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Assessment of Dry Eye Symptoms and Quality of Sleep in Engineering Students During the Covid-19 Pandemic

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ABSTRACT

To assess dry eye symptoms (DES) and quality of sleep in engineering students during the Covid19 pandemic lockdown and also to assess the association between DES and sleep quality. A cross-sectional questionnaire-based study was carried out among 396 engineering students studying in Saveetha engineering college. The study tool used was a semi-structured google form questionnaire designed for assessing digital device usage, symptoms of dry eye disease and sleep pattern. Responses were analyzed using appropriate statistical tests. Overall 64.1% attained a score of more than 10, indicating the presence of DES. 70.2% of the study population used digital screens for more than 13 hours. A statistically significant association was found between increased screen time and presence of DES($p<0.05$). 64.9% had a score of >18 indicating reduced sleep quality. About 77.1% of the students with DES had reduced sleep quality, and a significant association ($p<0.01$) was observed between the two. During the Covid19 pandemic lockdown, there appears to be rising prevalence of DES in student population, one of the reasons being increased screen time. The sleep quality was also found to be reduced, and a significant association was found between DES and sleep quality.

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INTRODUCTION

Dryness of eyes is a frequently reported symptom by people with high usage of digital devices. Dry eye disease being multifactorial is defined as the disease of the tear film and ocular surface, which causes discomfort and visual disturbances (Lemp and Foulks, 2007). Lengthy screen time can cause numerous symptoms like itching, soreness, sensitivity to light, and is one of the critical risk factors resulting in dry eye disease (Uchino *et al.*, 2008). Presence of dry eye symptoms (DES) poses a challenge for a person's physical, social and psychological well-being (Pouyeh *et al.*, 2012). It significantly affects the quality of life and the work efficiency of a person (Yamada *et al.*, 2012).

On the contrary, sleep is an important or essential physiological prerequisite to maintain the physical and mental health of a person. Sleep quality is described as feeling energetic and fit after sleeping (Karatay *et al.*, 2016). A decrease in sleep quality can lead to lack of concentration in academics, alterations in personal behaviour and emotional imbalances (Verlander *et al.*, 1999).

The Covid19 pandemic has forced many countries to undergo complete lockdown, confining people within the four walls of their dwelling, resulting in disruption of the student population from attending their schools and colleges. In this new normal world, digitalization among the students, may it be online

teaching, E-Lectures or entertainment has led to an exponential increase in the screen time of the world student community.

In this study, we have assessed the occurrence of DES in engineering students due to their increased usage of devices and their sleep quality during this Covid19 pandemic lockdown and also if there is an association between DES and sleep quality. Engineering students were selected as the target population because they spend a substantial period of their daily routine on various devices for academics, entertainment, social networking and other daily updates as they are crippled to their houses. This lifestyle paves potential risks for the development of DES.

Methodology

A questionnaire-based cross-sectional descriptive study was conducted among Undergraduate Engineering students studying in Saveetha Engineering College, Thandalam, Tamilnadu in South India.

Based on a similar study (Kawashima *et al.*, 2016) conducted, the sample size was calculated to be 376 by the formula 4pq/d2. The Institutional Ethics Committee approved the study protocol, and a study was conducted according to the tenets of the declaration of Helsinki.

A google forms based semi-structured questionnaire was designed to assess the symptomatology of dry eye due to the increased usage of devices and the sleep quality among the engineering students during the Covid19 pandemic.

The survey questionnaire was developed with four sections covering the students' pre-existing medical conditions, habits of device usage, symptoms of dryness of eyes and quality of their sleep.

The DES section had five items which included symptoms like itching, soreness, dryness, sensitivity to light and stickiness and the responses were scored from 0(Never) to 3(Constantly). Students with a cut-off score of >9 were considered as subjects with DES, according to the frequency of symptoms present among the study population during Covid19 pandemic lockdown. The sleep quality section had ten items to assess sleep quality during the past month, which included specific pretested indicators of good sleep. The responses were scored from 0(Not once) to 3(Three or more times a week), and the students with a cut-off score of $\geq$18 were considered as subjects with a decrease in the quality of sleep.

