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Comparison of Ocular and Periocular Discomfort among Healthcare Workers Using Different Types of Face Masks, Including N95 Respirators and Surgical Masks

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Abstract

Introduction: Wearing a face mask is a regular practice in health care workers, however it has increased during and after COVID 19 era. Mask associated dry eye has also increased in prevalence. This paper aims to compare ocular and periocular discomfort among healthcare workers using different types of face masks, including N95 respirators and surgical masks.

Methods: A cross-section observational survey was conducted to compare surgical and N95 mask in terms of dry eye induced in Health care workers. A questionnaire was prepared for the participants regarding general information about the participants; the effects of masks that they use in terms of quality of vision, pain/ discomfort, quality of communication with patients and comorbidities. OSDI questionnaire was also provided.

Results: Out of 110 participants (males =47, females= 63), average age was 36.67years. 72.73% of the participants were using N95 mask as they were the recommended masks to be used during COVID patient care. Average quality of vision in all the participants was 1.74 out of 5 (max) with no significant difference between N95 and Triple-layered surgical masks (p=0.62). Average discomfort / pain in all the participants was 2.25 out of 5 (max) with no significant difference between N95 and Triple-layered surgical masks (p=0.67). 4% reported foreign body sensation in eyes and 13-26% reported skin rashes around eyes. 79% participants using the masks complained of air leak towards the eyes while using the mask.

Conclusion: Both N95 and Triple-layered surgical mask were associated with mild dry eyes, without a significant difference between the two.

Keywords: N95, Surgical Mask, Dry Eye.

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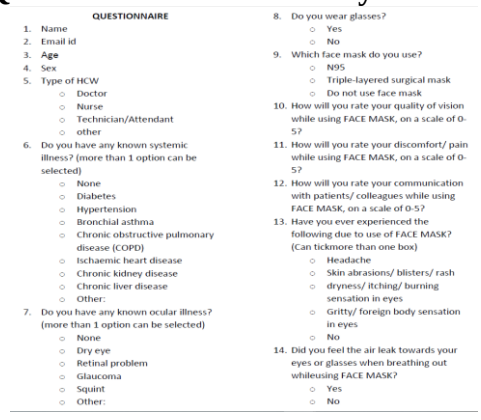
1. INTRODUCTION

Dry eye disease is a common condition that affects the ocular surface and can significantly impact quality of life. It is characterized by a complex pathophysiology involving tear film instability, increased evaporation, and ocular surface inflammation.(1) The prevalence of dry eye disease is higher than many other important systemic disorders, affecting up to 33.7% of the population over 65 years of age.(2,3) One emerging risk factor for dry eye that has gained attention during the COVID-19 pandemic is the prolonged use of face masks by healthcare workers. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), later named as COVID-19, was a pandemic that spread rapidly and needed people to practice physical distancing, repeated hand washing and wearing a mask to reduce the transmission of Coronavirus. (4) Researchers have hypothesized that the occlusive nature of face masks, particularly N95 respirators, may disrupt the normal tear film dynamics and lead to increased evaporative dry eye.(1,5) The health care workers are at increased risk due to long hours of duty during which they have to wear the mask. Some studies propose wearing mask is associated with dry eye disease.(6) This paper aims to compare ocular and periocular discomfort among healthcare workers using different types of face masks, including N95 respirators and surgical masks.

2. MATERIAL AND METHODS

A cross-section observational survey was conducted to compare surgical and N95 mask in terms of dry eye induced in Health care workers using the masks while taking care of COVID patients. HCWs (Doctors, Nurses, Technicians/Attendants) working in COVID patient care were included in the study. HCWs with systemic diseases such as Diabetes, Hypertension, Bronchial asthma, Chronic obstructive pulmonary disease (COPD), Ischemic heart disease, Chronic kidney disease, and Chronic liver disease and ocular diseases like Dry eye, Retinal diseases, squint and Glaucoma were excluded. Pregnant women and patients with dementia were also excluded. After obtaining consent of the participants, a questionnaire was provided to the participants to fill. The questionnaire contained questions regarding general information about the participants; the effects of masks that they use in terms of quality of vision, pain/ discomfort, quality of communication with patients and comorbidities. OSDI questionnaire was also provided.

