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Effect of Prolonged Use of Face Masks in Dental Professionals during COVID-19

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Abstract

Objective: The study was undertaken to understand the long-term effect of using non-pharmaceutical intervention like face mask for protection against COVID-19. The dental professionals are at high risk as mostly all procedures generate aerosols and thus they were using the face masks with PPE for long hours. This study evaluated the various symptoms which were experienced by the professionals when the masks were worn for <4 h, 4 h, and >4 h. **Methods:** A cross-sectional and observational study was carried out online by circulating a Google form among dental professionals practicing in Delhi NCR Region. The form was circulated using social platform. The survey included MCQ questions enquiring about the symptoms that were experienced by professionals after using face masks. The data were assembled and analyzed using SPSS (Version 16, IBM). **Results:** The Google form was distributed to 150 professionals and we received responses from 99. Our study showed that the symptoms were more pronounced when the mask was worn for 4 h or >4 h. The symptoms such as sweating around mask, sore throat, difficulty in breathing, feeling of nasal discomfort, and other symptoms were seen around in 11.1% cases when worn <4 h whereas other symptoms were not presented at all during this time period. **Conclusion:** This study showed that whenever face masks were worn for 4 or more h, it leads to significant discomfort. This would, in turn, affect the efficiency of the face mask, breach the PPE protocol, and hamper the quality of work.

Keywords: Face mask, Covid-19, Personal protective equipments, Dental health care workers

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Introduction

COVID-19 took the world by storm in December 2019 and infected a large number of populations worldwide. The WHO declared it as a pandemic in March 2020.[1] Worldwide governments adopted various means to control this spread but the transmission could not be stopped.[2] Many pharmaceutical and non-pharmaceutical options are available to combat any disease. Respiratory infections respond well to vaccines and antiviral medications but the rapid spread of the disease and time to develop vaccines brought the world to stand still. The containment of new pathogen especially in the early spread becomes difficult.[3]

Various non-pharmaceutical interventions such as face masks, respirators, and face shields were implemented at community level and individual level.[4] These methods are cheap and non-invasive and can be adapted by the community easily. Face mask reduce the transmission as it minimizes the spread of droplets to wearers nasal or oral mucosa[5] also reducing the constant touching to oral tissues. Although it has various benefits, it also has physiologic and psychological effect on the person who wears the mask for long time. There are various studies which report associated symptoms due to prolonged face mask usage such as headaches, eye and nasal dryness, adverse skin reactions, and epistaxis.[6]

This study was undertaken to evaluate the effects of prolonged face masks on oro facial tissues among dental professionals.

Methodology

Study Design and Population

A cross-sectional and observational study was carried out online by circulating a Google form among dental professionals practicing in Delhi NCR Region. The participants were required to fill the form titled "Effects of prolonged use of face masks in dental professionals".

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The form was circulated using various social media platforms. The form was concise and to the point so that the participant did not lose interest in filling the survey questionnaire. The form was sent to 150 professionals randomly selected out of whom we got a response from 99. The inclusion criteria included all professionals (specialists and non-specialists) between 18 and 45 years of age. The exclusion criteria were any professional who had any underlying systemic disorder. The time frame for the study was approximately 1 month (September 15, 2021–October 10, 2021).

Questionnaire

The authors pre-tested the self-administered questionnaire for proper working, submission, and validity of survey and it was then circulated among participants. The questionnaire had two sections to it first part had a detailed email which explained the purpose of the study and the second part was informed consent. The personal information shared by the participants was kept discrete. No incentives whatsoever were offered to participate in the study.

The second section consisted of 10 questions, out of which three were open ended and seven were close ended. The first two

questions were related to participant's age and gender and the other questions were related to study that were patients shared the experience of using a face mask for a long period of time. Each question was provided with provision for participant to express his views related to question other than the options given. The data that were collected were stored in Excel sheet and descriptive data analysis was carried out later on it.

The symptoms that were evaluated were

1. feeling of dry mouth
2. Halitosis
3. inflamed gums
4. angular chelitis/ulcer around the mouth
5. difficulty in breathing on exertion
6. sore throat
7. sweating around the mouth
8. nasal discomfort
9. dry nose
10. other symptoms (such as headache and dry eyes).

Statistical Analysis

The data were assembled and analyzed using SPSS (Version 16, IBM). The variables were summarized as absolute and relative frequencies as they were categorical in nature. Inferential statistics were assessed by Chi-square test and the level of statistical significance was set at 0.05.

Results

A total of 150 healthcare workers were asked to participate in the survey out of which 99 responded. The female and male ratio was 72.7%, males and females were 27.3% (Table S1).

Our study showed that the symptoms were more pronounced when the mask was worn for 4 h or >4 h. The symptoms such as sweating around mask, sore throat, difficulty in breathing, feeling of nasal discomfort, and other symptoms were seen around in 11.1% cases when worn <4 h whereas other symptoms were not presented at all during this time period.