Associations between different variables and DES were analyzed using Chi-square test. P-value of less than 0.05 was considered significant.

RESULTS AND DISCUSSION

A total of 396 engineering students of various streams studying at Saveetha Engineering College participated in the study.

Demographic details

Of the 396 students, males constituted 46.3% (n=183) and females constituted 53.7% (n=213) About 34.3% (n=136) of the students were myopic and 12.6% (n=50) had hypermetropia. About 27% (n=107) used spectacles and 20.7% (n=82) used contact lenses. 88.6% (n=351) of the students did not have previous eye conditions and merely about 8.3% (n=33) had previous episodes of eye symptoms as shown in Table 1.

DES

Among the 396 students, 64.1% (n=254) had a score of 10-15 indicating the presence of DES as shown in Table 2, during the Covid19 pandemic lockdown.

Figure 1 shows that the most commonly reported symptom among the entire study population was itching (94.10% n=373) and dryness (93.90% n=372) Other symptoms like sensitivity to light was reported by 93.10% (n=369) and stickiness was reported by 86.80% (n=344). Soreness of the eyes was a relatively lesser reported symptom (73.20% n=290).

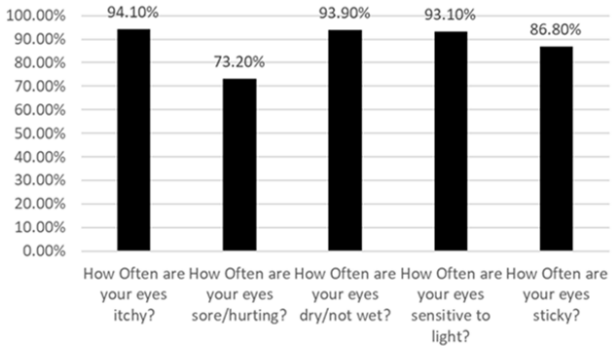

Figure 1: Frequency of DES

Among the 254 students who had DES only 7.8% (n=20) stated that they had similar symptoms even before Covid19 lockdown. About 92.1% (n=234) of those who had DES stated that they developed symptoms only during the lockdown.

About 70.2% (n=278) used digital screens for more than 13 hours, and 83.3% (n=330) of the study population felt that their screen time has increased during the Covid19 pandemic lockdown. 83.3% (n=330) of the study population felt that their total screen time had increased significantly during the Covid19 pandemic lockdown**.** 73.2% (n=290) used devices till they fell asleep, as shown in Table 3.

Table 1: Demographic details of the study participants

Demographic Details		N	%
Year of study	1	51	12.9
	2	51	12.9
	3	126	31.8
	4	168	42.4
	Total	396	100
Gender	Male	183	46.3
	Female	213	53.7
	Total	396	100
Refractive error	Short-sightedness	136	34.3
	Farsightedness	50	12.6
	Normal	157	39.6
	Don't know	53	13.4
	Total	396	100
Corrective measures	Spectacles	107	27.0
	Contact lenses	82	20.7
	Refractive surgery	6	1.5
	None	201	50.8
	Total	396	100
Previous eye conditions	None	351	88.6
	Eye infection	33	8.3
	Others	12	3.0
	Total	396	100

Table 2: Shows the scoring for DES. A score $\geq$10 wasconsidered to be symptomatic

Scoring for DES		
Score	N	%
0-4	44	11.11%
5-9	98	24.75%
10-15	254	64.14%

Sleep quality

Among 396 students, 64.9% (n=257) scored >18 in sleep quality assessment indicating the decreased quality of sleep during this Covid19 pandemic lockdown, as shown in Table 4 . It was observed that sleep quality was reduced significantly during the Covid19 pandemic lockdown.

