



## MASK ASSOCIATED DRY EYE AMONG HEALTH CARE WORKERS FROM SOUTH KERALA –A CROSS SECTIONAL STUDY

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### ABSTRACT

This study aims to estimate the proportion of mask-associated dry eyes (MADE) among health workers and also to evaluate the change in frequency and severity of symptoms of the dry eye depending on the type and duration of mask wear. A cross-sectional study was conducted using Google forms in April 2021 in the Department of Ophthalmology, Sree Gokulam Medical College, Venjaramoodu, Trivandrum, Kerala. The study included 203 health workers. Data collection was done using Google forms regarding self-reported symptoms related to dry eye and the type and duration of mask use. Data regarding other confounding factors were also collected. The proportion of dry eye among health care workers was 72.9% based on symptoms. The most common symptom among the study population was watering (26.6%) followed by grittiness and foreign body sensation (23.6%). The symptoms were experienced sometimes by 57.1%, frequently by 13.3 %, and constantly by 1%. 23.2 % were previously diagnosed with dry eyes. Among those who had symptoms 28.1 % had an increase in severity of symptoms after mask use, 11.8% have improved their symptoms and 31 % stayed the same. 47.8% used a combination of N95 and surgical masks and 31% used N95 masks alone. The study concluded that a significant number of health care workers had dry eye symptoms after mask use. Health care workers should be made aware of this entity and should be educated to wear masks properly. The major limitation was the lack of clinical confirmation of dry eye.

**KEYWORDS :** Dry eye, Mask, Mask Associated Dry Eye, Health care workers, COVID-19, N95 Mask

### INTRODUCTION

The use of face masks was widely recommended for the COVID-19 pandemic as a crucial measure to fight against SARS-CoV-2<sup>1,2</sup>. A few concerns have arisen from this, with masks perceived as uncomfortable and inconvenient: prolonged use of masks has been linked to headaches, breathing problems, skin irritation, sweating, and fogged glasses<sup>3,4</sup>. D.E. White, an American ophthalmologist, described mask-associated dry eye in his blog and coined the acronym "MADE" in June 2020<sup>5</sup>. If the mask sits loosely against the face it may cause exhaled air to rise over the ocular surface which may lead to ocular irritation and symptoms of dry eye due to the increased evaporation of tear film<sup>6,7</sup>. A substantial number of patients have reported dry eyes as a result of wearing a facial mask and using digital devices for long periods. In the fight against COVID19, face masks and face shields are essential and during the COVID19 pandemic era, most ophthalmologists are observing an increase in patients with dry eye as a result of prolonged usage of face masks and increased screen time. Patients with pre-existing dry eye illness, postmenopausal dry eye, and people who use a smartphone, digital gadget, or computer for more than 2 hours may experience worsened symptoms after using Mask. MADE may exacerbate dry eye symptoms in the elderly, postmenopausal women, post-cataract IOL surgery cases, post-Lasik cases, contact lens wearers, who typically have a poorer quality corneal tear film, and masked people working long hours in air-conditioned environments and/or while using digital screens. Recent research shows that regular mask users show increased symptoms of dry eye<sup>8</sup>. However, the prevalence of these symptoms has not been reported. This study was designed to estimate the type and frequency of self-reported symptoms of MADE among healthcare workers and to determine factors that affect this condition, such as age, sex, the use of different corrective lenses (contact lenses or glasses), and the type and duration of mask usage.

