



Mask-Associated Dry Eye (MADE) in University of Mostar Students

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ABSTRACT

Background: The aim of this research was to examine the frequency of mask-associated dry eye in students from the University of Mostar and to compare the incidence among students in different study programs.

Methods: The study included 56 participants. The first group comprised 31 biomedical students, and the second was composed of 25 students from other fields. The participants were given a modified Ocular Surface Disease Index (OSDI) questionnaire, and were subjected to Schirmer and tear break-up time (TBUT) tests for an objective assessment of dry eye.

Main findings: Participants who wore a facemask for 3-6 hours (h) a day had significantly lower TBUT test results ($Z = -2.172$, $p = 0.030$), lower Schirmer test values ($Z = -1.962$, $p = 0.050$) and higher OSDI scores ($Z = 2.095$, $p = 0.036$), compared to participants who wore one for less than 3 h a day. Moreover, women had a statistically higher OSDI score compared to men ($Z = 2.052$, $p = 0.040$).

Principal conclusion: Participants who wore masks for longer hours had more objectively defined dry eye demonstrated by the Schirmer and TBUT tests. The study showed that biomedical students did not wear facemasks longer than average, or at least not long enough to indicate a significant difference.

Key words: humans, masks, dry eye syndromes, students.

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INTRODUCTION

According to the definition of the Tear Film and Ocular Surface Society Dry Eye Workshop II (TFOS DEWS II), “dry eye is a multifactorial disease of the ocular surface characterized by a lack of homeostasis of the tear film, and accompanied by ocular symptoms, in which tear film instability and hyperosmolarity, ocular surface inflammation and damage, and neurosensory abnormalities play etiological roles” (1). Between 5% and 34% of people worldwide suffer from symptoms of dry eye (2). The most frequent ones are ocular discomfort, foreign body sensation, redness and itching, which can heavily interfere with productivity and quality of life (3, 4).

When the COVID-19 pandemic started, growing numbers of people reported ocular discomfort and irritation. Since facemask wearing was one of the main measurements against the spreading of the virus, there were a number of reports connecting the two (5, 6). Proper facemask wearing is very important because when a facemask sits loosely against the face, some of the exhaled air will disperse toward the eyes. This creates conditions that accelerate corneal tear film evaporation, which can in the long term lead to dry eye disease (DED) (7).

It was noted that people who wear facemasks for a longer time can develop mask-associated dry eye (MADE). Current data on MADE symptoms are very limited. Some studies show that DED can occur in patients who suffered from COVID-19 (8, 9). However, it is more likely that symptoms are connected to wearing a facemask for long hours than a direct complication of the disease (6). MADE can also cause a more severe outburst of an already existing DED (10).

Students were some of the most frequent mask users during the COVID-19 pandemic. Some studies have shown that many healthy medical students experienced ocular discomfort and used artificial tears (11).

The main aim of this research was to examine the frequency of mask-associated dry eye in

students at the University of Mostar and to compare the incidence among students in different fields of study.

An additional objective was to investigate if the severity of MADE syndrome was directly related to the duration of daily facemask wearing. Another aim was to examine if there was a difference between the sexes in the incidence of MADE.

PARTICIPANTS AND METHODS

Participants

The study included 56 participants (112 eyes), who were students from the University of Mostar, equally distributed between the sexes, aged between 18 and 25 years. The participants were divided into two groups. The first group comprised 31 biomedical students (medicine, pharmacy and health sciences students). The second one consisted of 25 students from other fields (philosophy, economy, law and engineering), and was considered a control group.

Methods

The methods used in this study were the Schirmer and tear break-up time (TBUT) tests. The participants completed a modified Ocular Surface Disease Index (OSDI) questionnaire (10). For the Schirmer test, we used “Bio Schirmer Ophthalmic Strips” (Biotech Co., Luzern, Switzerland). The original OSDI questionnaire was modified by inserting “while wearing a facemask” at the end of each question. Three YES/NO questions and one question regarding the duration of mask wearing were added:

Did you have any dry eye symptoms (pain, irritation, redness, discomfort...) before you started to wear a facemask?

If YES, did you use artificial tears or any other lubricant therapy for relieving dry eye symptoms before you started to wear a facemask?

Have you noticed the occurrence/worsening of dry eye symptoms after the initiation of facemask wearing?

Statistical analysis

The distribution of the data was tested with a Kolmogorov-Smirnov test that showed a deviation from normal data distribution. Therefore, in further analysis, the Mann-Whitney U-test was used for testing differences in continuous variables. The variances in categorical variables were tested by the chi-square test. The probability level of $p < 0.05$ was considered statistically significant. The parameters were processed with Microsoft Excel (version 2016, Microsoft Corporation, Redmond, WA, USA), and SPSS for Windows (version 17.0, SPSS Inc, Chicago, Illinois, USA) was used for statistical analysis.

RESULTS

Students did not exhibit statistical differences in dry eye symptoms depending on their field of study (Table 1).

The duration of mask wearing was negatively related with all objectively measured signs of

dry eye results (TBUT and Schirmer tests). Participants who wore a facemask for 3-6 hours (h) a day had significantly lower TBUT test results compared to participants who wore one for less than 3 h a day (Table 2). In addition, there was a statistically significant difference in Schirmer test results between participants who wore facemask for 3-6 h a day compared to the ones who wore it for less than 3 h. (Table 3). All the results that were 10 mm and above were presented as 10 mm in this study.

Participants who wore a facemask for 3-6 h a day had significantly higher OSDI scores compared to those who wore one for less than 3 h a day (Table 4).

