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## **Mask Mouth: An Evaluation of Emerging Problem amongst Orthodontic Patients**

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**Abstract**--To evaluate the oral health problems faced by the orthodontic patients arising due to prolong use of mask. A cross-sectional survey was administered via a web platform. The patients undergoing orthodontic treatment were invited to participate in the study. Minimum sample size of 325 estimated. Structured questionnaire was developed. Reliability was assessed using Cronbach's alpha and intra-class correlation coefficient. Cronbach's alpha of questionnaire was 0.909. Test-retest reliability to measure external consistency was assessed on 30 study subjects with two-weeks interval between two observations. The correlation coefficient was 0.9 indicating good reproducibility and reliability of questionnaire. The analysis was performed using Social Sciences statistical software. (SPSS, version 20.0). The estimated prevalence rates presented with 95% confidence interval. Descriptive statistics was used to find the frequencies, mean and standard deviation. The chi-square test was used to compare the categorical variables. Out of 341 responders, 158 were males and 183 were Females and were between the age group of 10 to 40 years. Majority of the patients were wearing fixed type of appliance and can wear cloth mask comfortably for 1-5 hours and prefer re-usable mask. Out of all reported problems, difficulty in breathing (69.2%) and feeling uncomfortable due to presence of

appliance (60.4), swollen gums (49.3%), pain on ear lobe (45.5%) and difficulty in speaking (41.3%) and Halitosis or bad breath (34.6%) appeared to be the most common one. Though there are many problems faced by the orthodontic patients still potentially life-saving benefits of wearing face masks seem to outweigh the discomforts caused by mask.

**Keywords**---COVID-19, face mask, pandemic, patients.

## **Introduction**

Recently, coronavirus disease 2019 emerged in late 2019 causing pandemic situation in many countries and territories (Rodriguez-Morales et al., 2020). Health professionals worldwide are currently making efforts to control further disease outbreaks. Subsequent outbreak was first identified in Wuhan City, China and spread rapidly throughout the China and other countries (Gralinski & Menachery, 2020). Due to the severity of this outbreak and high infectivity of virus, the WHO declared a global health emergency on 31 January 2020; subsequently, on 11 March 2020, they declared it a pandemic situation (Lu, 2020; Sheahan et al., 2020; Pillaiyar et al., 2020). The current scenario demands effective implementation of vigorous prevention and control strategies (Vincent & Cheng, 2020). In countries where community transmission is exponential, population level physical distancing and movement restriction are set. In the event of pandemic it is likely that antiviral drugs and vaccines will be in short supply or that delivery could be delayed. Therefore, non-pharmaceutical interventions such as usage of mouth masks, hand washing and other hygiene measures might be effective as early control strategies (MacIntyre et al., 2009). Medical masks are a type of personal protective equipment used to prevent the spread of respiratory infections. These masks cover the mouth and nose of the wearer and, if worn properly may be effective at helping prevent transmission of respiratory viruses and bacteria (Desai & Mehrotra, 2020). Various devices are used in healthcare and community settings worldwide, ranging from cloth, cotton, or gauze masks; medical, surgical, or procedure masks; and N95, N99, N100, P2, P3, FFP2 and FFP3 respirators. The difference between the products arises from their design and intended use. Medical masks and cloth masks were designed to prevent the spread of infection from wearers to others but are commonly used to protect the wearer from splashes of blood or body fluid (Fallahi et al., 2020). The Centers for Disease Control and Prevention in the USA has modified previous recommendations, suggesting that, together with infected persons and health care workers, healthy people “should wear a cloth face cover when they have to go out in public (Centers for Disease Control and Prevention, 2020). The need for universal use of cloth face coverings or, when available, of surgical masks seems further suggested by the results of some studies that support the hypothesis that face masks are effective in reducing the presence of viral particles in droplets and aerosol generated by symptomatic SARS- CoV-2-infected individuals (Leung, 2020). Practice of wearing a mask has been widely debated in other countries, as some previous experimental studies on other respiratory diseases such as influenza H1N1 suggested the limited effectiveness of using face masks to prevent infection (Cowling et al., 2010). However, risk assessment studies