Fig. 1: Questionnaire to be filled by the Participants



QUESTIONNAIRE

1. Name
2. Email id
3. Age
4. Sex
5. Type of HCW
   - Doctor
   - Nurse
   - Technician/Attendant
   - other
6. Do you have any known systemic illness? (more than 1 option can be selected)
   - None
   - Diabetes
   - Hypertension
   - Bronchial asthma
   - Chronic obstructive pulmonary disease (COPD)
   - Ischaemic heart disease
   - Chronic kidney disease
   - Chronic liver disease
   - Other:
7. Do you have any known ocular illness? (more than 1 option can be selected)
   - None
   - Dry eye
   - Retinal problem
   - Glaucoma
   - Squint
   - Other:
8. Do you wear glasses?
   - Yes
   - No
9. Which face mask do you use?
   - N95
   - Triple-layered surgical mask
   - Do not use face mask
10. How will you rate your quality of vision while using FACE MASK, on a scale of 0-5?
11. How will you rate your discomfort/ pain while using FACE MASK, on a scale of 0-5?
12. How will you rate your communication with patients/ colleagues while using FACE MASK, on a scale of 0-5?
13. Have you ever experienced the following due to use of FACE MASK? (Can tickmore than one box)
    - Headache
    - Skin abrasions/ blisters/ rash
    - dryness/ itching/ burning sensation in eyes
    - Gritty/ foreign body sensation in eyes
    - No
14. Did you feel the air leak towards your eyes or glasses when breathing out whileusing FACE MASK?
    - Yes
    - No

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Fig. 2: Osdi Questionnaire

Ocular Surface Disease Index

Have you experienced any of the following during the last week?	All of the time	Most of the time	Half of the time	Some of the time	None of the time
1. Eyes that are sensitive to light?	4	3	2	1	0
2. Eyes that feel gritty?	4	3	2	1	0
3. Painful or sore eyes?	4	3	2	1	0
4. Blurred vision?	4	3	2	1	0
5. Poor vision?	4	3	2	1	0

Subtotal score for answers 1 to 5 (A)

Have problems with your eyes limited you in performing any of the following during the last week?	All of the time	Most of the time	Half of the time	Some of the time	None of the time
1. Reading?	4	3	2	1	0
2. Driving at night?	4	3	2	1	0
3. Working with a computer or bank machine (ATM) ?	4	3	2	1	0
4. Watching TV?	4	3	2	1	0

Subtotal score for answers 6 to 9 (B)

Have your eyes felt uncomfortable in any of the following situations during the last week?	All of the time	Most of the time	Half of the time	Some of the time	None of the time
1. Windy conditions?	4	3	2	1	0
2. Places or areas with low humidity (very dry)?	4	3	2	1	0
3. Areas that are air conditioned?	4	3	2	1	0

Subtotal score for answers 10 to 12 (C)

Subtotals A, B, and C were added up to obtain D (D = sum of scores for all questions answered) (D)
Total number of questions answered (questions answered N/A not include)(E)
OSDI score = sum of scores (D) x 25
No. of ques. Answered (E)
OSDI score ≥ 13 was considered to be Dry Eye Disease (DED). Mild (13–22) Moderate (23–32) and Severe (33–100) DED diagnosis based on OSDI score was made.
The answers were graded and compiled on an Excel sheet for statistical analysis with SPSS software. A level of $p < 0.05$ was used to determine statistical significance.

3. RESULTS

110 HCWs involved in the care of COVID patients participated in our study.

Table 1: Age Wise Distribution of the Participants

Age group	Count
21-30	43
31-40	51
41-61	16
Total	110

Average age of the participants was 36.67 years.

Fig. 3: Age Wise Distribution of the Participants

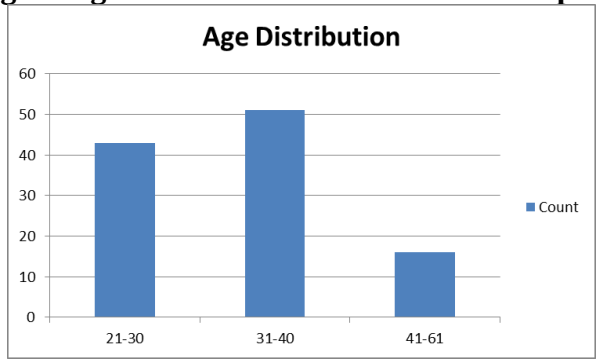

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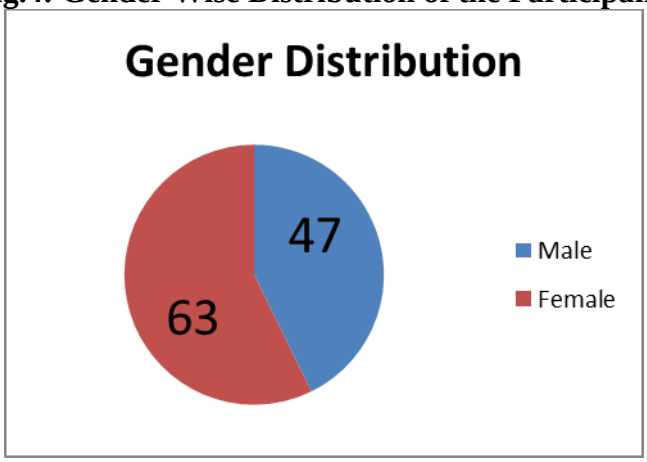
Table 2: Gender Wise Distribution of the Participants

Sex	Count
Male	47
Female	63
Total	110

Fig.4: Gender Wise Distribution of the Participants



56.36% of the participants wore glasses.