### MATERIALS AND METHODS

This was an observational, descriptive, and cross-sectional study conducted in the Department of Ophthalmology, Sree Gokulam Medical College and Research Foundation, Venjaramoodu, Trivandrum, Kerala as an online survey by distributing Google Forms through different social media platforms, seeking health care workers to furnish the details by completing the questionnaire. The study was approved by the institutional review board. Once the survey was completed data were collected in April 2021. A total of 203 health workers were enrolled in this study with self-consent. Participants were asked to respond about their age, sex, and the frequency of dry

eye symptoms (i.e. foreign body sensation, dryness, irritation, itching, or burning)<sup>8</sup>. For symptom frequency, participants could select: never, sometimes or frequently, or constantly. Instead of using a structured questionnaire, to facilitate the dissemination of the survey, the numbers of questions were minimized and all symptoms were grouped into one single question<sup>9</sup>. Participants who reported symptoms of ocular discomfort were asked if these symptoms were better, worse, or stayed the same while wearing a face mask. Participants were also asked if they wore glasses or contact lenses. For this study, MADE was defined as the condition in which dry eye symptoms are present at least sometimes and became worse using a face mask. People who had no symptoms and those who had symptoms but no worsening were considered unaffected by MADE. Also, the data regarding the association between dry eye and the type and duration of mask use were collected. Data regarding other confounding factors were also collected. Data collected were entered into an Excel sheet and was analyzed using SPSS software for statistical interpretations.

### RESULTS

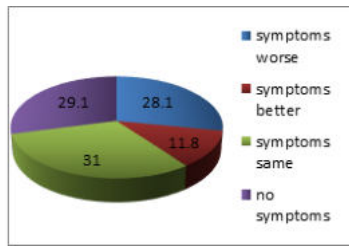
Out of the 203 healthcare workers enrolled, 80 (39.4%) were males and 123 (60.6%) were females. Among the subjects, a majority (58.6%) were in the age group of 20-30 years followed by 21.2% in the 30-40 year age group. The proportion of dry eye among health care workers was 72.9% based on symptoms. Among those who had dry eye symptoms, 54.7% were females and 45.3% were males.

The most common symptom among the study population was watering (26.6%) followed by grittiness and foreign body sensation (23.6%) (Table1). The majority (57.1 %) experienced the symptoms sometimes, 13.3 % frequently and only 1% constantly. Subjects who were previously diagnosed with dry eyes were 23.2 %.

**Table 1: Symptoms Of Each Study Participant In Count And Percentage**

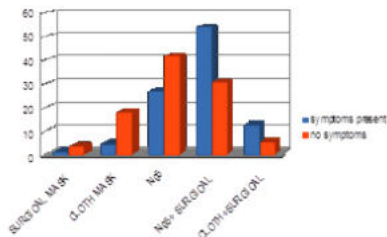
SYMPTOMS	COUNT	PERCENTAGE
Watering	54	26.6
Grittiness and foreign body sensation	48	23.6
Stinging and burning sensation	26	12.8
Crusting or discharge	20	9.9
No symptoms	55	27.1

**Figure 1: Pie chart showing percentages of participants never having symptoms of ocular discomfort, or experiencing better, same, or worse symptoms while wearing a face mask.**

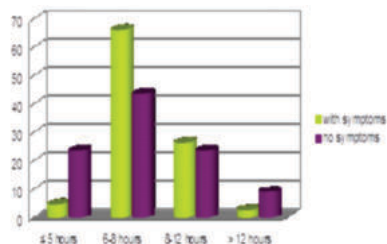


Among the patients with dry eye symptoms, 28.1 % had an increase in severity of symptoms after mask use, 11.8 % had improvement and 31% symptoms stayed the same (Figure 1). In this study, the majority of the population (47.8% of subjects) used a combination of N95 and surgical masks and 31% used N95 masks alone. Spectacles or goggles along with masks were used by 63.5% of subjects. Use of face shield along with mask was present in 68.5%. Smartphones or computer screens were used by 99%, among them 67.5% used screens for less than 5 hours. Among those who had dry eye symptoms 54.1% used a combination of N95 and surgical mask, and 27% used N95 alone. There is a statistically significant association between mask type and dry eye symptoms (Figure: 2).