using population transmission models suggested that the population-wide use of face masks could delay an influenza pandemic (Brienen et al., 2010). The risk of influenza, SARS, and COVID-19 infection were reduced by 45%, 74%, and 96% by wearing masks, respectively. Analysis of its effects based on different geographic locations, for non-healthcare populations, reduced risk of 54% was found in western countries, and a reduced risk of 49% was found in Asia. This would suggest that the proper use of masks might play a significant role in public health efforts to suppress the spread of COVID-19, regardless of the geographic locations, especially during an outbreak (Liang et al., 2020)

A recommendation for wearing hygienic masks is currently used in the general population through-out India. A recent publication suggested that wearing face masks by the general public is potentially of high value in curtailing community transmission. Public face mask wearing is now claimed as a new habit during the COVID-19 pandemic (Eikenberry et al., 2020). Like any medical therapy, orthodontic treatment exposes the patient to certain risks. Orthodontic therapy inevitably produces a biological challenge to the stomatognathic system. Failure to properly identify and manage the risks of orthodontic treatment cannot only give rise to patient dissatisfaction but also to litigation. So clinicians must be very careful in managing patients' expectations as part of their overall risk management strategy (Wishney, 2017). Orthodontic appliances deteriorate the self-cleaning of teeth provided by the tongue, cheek and lip muscles during mastication, and they increase biofilm accumulation by expanding plaque retention sites around the components of fixed appliances attached to the teeth (Arici et al., 2007; Ren et al., 2014; Ristic et al., 2007). There are reports from dental communities about negative effects of masks and are accordingly titled "mask mouth" (Muley, 2020). Provocation of gingivitis (inflammation of the gums), halitosis (bad breath), candidiasis (fungal infestation of the mucous membranes with *Candida albicans*) and cheilitis (inflammation of the lips), especially of the corners of the mouth, and even plaque and caries are attributed to the excessive and improper use of masks. The main trigger of the oral diseases mentioned is an increased dry mouth due to a reduced saliva flow and increased breathing through the open mouth under the mask. Mouth breathing causes surface dehydration and reduced salivary flow rate (Muley, 2020). Redness of the cheeks, redness of the nose bridge, and redness of the ears reported due to masks (Atay & Cura, 2020). Dry mouth is scientifically proven due to mask wear (Liu et al., 2020). This came to the purpose of the present research to evaluate the oral health problems faced by the orthodontic patients arising due to prolong use of mask

## **Materials and Methods**

A cross-sectional survey was administered via a web platform conducted under the aegis of Orthodontic and Dentofacial Orthopedics Department of Government Dental College, Mumbai. The patients undergoing orthodontic treatment who had visited the Department of Orthodontics and Dentofacial Orthopedics were invited to participate in the study. Using the Survey Monkey platform, a survey link was circulated using the Whatsapp. The link was designed in such a way, that only 1 response can be generated using one device. Written Informed consent for

participation was obtained from the patients. Inclusion criteria includes all the patients who are willing to participate in the study. Exclusion criteria includes patients who does not provide informed consent. Two reminders were sent 5 days apart with a request to complete the survey. We disabled the online survey link after 10 days.

### **Sample size and sampling method**

In order to determine the minimum sample size, we used estimates using single proportion formula as:

$$n = 1.96^2 \frac{p(1-p)}{d^2} (DEFF)$$

Where,  $p$  = Estimate of the expected proportion

$d$  = Desired level of absolute precision

For this purpose,  $\alpha = 0.05$ ,  $p = 0.3$ ,  $d = 0.05$  were considered and minimum sample size of 325 estimated. Considering the non-respondent we recruit 5% more than estimated sample. So our final sample size  $325 + 16 = 341$ .

