pre-test and post-test score on headache symptoms for Group 3 control group (Without glasses or contact lens). There is no significant difference between pre and post-test components analysed.

Comparison of the Pre and Post-Test of Sleep Quality Within Group

Table 4: The difference between pre- and post-test for Group 1

Variables	Time of Test		Mean (SD)	p-value
	Pre-test Mean (SD)	Post-test Mean (SD)		
Component 1: Subjective sleep quality	1.26 (0.656)	0.85 (0.662)	0.407 (1.083)	0.062
Component 2: Sleep latency	1.04 (0.980)	0.78 (.892)	0.259 (1.228)	0.283
Component 3: Sleep duration	1.26 (0.944)	0.56 (.934)	0.704 (1.325)	0.010*
Component 4: Sleep efficiency	0.63 (0.967)	0.56 (.934)	0.74 (1.207)	0.752
Component 5: Sleep disturbance	1.78 (0.641)	1.70 (.724)	0.74 (1.035)	0.713
Component 6: Use of sleep medication	0.07 (0.267)	0.00 (.000)	0.74 (0.267)	0.161
Component 7: Daytime dysfunction	1.00 (0.734)	0.93 (0.781)	0.74 (1.107)	0.731
Global PSQI Score	1.48 (0.509)	1.26 (0.447)	0.222 (0.641)	0.351

note: SD=standard deviation, * significant value

Table 4 illustrates the difference on both pre and post-test scores among Group 1 experimental group (Glasses). The p-value obtained indicate that there is no significant difference between pre and post test score on component 1 – 7 except for component 3.

Table 5: The difference between pre- and post-test for Group 2

Variables	Time of Test		Mean (SD)	p-value
	Pre-test Mean (SD)	Post-test Mean (SD)		
Component 1: Subjective sleep quality	0.75 (0.463)	0.88 (0.354)	-0.125 (0.354)	0.351
Component 2: Sleep latency	1.13 (0.991)	0.50 (0.535)	0.625 (1.061)	0.140
Component 3: Sleep duration	1.50 (0.756)	1.13 (1.126)	0.375 (1.408)	0.476
Component 4: Sleep efficiency	1.13 (1.356)	0.50 (1.069)	0.625 (1.685)	0.329
Component 5: Sleep disturbance	1.25 (1.035)	1.50 (0.926)	-0.250 (1.282)	0.598
Component 6: Use of sleep medication	0.25 (0.463)	0.00 (.000)	0.250 (0.463)	0.170
Component 7: Daytime dysfunction	1.00 (0.756)	0.75 (0.886)	0.250 (1.282)	0.731
Global PSQI Score	1.50 (.756)	1.13 (0.641)	1.061 (0.375)	0.351

note: SD=standard deviation, * significant value

Table 5 illustrates the difference on both pre and post-test scores among Group 2 experimental group (Contact Lens). The p-value obtained indicate that there is no significant difference between pre and post test score on component 1 – 7.

Table 6: The difference between pre- and post-test for Group 3

Variables	Time of Test		Mean (SD)	p-value
	Pre-test Mean (SD)	Post-test Mean (SD)		
Component 1: Subjective sleep quality	1.50 (0.577)	1.00 (0.000)	0.500 (0.577)	0.182
Component 2: Sleep latency	1.00 (0.000)	0.50 (0.577)	0.500 (0.577)	0.182
Component 3: Sleep duration	1.75 (0.500)	1.25 (0.957)	0.500 (1.291)	0.495
Component 4: Sleep efficiency	0.75 (0.957)	0.00 (0.000)	0.750 (0.957)	0.215
Component 5: Sleep disturbance	2.00 (0.000)	1.50 (1.000)	0.500 (1.000)	0.391
Component 6: Use of sleep medication	0.25 (0.500)	0.00 (.000)	0.250 (0.500)	0.391
Component 7: Daytime dysfunction	1.75 (0.500)	0.75 (0.957)	1.000 (1.155)	0.182
Global PSQI Score	1.75 (0.500)	1.00 (0.000)	0.750 (0.500)	0.580

note: SD=standard deviation, * significant value

Table 6 illustrates the difference on both pre and post-test scores among Group 3 control group (Without wearing any contact lens or glasses). The p-value obtained indicate that there is no significant difference between pre and post test score on component 1 – 7.