Figure 2 shows that, in the study population, among 64.1% (n=254) students who had DES, 77.1% (n=196) of them had reduced sleep quality and among 25.9% (n=142) students who did not have DES, 42.9% (n=61) had reduced quality of sleep (p-value < 0.00001).

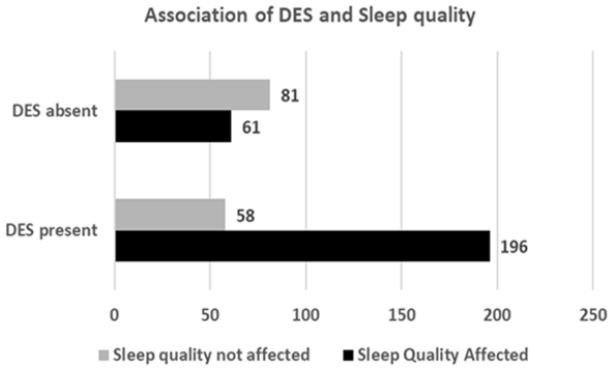

Figure 2: Association of DES and Sleep quality

The novel coronavirus (SarsCov2) pandemic has affected millions of people. Many countries have enforced strict lockdown to control the spread of this highly communicable disease. On 24 March 2020, the Government of India, ordered a nationwide lockdown for 21 days, limiting movement of the entire 1.3 billion population of India as a preventive measure against the COVID-19 pandemic.

Table 3: Associations of DES with gender, refractive error, use of eyewear and screen time

Variables	n (%)	DES Present (%)	DES Absent (%)	Chi-square value	p-value
Gender					
Female	213 (53.7)	137 (64.3)	76 (35.6)	0.0063	0.936548
Male	183 (46.3)	117 (63.9)	66 (36)		
Refractive error					
Short-sightedness	136 (34.3)	94 (69.1)	42 (30.9)	4.6825	0.196578
Farsightedness	50 (12.6)	26 (52)	24 (48)		
Normal	157 (39.6)	100 (63.7)	57 (36.3)		
Don't Know	53 (13.3)	34 (64.2)	19 (35.8)		
Corrective measures					
Spectacles	107 (27)	68 (63.6)	39 (36.4)	0.0767	0.994479
Contact lenses	82 (20)	52 (63.4)	30 (36.6)		
Refractive surgery	6 (1.5)	4 (66.7)	2 (33.3)		
None	201 (50.7)	130 (64.7)	71 (35.3)		
How many hours per day do you use these devices during this lockdown?					
1-4 hours	11 (2.7)	1 (9)	10 (91)	20.33	0.000145*
5-8 hours	7 (1.7)	2 (28.5)	5 (71.5)		
9-12 hours	100 (25.2)	62 (62)	38 (38)		
>13 hours	278 (70.2)	189 (68)	89 (32)		
Has your screen time increased during this lockdown					
Yes	330 (83.3)	251 (76)	79 (24)	122.3002	<0.00001*
No	66 (16.6)	3 (4.5)	63 (95.5)		

* Note: p value <0.05 is significant

Table 4: Shows the scoring for Sleep quality. A score of ≥18 was considered to be reduced sleep quality

Scoring for Sleep quality		
Score	N	%
0-8	23	5.8%
9-17	116	29.3%
>18	257	64.9%

Lockdown was further extended till 30 June 2020, and services were resumed in a phased manner starting from 8 June 2020. Schools and colleges have been shut since 17 March 2020 till date and as the student population are disrupted from their schools and colleges and bound to their dwellings. Digitalization has increased exponentially for academics as wells as entertainment purposes, leading to increased screen time and hence the risk of developing DES has also increased.