Table 3: Face Masks Used by the Participants.

Face mask used	Percentage
N95	72.73%
Triple-layered surgical mask	27.27%

72.73% of the participants were using N95 mask as they were the recommended masks to be used during COVID patient care.

Table 4: Average Quality of Vision while using Different Masks

	Average quality of vision	p-value
Triple layered surgical mask	1.87 (+1.70)	0.62
N95 mask	1.70 (+1.56)	

Average quality of vision in all the participants was 1.74 out of 5 (max). So the quality of vision was very poor with both the masks. There was no statistically significant difference between the 2 groups.

Table 5: Average Discomfort / Pain while using Different Masks

	Average discomfort/pain	p-value
Triple layered surgical mask	2.17 (+1.32)	0.67
N95 mask	2.29 (+1.36)	

Average discomfort / pain in all the participants was 2.25 out of 5 (max). So the quality of vision was poor with both the masks. There was no statistically significant difference between the 2 groups.

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Table 6: Average Communication while using Different Masks

	Average communication	p-value
Triple layered surgical mask	2.33 (+1.37)	0.31
N95 mask	2.61 (+1.26)	

Average communication in all the participants was 2.53 out of 5 (max). So the quality of communication was poor with both the masks. There was no statistically significant difference between the 2 groups.

Table 7: Side Effects Associated with Different Masks

Side Effects	N95	Triple-Layered Surgical Mask
dryness/ itching/ burning sensation in eyes	13 (16.25%)	5 (16.67%)
Gritty/ foreign body sensation in eyes	4 (5.00%)	2 (6.67%)
Headache	19 (23.75%)	10 (33.33%)
Skin abrasions/ blisters/ rash	26 (32.50%)	13 (43.33%)
No	30 (37.50%)	10 (33.33%)

There was no statistically significant difference between the 2 groups in terms of any side effect associated with masks. Skin abrasions/ blisters/ rash was the most common side effect followed by headache and dryness/ itching/ burning sensation in eyes.

Table 8: Air Leak towards the Eyes with Different Masks

Air leak towards the eyes	N95	Triple-layered surgical mask	Grand Total
No	18 (22.50%)	5 (16.67%)	23
Yes	62 (77.50%)	25 (83.33%)	87
Grand Total	80	30	110

79% participants using the masks complained of air leak towards the eyes while using the mask. There was no statistically significant difference between the 2 groups.

Table 9: OSDI Score with Different Masks

	OSDI Score	p-value
Triple layered surgical mask	14.64 (15.05)	0.13
N95 mask	20.35 (18.59)	

HCWs using either Triple layered surgical mask or N95 mask had OSDI score >13. Thus both the groups had mild dry eye disease with more severe dry eye in N95 mask users.

4. DISCUSSION

Prolonged use of face masks has been associated with ocular dryness and discomfort. The term "mask-associated dry eye (MADE)" has become prevalent especially during COVID era as the prevalence of dry eye related to mask use has increased(7). Use of masks created a flow of expired air towards the eyes through the openings in the mask.(6) The increased airflow from an ill-fitted mask can result in dry eyes in anaesthetized patients due to abnormal airflow.(8) The first survey on dry eye due to masks was conducted by Boccardo et al which reported self-

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reported symptoms in 3605 patients, where 27% of patients reported that their dry eye symptoms increased with the use of masks.(9) There was a positive association of dry eye with female sex and retail work. Face masks cause tear film instability and evaporative dry eye due to upward air flow.(10)

We conducted a cross-sectional observational survey at Government Medical College Patiala in which health care workers involved in the care of COVID-19 patients were included. Total 110 HCWs participated in the study in which 57.27% were female. 72.73% of the HCWs were using N95 respirators and the remaining 27.27% were using triple layer surgical masks. We have found that masks deteriorated the quality of vision and cause ocular discomfort equally in both N95 and triple layer mask. Masks, both N95 and triple layer, equally lead to difficulty in communication with the patients. 16% Health care workers reported Dryness/ itching/ burning sensation in eyes, 4% reported foreign body sensation in eyes and 13-26% reported skin rashes around eyes. They also reported active air leak towards the eyes in 62%. The OSDI score was also in abnormal range showing dry eye disease in both types of masks. There was no significant difference between overall dry eye symptoms and OSDI score when comparing N95 with Triple-layered surgical mask.