Comparison of Post-Test Between Groups

Table 7: Post-test scores among Group 1, 2 and 3 on sleep quality

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
New_contact_PSQI	Between Groups	1.550	1	1.550	1.064	.309
	Within Groups	53.886	37	1.456		
	Total	55.436	38			
New_Glasses_PSQI	Between Groups	16.047	1	16.047	11.519	.002
	Within Groups	51.543	37	1.393		
	Total	67.590	38			
New_None_PSQI	Between Groups	32.308	1	32.308	.	.
	Within Groups	.000	37	.000		
	Total	32.308	38			

Table 7 illustrates the post-test scores among Group 1, 2 and 3 on sleep quality. The p-value obtained for post Global PSQI scores among Group 2 (new contact) is 0.309. The p-value is > 0.05. Thus, the difference between the mean is not statistically significant. For Group 1 (new glasses), the p-value obtained is 0.002 which is < 0.05. Therefore, the difference between some of the means are statistically significant.

Table 8: Post-test scores among Group 1, 2 and 3 on Headache symptoms: Duration of headache

		Sum of Squares	df	Mean Square	F	Sig.
Glasses_H1	Between Groups	27.007	1	27.007	11.267	.002
	Within Groups	88.686	37	2.397		
	Total	115.692	38			
CL_H1	Between Groups	2.297	1	2.297	1.068	.308
	Within Groups	79.600	37	2.151		
	Total	81.897	38			
None_H1	Between Groups	32.308	1	32.308	597.692	.000
	Within Groups	2.000	37	.054		
	Total	34.308	38			

Table 8 showed the result on post-test scores among Group 1, 2 and 3 on headache symptoms: Duration of headache. The p-value obtained for Group 1 (glasses_H1) is 0.002 which is < 0.05. Thus, the difference between some of the means are statistically significant. Next, the p-value obtained for Group 2 (Contact Lens – CL_H1) which is 0.308. Therefore, the difference between the mean is not statistically significant. Lastly, the significant p-value for Group 3 (None_H1) on the post-test score on duration of headache is p<0.0001. Thus, the difference between the mean is statistically significant.

Table 9: Post-test scores among Group 1, 2 and 3 on Headache symptoms: Headache awake patient

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Glasses_H2	Between Groups	2.464	1	2.464	10.164	.003
	Within Groups	8.971	37	.242		
	Total	11.436	38			
None_H2	Between Groups	3.590	1	3.590	.	.
	Within Groups	.000	37	.000		
	Total	3.590	38			
CL_H2	Between Groups	.188	1	.188	1.124	.296
	Within Groups	6.171	37	.167		
	Total	6.359	38			

Table 9 showed the result on post-test scores among Group 1, 2 and 3 on headache symptoms: Headache wake patient. The p-value obtained for Group 1 (Glasses_H2) is 0.003 which is < 0.05. Thus, the difference between some of the means are statistically significant. Lastly, the significant p-value for Group 3 (CL_H2) on the post-test score on duration of headache is 0.296. Thus, the difference between the mean is not statistically significant.

Table10: Post-test scores among Group 1, 2 and 3 on Headache symptoms: Headache relieves after sleep

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Glasses_H3	Between Groups	8.232	1	8.232	12.309	.001
	Within Groups	24.743	37	.669		
	Total	32.974	38			
CL_H3	Between Groups	.659	1	.659	1.081	.305
	Within Groups	22.571	37	.610		
	Total	23.231	38			
None_H3	Between Groups	10.994	1	10.994	542.350	.000
	Within Groups	.750	37	.020		
	Total	11.744	38			

Table 10 showed the result on post-test scores among Group 1, 2 and 3 on headache symptoms: Headache relieves after sleep. The p-value obtained for Group 1 (Glasses-H3) is 0.001 which is < 0.05. Thus, the difference between some of the means are statistically significant. Next, the p-value for Group 2 (Contact Lens: CL_H3) is 0.305 which indicate the difference between the mean is not statistically significant. Lastly, the significant p-value for Group 3 (None_H3) on the post-test score on headache relieves after sleep is p < 0.0001. Thus, the difference between some of the means are statistically significant.