The symptoms that were very pronounced, seen in 85.7% when worn for 4 h were sweating around nose and headache. The other symptoms that were seen in 71.4% was dry mouth and around 57.1% people showed symptoms such as dry mouth, sore throat, and feeling of nasal discomfort. Around 47% and less showed symptoms such as halitosis, inflamed gums, and difficulty in breathing.

The symptoms that were enhanced when the mask was worn for 4 h or more were sweating around mouth (72.35), dry mouth (66.3%), feeling of nasal discomfort (61.4%), and difficulty in breathing (61%). Halitosis was seen in 59% of total participants. Dry nose and sore throat were seen in 49.4% and 47%, respectively. Cracking around mouth (34.9%), other symptoms like headache (27.7%), and inflamed gums (13.3%) were presented in least number of participants.

Discussion

Many studies[7] have shown that prolonged use of masks can cause irritation to nose and surrounding mucosa. This study aimed to understand the effect of time of various symptoms. Some symptoms were more pronounced in males and some in females. Out of these, inflamed gums was seen in 22.9% females and 11.1% males, cracking ulcers was seen in 25.9% females and 16.7% males, and dry nose was seen in 48.1% females and 52.8% males. These symptoms mostly were experienced due to accumulation of hot and humid air beneath the mask.[7]

Difficulty in breathing was experienced by 81.5% females and 54.2% males which could be attributed to hypercapnic hypoxic environment that can cause cardiorespiratory stress.[7]

Dry mouth was experienced by 66.7% females and 55.6% males, halitosis was experienced by 51.9% females and 41.9% males, and sore throat was seen in 59.3% females and 38.9% males; this could probably be due to decrease in water intake.[7]

Other symptoms like headache were seen in 29.6% females and 30.6% males, excessive sweating was seen in 85.2% females and 70.8% males, and nasal discomfort was seen in 55.6% females and 47.2% males.

The symptoms were more pronounced when the usage increased more after 4 h of continuous wearing. The symptoms worsen as there is a decrease in humidification of air leading to decrease in transpiration beneath the area covered by masks.[8]

Face masks have proved to be very efficient in preventing spread of droplet transmission.[9] A well fitted face mask can prevent the forward momentum of expelled particles from cough and sneeze hereby preventing the spread of infection.[10] Even the ill-fitted face mask has potential to prevent the entry of pathogens near the breathing zone.[11]

Many symptoms are manifested when the masks are worn for 4 h or more. This can be attributed to reduction in heat loss from body by various mechanism[12] leading to increased heat burden. It has been seen that there is a temperature difference around outer surface of mask and environment. This leads to condensation of moisture around the masks.[13] Hence, the dead space gets accumulated with hot and humid air. It leads to increase in temperature of surrounding areas to up to 34.5°C which is not acceptable by the skin around oral mucosa. It leads to increased thermal sensation and thus discomfort to the person who wears masks for prolonged period of time.[13]

Our study has shown when the time period increased to 4 h or more the severity of symptoms increased. This can attributed to both the physiological and psychological need of wearer. Sweating around mouth was the most pronounced symptom in majority (72.3%) of participants. This tends to make the wearer continuously touch the face area to wipe the sweat, hence, causing a breach in the PPE protocol and leading to dissemination of infectious particles in the breathing space.[14]

Difficulty in breathing (61%) Table S2, dry nose (71.4%) Table S3, feeling of nasal discomfort (61.4%) Table S4, dry mouth (66.3%) Table S5, and sore throat (47%) Table S6 were other symptoms that manifested more after the time period increased from 4 h. These symptoms are both interrelated. Increase in effort to breathe leads to decrease in conditioning.[15] Studies have shown that quantity of water delivered by mouth breathing in expired air is more than nasal breathing,[16] hence, leading to more heat loss.

Many participants experienced skin related concerns such as cracking around mouth (34.9%) Table S7, inflamed gums (13.3%) Table S8, and other symptoms like headache (27.7%) Table S9. These symptoms can be a cause for each other. It has been seen that the free formaldehyde released from non-woven polypropylene may cause itch around the oral mucosa leading to cracking.[17]

Such symptoms tend to lead the wearer from either constantly touching the oro nasal mucosa leading to breach in the PPE protocol or the compliance is hampered.

This study has its own limitation like a small sample size and also limited to specific area.

Conclusion

Face masks are essential to provide protection again new pathogens and complying by it is also a necessity more than a protocol for one's safety. This study showed that whenever face masks were worn for 4 or more h, it leads to significant discomfort. This would, in turn, affect the efficiency of the face mask, breach the PPE protocol, and hamper the quality of work.