**Figure 2: Type of mask used and percentage of persons with symptoms and without symptoms**



**Figure 3: Bar diagram showing percentage of persons with symptoms and no symptoms with duration of mask use**



The proportion of MADE among the sample population was 28.1%. Among the 28.1% having MADE, 49.1% were males and 50.8% were females. The majority (70.2%) had the symptoms sometimes and 22.8 % had symptoms frequently. The most common symptom was grittiness and foreign body sensation (43.85%), followed by watering (38.6%). About 52.63% had the symptoms during any time of the day, 24.56% had at the end of the day within 2 hours of getting into bed, and 19.3% in the morning within 2 hours of getting up from the bed. Among those who had MADE, 38.6% were already diagnosed to have dry eye before. In the study population having MADE, the majority were using a combination of N95 and surgical masks (68.4%), 14% used N95 alone, and 15.8% used a combination of cloth masks and surgical masks. The duration of mask used in 52.6 % of persons with MADE was 6-8 hours and 42.1% used it for 9-12 hours.

**DISCUSSION**

In this study, out of 203 healthcare workers, 72.9% had dry eye symptoms, which is similar to another study done by Laura Boccardo et.al.<sup>10</sup> in which 67.9% had dry eye symptoms. A study conducted by Krolo I et al. included 203 participants, among which 70.9% (144) were women. And the results indicated that women have a statistically higher OSDI score compared to men which was similar to our study<sup>11</sup>. Chalmers et al.<sup>9</sup> observed that clinicians often underestimated the severity of participants' self-assessment of dry eye. As face masks are necessary, along with social distancing and hygiene measures to slow down the spread of COVID-19<sup>1</sup>, it is important not to underestimate all

the symptoms that could discourage the population from using them. Among the total study population, 38.9% of persons experienced dry eye symptoms within 2 hours of getting up from the bed but those having MADE experienced the symptoms any time of the day (52.63%). Out of the 72.9% of persons with dry eye symptoms, 57.1% experienced the symptoms sometimes, similar to a previous study<sup>10</sup> in which 54.3% had the symptoms sometimes. Only 28.1% reported worsening of symptoms with mask use, which is considered MADE, but it is more than the previous study<sup>10</sup>, where they had 18.3% of MADE. In a study done by Bartlett JD et.al, there was a poor association between signs and symptoms, explained by the fact that symptom measures may assess particular properties of the disease (e.g., grittiness or fatigue), which may not be related to measurable signs also have suggested that sensory changes on the ocular surface may be an important factor. One theory is that in early/mild Dry Eye Disease, corneal hyperalgesia may cause ocular discomfort before any clinical signs are evident<sup>12</sup>. We also found that in the study population with MADE, the majority were using a combination of N95 and surgical masks (68.4%) and 52.6% used the mask for 6-8 hours.

Matusiak et al.<sup>3</sup> documented that wearing surgical masks was linked to a significantly lower risk of adverse reactions than cloth masks and in our study, a statistically significant (p=0.001) lower risk of dry eye symptoms was present among those wearing surgical masks (4.7%) or cloth mask (1.4%) alone compared to the combined use of N95 and surgical mask (54.1%) which showed a higher risk for dry eye symptoms with a p-value of 0.001.

The results of this survey showed that many people reported no change in ocular symptoms while wearing a face mask (31%) which is similar to a previous study<sup>10</sup>, in which the majority reported no change with face mask (49.1%). Among those who had MADE, 38.6% were already diagnosed to have dry eye before, and among those who have dry eye symptoms 29.1% were already diagnosed to have dry eye and it is statistically significant with a p-value of 0.001. The majority of studies report a significantly higher prevalence of dry eye disease, both dry eye symptoms and MADE, in women compared to men<sup>13</sup>. It is comparable to our study which showed that the dry eye symptoms were more in females (54.7%). The gender-wise difference was not statistically significant in those diagnosed with MADE. Although a higher prevalence of dry eye disease in older people is described in the literature,<sup>14</sup> in this sample; the worsening of symptoms due to the use of the mask was not correlated with age as the responses obtained from aged people were limited.