Table 11: Post-test scores among Group 1, 2 and 3 on Headache symptoms: Headache affect daily activity

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Glasses_H4	Between Groups	3.388	1	3.388	8.372	.006
	Within Groups	14.971	37	.405		
	Total	18.359	38			
CL_H4	Between Groups	.237	1	.237	1.011	.321
	Within Groups	8.686	37	.235		
	Total	8.923	38			
None_H4	Between Groups	5.609	1	5.609	276.709	.000
	Within Groups	.750	37	.020		
	Total	6.359	38			

Table 11 showed the result on post-test scores among Group 1, 2 and 3 on headache symptoms: Headache affect daily activity. The p-value obtained for Group 1 (Glasses_H4) is 0.006 which is > 0.05. Thus, the difference between the mean is not statistically significant. Next, the p-value for Group 2 (Contact Lens: CL_H4) is 0.321 which indicate the difference between the mean is not statistically significant. Lastly, the significant p-value for Group 3 (None_H4) on the post-test score on duration of headache is p < 0.0001. Thus, the difference between some of the means are statistically significant.

Table 12: Post-test scores among Group 1, 2 and 3 on Headache symptoms: Causes of Headache

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Post_H_G	Between Groups	.303	1	.303	.194	.661
	Within Groups	87.353	56	1.560		
	Total	87.655	57			
Post_H_CL	Between Groups	11.491	1	11.491	3.140	.082
	Within Groups	204.923	56	3.659		
	Total	216.414	57			
Post_H_N	Between Groups	101.011	1	101.011	1696.993	.000
	Within Groups	3.333	56	.060		
	Total	104.345	57			

Table 12 showed the result on post-test scores among Group 1, 2 and 3 on headache symptoms: Causes of headache. The p-value obtained for Group 1 (Post_H_G) is 0.661 which is > 0.05. Thus, the difference between the mean is not statistically significant. Next, the p-value for Group 2 (Post_H_CL) is 0.082 which indicate the difference between the mean is not statistically significant. Lastly, the significant p-value for Group 3 (None_H_N) on the post-test score on causes of headache is p < 0.0001. Thus, the difference between some of the means are statistically significant.

Correlation between refractive errors, headache symptoms and sleep quality

Table 13: Correlation between refractive error and sleep quality

	Refractive error	Sleep Quality
Refractive errors Pearson correlation Sig. (2-tailed) N	1.000 39	0.378 0.018* 39
Sleep Quality Pearson correlation Sig. (2-tailed) N	0.378 0.018* 39	1.000 39

note: Sig.= significant p-value, N=number of participants

Table 13 showed the correlation between refractive error and sleep quality. Pearson analysis was used to test the correlation between refractive error and sleep quality. r= 0.378 means fair positive correlation; and r^2 = 0.14. The significant p-value is 0.018.

Table 14: Correlation between refractive error and headache symptoms

	Refractive errors	Duration of headache	Headache awake patient	Headache relieves on sleep	Headache on regular daily activities	Causes of headache
Refractive errors Pearson correlation Sig. (2 tailed) N	1.000 39	0.485 0.002* 39	0.051 0.757 39	0.762 < 0.0001* 39	0.129 0.433 39	0.275 0.091 39
Duration of headache Pearson correlation Sig. (2 tailed) N	0.485 0.002 39	1.000 39	0.177 0.282 39	0.636 < 0.0001 39	0.396 0.013 39	0.811 < 0.0001 39
Headache awake patient Pearson correlation Sig. (2 tailed) N	0.051 0.757 39	0.177 0.282 39	1.000 39	0.067 0.685 39	0.170 0.302 39	0.385 0.024 39
Headache relieves on sleep Pearson correlation Sig. (2 tailed) N	0.762 < 0.0001 39	0.636 < 0.0001 39	0.067 0.685 39	1.000 39	0.170 0.302 39	0.360 0.021 39
Headache on regular daily activity Pearson correlation	0.129 0.433 39	0.446 0.004 39	0.396 0.013 39	0.170 0.302 39	1.000 39	0.760 < 0.0001 39