A similar study by Alsulami et al, on mask related dry eye in nurses was done in 266 participants, showed that 29% had moderate to severe dry eye symptoms and was associated with wearing a mask for >6 hours per day, wearing eye glasses and rheumatoid arthritis.(11) Another study by Al-Dolat et al, studied mask related dry eye in 1219 participants and found symptomatic dry eye in 71.7% , which was not significantly associated with mask use.(12)

The strength of our study is that the sample includes health workers in hospital setting and hence, the results can be applied to health care workers. The limitation of our study is that OSDI scoring is subjective and may vary in different subjects.

5. CONCLUSION

The dye eye disease is associated with use of both N95 and Triple-layered surgical masks in health care workers. Care must be maintained to avoid flow of expired air towards the ocular surface, while wearing any kind of mask.

Conflict of interest: Nil

6. REFERENCES

1. Wolkoff P. Ocular discomfort by environmental and personal risk factors altering the precorneal tear film. Toxicol Lett. 2010 Dec 15; 199(3):203–12.
2. Chen YZ, Chen ZY, Tang YJ, Tsai CH, Chuang YL, Hsieh EH, et al. Development of Lutein-Containing Eye Drops for the Treatment of Dry Eye Syndrome. Pharmaceutics. 2021 Nov; 13(11):1801.
3. Mohammed S, Kefyalew B, Kebede BN, Lorato MM. Prevalence and associated factors of symptomatic dry eye among undergraduate students in Hawassa University College of Medicine and Health Sciences, Hawassa, Ethiopia. BMJ Open Ophthalmol [Internet]. 2022 Dec 20 [cited 2024 Nov 18]; 7(1). Available from: https://bmjophth.bmj.com/content/7/1/e001149
4. Wang C, Horby PW, Hayden FG, GAO GF. A novel coronavirus outbreak of global health concern. Lancet Lond Engl. 2020 Feb 15; 395(10223):470–3.

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5. Rodriguez-Garcia A, Babayan-Sosa A, Ramirez-Miranda A, Cruz-Valdes CS, Hernandez-Quintela E, Hernandez-Camarena JC, et al. A Practical Approach to Severity Classification and Treatment of Dry Eye Disease: A Proposal from the Mexican Dry Eye Disease Expert Panel. Clin Ophthalmol. 2022 Apr 28; 16:1331–55.
6. Moshirfar M, West WB, Marx DP. Face Mask-Associated Ocular Irritation and Dryness. Ophthalmol Ther. 2020 Sep; 9(3):397–400.
7. BLOG: MADE: A new coronavirus-associated eye disease [Internet]. [Cited 2024 Dec 9]. Available from: https://www.healio.com/news/ophthalmology/20200622/blog-a-new-coronavirusassociated-eye-disease
8. Chadwick O, Lockington D. Addressing post-operative Mask-Associated Dry Eye (MADE). Eye Lond Engl. 2021 Jun; 35(6):1543–4.
9. Boccardo L. Self-reported symptoms of mask-associated dry eye: A survey study of 3,605 people. Contact Lens Anterior Eye J Br Contact Lens Assoc. 2022 Apr; 45(2):101408.
10. Arriola-Villalobos P, Burgos-Blasco B, Vidal-Villegas B, Oribio-Quinto C, Ariño-Gutiérrez M, Diaz-Valle D, et al. Effect of Face Mask on Tear Film Stability in Eyes With Moderate-to-Severe Dry Eye Disease. Cornea. 2021 Oct 1; 40(10):1336–9.
11. Alsulami RA, Alotaibi R, Alsulami G, Alharbi R, Alamoudi R, Badeeb NO, et al. Effects of Face-Mask Use on Dry Eye Disease Evaluated Using Self-Reported Ocular Surface Disease Index Scores: A Cross-Sectional Study on Nurses in Saudi Arabia. Cureus. 14(12):e33071.
12. Al-Dolat W, Abu-Ismail L, Khamees A, Alqudah N, Abukawan MM, Alrawashdeh HM, et al. Is wearing a face mask associated with symptomatic dry eye disease among medical students during the COVID-19 era? An online survey. BMC Ophthalmol. 2022 Apr 7; 22(1):159.