Strategies such as encouraging nasal breathing, taking breaks after every patient, increase in water consumption, and frequent change in facemask could decrease the discomfort.

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Author Contribution

Conceptualization – Dr Apoorv Rana and Dr Shradha. Data Collection and maintenance of record – Dr Neelam and Dr Apoorv Rana. Original Draft – Dr Natasha and Dr Neelam. Review and Editing – Dr Natasha.

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Supplementary Tables

Table S1: Male: Female ratio

Participants	*Frequency*	*Percent*	*Mean Age (years)*
Males	72	72.7%	36.81±8.09
Females	27	27.3%	33.59±8.51
Total	99	100.0	

Table S2: Breathing on exertion

Mask wearing time in hours(hrs)	*Experienced feeling of difficulty in breathing on exertion*		*Total*
	No	*Yes*	
Mask wearing time			
<4 h			
N	2	7	9
%	22.2	77.8	100.0
Nearly 4 h			
N	0	7	7
%	0.0	100.0	100.0
>4 h			
N	36	47	83
%	43.4	56.6	100.0
Total			
N	38	61	99
%	38.4	61.6	100.0
P value		0.044, S	

Table S3: Feeling of Dry Nose

Mask wearing time in hours(hrs)	*Experienced feeling of dry nose*		*Total*
	No	*Yes*	
Mask wearing time			
<4 h			
n	4	5	9
%	44.4	55.6	100.0
Nearly 4 h			
n	2	5	7
%	28.6	71.4	100.0
>4 h			
n	42	41	83
%	50.6	49.4	100.0
Total			
n	48	51	99
%	48.5	51.5	100.0
P value	0.517, NS		

Table S4: Nasal Discomfort

Mask wearing time in hours (hrs)			*Experienced feeling of nasal Discomfort*		*Total*
			No	*Yes*	
Mask wearing time	Less than 4 hrs	n	8	1	9
		%	88.9%	11.1%	100.0%
	Nearly 4 hrs	n	3	4	7
		%	42.9%	57.1%	100.0%
	More than 4 hrs	n	32	51	83
		%	38.6%	61.4%	100.0%
Total		n	43	56	99
		%	43.4%	56.6%	100.0%
				0.015, S	

Table S5: Feeling of Dry Mouth

Mask wearing time in hours (hrs)			*Experienced feeling of dry mouth*		*Total*
			No	*Yes*	
Mask wearing time	Less than 4 hrs	n	7	2	9
		%	77.8%	22.2%	100.0%
	Nearly 4 hrs	n	3	4	7
		%	42.9%	57.1%	100.0%
	More than 4 hrs	n	28	55	83
		%	33.7%	66.3%	100.0%
Total		n	38	61	99
		%	38.4%	61.6%	100.0%
				0.035, S	

Table S6: Sore throat

Mask wearing time in hours(hrs)	*Experienced feeling of sore throat*		*Total*
	No	*Yes*	
Mask wearing time			
<4 h			
n	8	1	9
%	88.9	11.1	100.0
Nearly 4 h			
n	3	4	7
%	42.9	57.1	100.0
>4 h			
n	44	39	83
%	53.0	47.0	100.0
Total			
n	55	44	99
%	55.6	44.4	100.0
P value		0.094, NS	

Table S7: Cracks or ulcers at the corner of the mouth

Mask wearing time in hours(hrs)	*Experienced cracking ulcers at the corner or around the mouth*		*Total*
	0.0	*1.0*	
Mask wearing time			
<4 h			
n	9	0	9
%	100.0	0.0	100.0
Nearly 4 h			
n	7	0	7
%	100.0	0.0	100.0
>4 h			
n	54	29	83
%	65.1	34.9	100.0
Total			
n	70	29	99
%	70.7	29.3	100.0
P value		0.019, S	

Table S8: Inflammation of Gums

Mask wearing time in hours(hrs)	*Experienced inflamed gums*		*Total*
	No	*Yes*	
Mask wearing time			
<4 h			
n	9	0	9
%	100.0	0.0	100.0
Nearly 4 h			
n	4	3	7
%	57.1	42.9	100.0
>4 h			
n	72	11	83
%	86.7	13.3	100.0
Total			
n	85	14	99
%	85.9	14.1	100.0
P value		0.043, S	

Table S9: Other discomfort(headache, ear pain)

Mask wearing time in hours(hrs)	*Experienced any other symptoms such as headache and ear discomfort*		*Total*
	No	*Yes*	
Mask wearing time			
<4 h			
n	8	1	9
%	88.9	11.1	100.0
Nearly 4 h			
n	1	6	7
%	14.3	85.7	100.0
>4 h			
n	60	23	83
%	72.3	27.7	100.0
Total			
n	69	30	99
%	69.7	30.3	100.0
P value		0.002, S	