Sig. (2 tailed) N						
Causes of headache Pearson correlation Sig. (2 tailed) N	0.275 0.091 39	0.811 < 0.0001 39	0.385 0.015 39	0.360 0.024 39	0.760 < 0.0001 39	1.000 157

note: N=number of participants, Sig.= significant p-value

Table 14 showed the correlation between refractive errors and headache characteristics. Pearson analysis was used to investigate the correlation between refractive errors and headache. Pearson analysis was used to investigate the correlation between refractive errors and duration of headache, r value is 0.485, which indicate fair positive correlation r^2 is 0.235. The significant p-value is 0.002. Next, to investigate the correlation between refractive errors and whether headache wake the patient up when they are asleep. The r value obtained after Pearson analysis is r=0.051 which indicate there is a poor correlation and value for r^2 is r2=0.003. The significant p-value is 0.757. Then, the correlation between refractive errors and whether headache relieved after sleep, Pearson analysis was tested. The r value for this variable is r=0.762, a moderate strong correlation was showed and r^2= 0.581. The significant p-value obtained is p<0.0001. The correlation between refractive errors and headache on regular activities, the r value obtained is r=0.129 that indicate the poor correlation, and r2=0.17. The significant p-value is 0.433. Lastly, for the correlation between refractive errors and causes of headache, the r value is r= 0.275 and r2=0.076. The p-value is 0.091. Since r= 0.275, poor correlation was showed on causes of headache.

DISCUSSION

This study aimed to analyse the impact of ocular exercises on headache symptoms and sleep quality among university students with refractive errors. Research shown that yoga eye exercises have some improvement in ocular symptoms (Ashok Kumar et al., 2014). Asthenopic symptoms like headache, eye fatigue and redness were reduced after ocular training (Ashok Kumar et al., 2014). However, to date, there is no current research on the impact of ocular exercises on individual with refractive errors and present with headache. According to the study, eye movement training was encouraged to practice among population which can improve sleep quality (Hu et al., 2021). The possible link between refractive errors on headache symptoms and sleep quality was not fully established. There is not much supporting factor reported on the association between refractive errors, headache, and sleep quality. Although uncorrected refractive errors might be one of the causes of headache (Lajmi et al., 2020). One of the studies also concluded that, headache symptoms were reported among children with ametropia (Mehoob et al., 2019). Individual with headache showed high prevalence rate on refractive errors (Sardar et al., 2020). The possible link between these three variables needs to be further investigate.

Effect of exercise within group on “Duration of headache” showed the significant p-value for 3 of the groups as 0.005 (Group 1), 0.626 (Group 2) and 1.000 (Group 3). Group 1 (Glasses) showed a significant improvement within group compared to Group 2 (Contact Lens) and Group 3 (Control Group). A study conducted recently in 2021, reported that any eye movement training can result in reduction of pain sensation (Hu et al., 2021). This might be the possible reason for the duration of headache to reduce after ocular exercise. This can be supported by a study in 2014, asthenopic symptoms of headache was significantly reduced after yoga eyes exercises. Other than that, eye fatigue, redness and discomfort were reduced after 6 weeks of intervention (Ashok Kumar, 2014). In conclusion, among the 5 characteristics of headache that was analysed, there is an improvement showed on Group 1 as the difference on pre and post-test on headache duration was significantly reduced after 4 weeks of ocular exercises. The other 4 variables should be further study to investigate the significant difference, since the other confounders like type of headache, location, secondary comorbidities also play an important role.

To compare the effect of ocular exercises on sleep quality on global PSQI scores, the p-values obtained for Group 1, Group 2 and Group 3 are 0.351, 0.351 and 0.580. Since the p-values for each group is > 0.05. Thus, there is no significant difference between pre-test and post-test scores on global PSQI scores on each group. This result was contrary with the previous study as according to Hu et al., 2021, an experimental study was conducted to compared eye exercises training on 2 different groups (Hu et al., 2021). One of the possible reasons could be the eyes use sleep to replenish, in a sense, which they do by taking in oxygen. Sleeping in contact lenses reduces the oxygen flow to the eyes, which can cause dry eyes and eye infections, says Dr. Chinn. This factor was not analysed, possibly contributing for significant differences. Irritation, eye fatigue, and dryness related to lenses left in overnight can all resulting in lower-quality sleep (Camacho, 2021). Each of the components on PSQI were analysed and the significant p-values for each component were obtained. For Group 1 (Glasses), the significant p-value on component 3: sleep duration is 0.010. Thus, an improvement was showed among Group 1 (Glasses) while comparing to Group 2 (Contact Lens) and Group 3 (Control Group) ($p < 0.05$). Hu et al suggested that eye movement training needed to be practice among individual to improve quality of sleep (Hu et al., 2021).