In this sample, participants wearing glasses or goggles experienced dry eye symptoms more frequently than people without any correction, and the prevalence of MADE in persons using spectacles or goggles was 78.9%, which is similar to a previous study<sup>10</sup>. Prolonged use of face masks in air-conditioned locations may also trigger MADE. In our study, 37.9% (30%) of persons working in an air-conditioned room with face masks had a working hour of 6-8 hours. MADE was reported among 52.63% of study participants working in AC rooms. Prolonged use of visual display terminals is associated with a dry eye diagnosis, as shown in several large-scale studies<sup>15</sup>. Increased digital device use while wearing masks can also increase the dry eye symptoms<sup>16</sup>, and 99% of our study population was using digital devices but only a few 5.9% used it for a prolonged period (9-12hours) and 25.1% used for 6-8 hours. All the 57 participants (28.1%) diagnosed with MADE were using digital screens. Among them, 75.4% were having a screen time of less than or equal to 5 hours only.

In a study done by Moss SE et al. after controlling for age and sex, the following factors were independently and significantly associated with dry eye in a logistic model: history of arthritis, smoking status, caffeine use, history of thyroid disease, history of gout, total to high-density lipoprotein cholesterol ratio, diabetes and multivitamin use<sup>17</sup> but in our study only 6.9 % of the study population had associated comorbidities that could interfere with the study result. The association between the use of PPE or contact lens with dry eye symptoms could not be found due to a limited number of subjects using these.

The double vicious circle may be used for understanding and revealing the complexity of the pathophysiological mechanisms underlying Dry Eye Disease (DED) and Meibomian Gland Dysfunction (MGD), as well as a tool to focus and guide therapy. MGD loop includes stasis of the meibum, bacterial proliferation, release of lipases and esterases, and increased meibum melting temperature and thus reducing its secretion onto the surface of the tear film<sup>18</sup>.

The diagnosis of dry eye is still a challenging task in many cases. Several factors contribute to making diagnosis difficult and warrant further attention: the invasiveness and low degree of standardization of most conventional tests (Schirmer, TBUT and ocular surface staining), and the overlapping of dry eye symptoms with those of other conditions, such as conjunctivochalasis (which can easily induce an unstable tear film) or delayed tear clearance (which is a frequent cause of ocular irritation)<sup>19</sup>.

## CONCLUSION

According to this study, a significant number of healthcare workers had Mask Associated Dry Eyes. Among them, the most common symptom was grittiness and foreign body sensation, and a majority had dry eye symptoms sometimes. The majority of study participants with MADE used a combination of N95 mask and surgical mask, and most of them used the mask for 6-8 hour duration. Though there is a well-established association between face mask use and dry eye in the general population, no such study exists till now about the association between face mask use and dry eye among healthcare workers. Healthcare workers are using masks for a long duration of time every day than the general population.

They should be made aware of Mask Associated Dry Eye and should be educated regarding the symptoms and other factors influencing dry eye. To eliminate or reduce the burden of these problems, masks with a pliable nose wire should be used, with attention to fitting the shape of the wire to prevent air from being directed toward the eyes. Masks can also be taped at the top to impede upward airflow, but care should be taken to ensure that lower lid excursion is not inhibited. Patients experiencing dry eye symptoms from extended mask wear should take breaks every few hours to remove the mask, allow the eyes to recover, and reapply lubricant eye drops. Blinking exercises may also be beneficial<sup>5</sup>. They should limit the time in air-conditioned environments and take regular breaks from digital devices. As the widespread use of masks will likely extend into the future for some time, further studies that relate symptoms to clinical signs are warranted.

## LIMITATIONS

The major limitation of this study was the lack of clinical confirmation of dry eye disease. We excluded the asymptomatic population, who may have dry eye.

## CONFLICTS OF INTEREST

No conflicts of interest

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