Female students had significantly higher OSDI scores compared to male students (Table 4).

There was no significant difference in any measurement of dry eye between biomedical and other students.

Table 1. Differences between students from different fields in subjectively measured signs of dry eye and previous symptoms, as well as the use of artificial tears and worsening of dry eye symptoms

	Field of study				χ^2	p
	Biomedical		Others			
	n	%	n	%		
Sex					3.437	0.064
F	20	64.5	9	36.0		
M	11	35.5	16	64.0		
OSDI					7.054	0.070*
Normal	18	58.1	14	56.0		
Mild	8	25.8	1	4.0		
Moderate	2	6.5	5	20.0		
Severe	3	9.7	5	20.0		
Previous symptoms	10	32.3	7	28.0	0.003	0.958
If yes, artificial tears	7	70.0	3	42.9	0.382	0.350*
Worsening of symptoms	7	22.6	4	16.0	0.077	0.737*

*Fisher's exact test

Table 2. Differences by sex, field of study and daily mask wear in average TBUT test results

	TBUT	C	Z	p
Sex	Female	7.0	1.228	0.220
	Male	8.0		
Field	Biomedical	7.0	1.016	0.310
	Others	8.0		
Mask wear	0-2 h	8.5	-	0.030
	3-6 h	6.5	2.172	

Legend: C – median, Z – Z test, p – statistical significance

Table 3. Differences by sex, field of study and daily mask wear in average Schirmer test results (mm/5 min)

	Schirmer	C	Z	p
Sex	Female	10.0	1.326	0.185
	Male	10.0		
Field	Biomedical	10.0	0.172	0.863
	Others	10.0		
Mask wear	0-2 h	10.0	-	0.048
	3-6 h	10.0	1.962	

Table 4. Differences by sex, field of study and daily mask wear in OSDI score

	OSDI	C	Z	p
Sex	Female	11.5	-	0.027
	Male	6.0	2.211	
Field	Biomedical	8.0	1.340	0.180
	Others	8.0		
Mask wear	0-2 h	7.0	2.095	0.036
	3-6 h	10.0		

DISCUSSION

This study showed that there are no statistically significant differences among biomedical students and those from other fields, either in self-estimated dry eye, or in objective tests of tear film stability and tear production.

In a study reported by Boccardo et al., 18.3% of participants experienced MADE symptoms. They described MADE as a condition in which symptoms occurred at least occasionally and worsened while wearing a facemask (12). In our research, one third of the students already had dry eye symptoms, while 19.6% claimed a

worsening of the symptoms while wearing a facemask. Among them, biomedical students had a lower frequency of subjectively assessed symptoms via the OSDI questionnaire, even though they reported longer daily facemask wear. However, sometimes symptoms and objective signs are not directly related (13). On the other hand, Hyon et al. reported a high prevalence of dry eye symptoms (27.1%) in medical students, which also positively correlated with female sex, contact lens use, prolonged screen time and elevated stress levels (14).

Regarding daily mask wear, differences were statistically significant in all measurements. Participants who wore a mask for 3-6 h a day had higher results in the subjectively estimated dry eye test (OSDI) than the ones who wore one for 0-2 h a day. Similar results were demonstrated by Krolo et al. They proved that individuals who wore a mask for 3-6 h a day had significantly higher OSDI scores than the ones who wore a mask for less than 3 h per day. Even longer facemask wearing did not show any relevant differences in subjective symptoms of dry eye, which can be explained by the fact that the group who wore a mask for more than 6 h a day contained mostly young, healthy individuals who wore masks in their workplaces (10).

The number of hours of mask wear per day was negatively correlated with all objective measures of dry eye. This means that participants who wore a mask for longer hours during the day had significantly drier eyes. Similar results were observed by Aksoy et al. They showed that participants who wore facemasks for eight or more hours per day had worse TBUT and Schirmer test results (15).

Additionally, regarding sex differences in subjective and objective test results, female participants expressed more subjective symptoms of dry eye, assessed by the OSDI questionnaire. This is in accordance with other reported studies (10, 16).

One of the limits of this study is a lack of data on how disciplined the students were in

wearing a facemask and whether they wore it correctly. There is a noticeable trend that biomedical students demonstrate a slightly higher incidence of normal eye wetness and mild dry eye, but students in other fields showed a higher percentage of moderate and severe dry eyes within their sample. However, statistically speaking, when we took the frequency of subjective eye disturbances into account, we found that students did not differ between different disciplines.

CONCLUSION

In conclusion, prolonged facemask use was associated with more severe dry eye disease. The severity of MADE was not influenced by the field of study. The research showed that there are no statistically significant differences among biomedical students and those from other fields, either in self-estimated dry eye, or in objective tests of tear film stability and tear production.

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CONFLICT OF INTEREST

None to declare.

AUTHORS' CONTRIBUTIONS

DB and IM: conceived and designed the study; DB, AS, APS, IS and IM: collected the data; DB and IM: analyzed the data; DB, AS, APS, IS and IM interpreted the results; DB and IM: prepared the figures; DB: drafted the manuscript; DB, AS, APS, IS and IM: edited and revised the manuscript; DB, AS, APS, IS and IM: approved the final version of the manuscript.

ETHICAL BACKGROUND

Institutional review board statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Ethics Committee.

Informed consent statement: Informed consent was obtained from all subjects involved in the study.

Data availability statement: We deny any restrictions on the availability of data, materials and associated protocols. Derived data supporting the findings of this study are available from the corresponding author on request.

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