By comparing the post-test scores on headache characteristics and sleep quality between Group 1, Group 2, and Group 3. Among three of the groups, Group 1 (Glasses) showed better result on both headache and quality of sleep. Although there is study proved that headache symptoms and sleep quality can improve after yoga eyes exercise (Ashok Kumar, 2014 & Hu et al., 2021), but the variable on the effect on eye exercises among glasses users was not analyse by the recent study, therefore the comparison between glasses and contact lens was not applicable with exhausting study. According to the recent study research, some relationship between refractive errors and headache were reported, but the relationship still not formally established (Lajmi et al., 2020). In this study, the correlation between 5 characteristics of headache (duration of headache, headache awake patient, headache relieve on sleep, headache on regular activity and causes of headache) and refractive errors was tested. For the first component, the duration of headache, $r = 0.485$ and $r^2 = 0.235$. $r = 0.485$ means fair correlation and $r^2 = 0.235$ can be explained by the refractive errors explains 23.5% on the duration of headache; the other 76.5% could probably be explained by other factors. A possible relationship between refractive errors and headache were reported by some researchers, but the association with high prevalence were high among general population instead of just mention among university students. The positive moderate strong correlation between headache and headache relives on sleep. This can be described by the causes of muscle of neck, frontal or scalp with the high reaction of ciliary muscle from this part of body which lead to the mechanism of headache symptoms (Lajmi et al., 2020). The reduced in activities of muscles might be the possible factor that reduced headache symptoms.

Refractive errors, near-sighted is the common refractive errors among young population. In this study, the result showed that there is correlation between refractive errors and sleep quality ($P < 0.05$). r value obtained was 0.378 means fair positive correlation, and $r^2 = 0.14$, which means that the refractive errors explain 14% of the sleep quality, the other 86% could probably explained by other factors. This might be supported by the study in 2020, the researcher studied on the association between circadian dysregulation and refractive errors. If the melatonin circadian was delayed, the possibility to delay once's sleep-wake phase. The researcher concluded that there is significant delayed and reduced melatonin in near-sighted population which can cause sleep disturbance (Chakraborty et al., 2021). According to Ayaki et al 2016, short duration of sleep was reported among children with high degree of myopia, and it contribute to poor sleep quality. Thus, a conclusion can be concluded that there is significant fair correlation between refractive errors and sleep quality ($p < 0.05$). The individual with refractive errors has the risk to develop sleep disorder especially high myopia (Ayaki et al., 2016).

In order to facilitate future research, it is recommended to broaden the sample of the population to encompass a larger group. This would yield the benefit of achieving a more comprehensive representation and generalization of the overall population. One possible approach to achieve this objective is by ensuring that participants from both the experimental and control groups are evenly distributed, thus allowing for a more precise presentation of the findings. Consequently, the findings may be more broadly applicable to the general population. Furthermore, it is imperative to conduct further studies on the impact of ocular exercises on various age groups and binocular vision anomalies, rather than solely focusing on near-sightedness and far-sightedness. This research is necessary in order to establish the effectiveness of ocular exercises in addressing this global epidemic and preventing the progression of headache and sleep disturbance, thereby enhancing the quality of life for the general population.

CONCLUSION

In summary, the result showed there is an impact of ocular exercise on headache symptoms and sleep quality among university students with some of the components. For headache characteristics, the "Duration of headache" was significantly improved in Group 1 (Glasses) whereas for sleep quality was significant improved in Group 1 (Glasses). A fair to moderate correlation between refractive errors, headache symptoms and sleep quality was analysed.

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