In this study, we have assessed the prevalence of DES during this ongoing Covid19 pandemic lockdown among a subset of engineering students. We observed that 64.1% had DES. A previous study by Asiedu K et al. to understand the prevalence and risk factors of DED among undergraduate students in Ghana showed that 44.3% had symptoms (Asiedu *et al.*, 2017). The studies conducted by Zhang Y (Zhang *et al.*, 2012) among high school students and Hyon JY (Hyon *et al.*, 2019) among medical students revealed that 23.7% and 27.1% of the study population had DES respectively. Our study observed a comparatively higher prevalence of DES. This may be because gazing into digital screens has considerably increased among the study population because of the restriction of outdoor activities during this pandemic.

Our study did not find any association between gender and DES unlike the study of Hyon JY (Hyon *et al.*, 2019) which showed an association between female gender and development of DES and had a p-value of 0.0026. This is probably because risk factors like increased screen time are seen in both the genders. There was no significant association between refrac-

tive errors and DES in contrast to a previous study by Zhang Y (Zhang *et al.*, 2012) in which there was an association between myopia and dry eye. Similarly, there was no association between usage of spectacle/contact lens and DES unlike previous studies (Zhang *et al.*, 2012; Guillon and Maissa, 2005) probably due to a limited number of study population using these measures.

About 70.2% used devices for >13hours per day and 68% of them had the DES (Iqbal *et al.*, 2018). A study conducted by Iqbal (Iqbal *et al.*, 2018) reported that 28% of students with >3 hours of screen time had symptoms of dryness. DES is more common in those with prolonged screen time as it can affect the tear dynamics and also can damage the ocular surface. This may be the reason for a higher prevalence of DES among the study population.

Sleep being one of the most important physiological activity, has also been affected vastly during Covid19 pandemic lockdown. Among the study population, 64.9% had reduced sleep quality during the pandemic. Previous studies conducted by Ghoreishi A (Ghoreishi and Aghajani, 2008) and Ghrouz AK (Ghrouz *et al.*, 2019) reported the prevalence of poor sleep quality to be 40.6% and 51% respectively, which was relatively lesser than the current study. Studies conducted by Bhandari PM (Bhandari *et al.*, 2017) and Lemma S (Lemma *et al.*, 2012) among university students showed that 35.4% and 55.8% had poor sleep quality, which was also lesser than our study. This difference in the prevalence rates may be due to varying levels of stress about academics, the existing fear of the pandemic and also due to the potential increase in screen usage among students before Covid19 lockdown and during Covid19 lockdown. Sleep quality is important to protect ones physical, mental and social health. Poor sleep quality jeopardizes one's quality of life and safety.

Poor quality of sleep can also lead to the development of DES and vice versa (Guillon and Maissa, 2005). Our study revealed that about 77.1% among 254 students who had DES also had decreased quality of sleep. Hence reduced sleep quality was significantly associated with DES similar to the studies conducted by Kawashima M (Kawashima *et al.*, 2016) and Ayaki M (Ayaki *et al.*, 2015). Usage of digital screens close to bedtime can affect the quality of sleep (of Ophthalmology, 2019) and in our study population, 73.2% used devices till they fell asleep.

CONCLUSION

The study had a few limitations. Clinically the symptoms of the subjects were not proven with Schirmer's test, and TBUT tests due to the constrain of movement during Covid19 pandemic lockdown. Sleep quality was also assessed subjectively. Other factors influenced by DES like emotional imbalances were also not assessed. In future, other systemic conditions causing DES and its association with sleep quality should be investigated.Based on our study, the Covid19 pandemic lockdown seems to play a definite role in the development of DES among students due to increased digital screen time. Sleep quality is also found to be reduced during this ongoing Covid19 pandemic lockdown with a notable association between the presence of DES and reduced sleep quality. Development of DES can be prevented by frequently blinking, following "20-20-20" rule and refocusing the eye often during strenuous reading and other near vision activities. Similarly, the student population should also try restricting screen time.

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Conflicts of Interest

The authors declare that they have no conflicts of interest for this study.

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