### **Data collection**

For Data collection, a structured questionnaire was developed considering all the factors that are related with Mask usages and problems faced by orthodontic patients due to the use of face masks.

### **Study tool**

For development of questionnaire, an item pool was developed through a review of literature of previous studies and also through subjective selection of items. Item pool was reviewed for its comprehensiveness, relevance, and clarity. All the items believed to be appropriate for the given topic were selected.

The closed ended questionnaire was designed to have 3 parts. Questions related to demographic variables, duration of orthodontic treatment and type of appliance were addressed in the first part of questionnaire. The next section included questions on Mask usages. The third part of questionnaire consisted of 22 closed ended questions on problems faced by orthodontic patients due to the use of face masks.

### **Validity and reliability of study tool**

The face and content validation was carried out with two subject experts and conducting a focused group discussion of a small representative sample of 10 study subjects. Cronbach's alpha as a measure of internal consistency or homogeneity of questionnaire was 0.909 and was not improving by any item deletion; it was decided to have all the items in the questionnaire. Test-retest reliability to measure external consistency was assessed on 30 study subjects with two-weeks interval between two observations. The correlation coefficient was 0.9 indicating good reproducibility and reliability.

## Statistical analysis

After taking all the demographic details from patients, the data were entered into an Excel worksheet. After extracting the data from the questionnaires into the worksheet, the analysis was performed using the commercially available Statistical Package for Social Sciences statistical software. (SPSS, IBM version 20.0). The estimated prevalence rates presented with 95% confidence interval (95% CI). The Statistical significance was declared if the *p*-value was less than 0.05. Descriptive statistics was used to find the frequencies, mean and standard deviation of variables considered in the study. The chi-square test was used to compare the categorical variables.

## Results

The results are based on the online data collected from patients. Cronbach's alpha of questionnaire was 0.909 showed internal consistency is acceptable. For test-retest reliability, the same questionnaire was administered on a convenience sample of 30 patients on two occasions with a gap of one week. This yields two scores for each participant and the intra-class correlation coefficient is calculated. The test-retest ICC of the questionnaire score was 0.98 (95%CI: 0.968-0.994) with *p* value <0.001 indicative of an excellent agreement

Table 1  
Showed Socio-demographic profile of the respondents (n=341)

Gender	Male	%	Female	%	Total	%
Socio-demographic	158	46.3	183	53.7	341	100
Age in years						
10 to 20	81	23.7	94	27.5	175	51.3
21-30	69	20.2	68	19.9	137	40.1
31-40	8	2.3	21	6.1	29	8.5
6 months	5	1.4	17	4.9	22	6.4
Treatment						
1 year	60	17.5	66	19.3	126	36.9
Years						
1.5 years	68	19.9	83	24.3	151	44.2
2 years	25	7.3	17	4.9	42	12.3
Type of						
Fixed	153	44.8	174	51	327	95.8
Appliance						
Removable	5	1.4	9	2.6	14	4.1

Majority of the patients were between the age group of 10 to 20 years (51.3%). One fifty eight participants (46.3%) were male and one eighty three participants (53.7) were female. Five participants (1.4%) started their orthodontic treatment in last 6 month, 60 participants (17.5%) were taking orthodontic treatment since last one year, 68 participants (19.9%) were taking orthodontic treatment since last one and half year and 25 participants (7.3%) were taking orthodontic treatment since last 2 years. Majority of the patients were wearing fixed appliance (44.8%).

Table 2  
Showed Knowledge and awareness of usage of mask among respondents (n=341)

Question	Options	Male		Female		P Value
		n	%	n	%	
Are you aware about the reason for wearing mask in the COVID times	Yes	165	99.4	175	100	0.304
	No	1	0.6	0	0	
Are you aware about the correct way of using the mask?	Yes	164	98.8	175	100	0.145
	No	2	0.6	0	0	
Are you aware about "Mask Mouth" syndrome	Yes	19	11.4	19	10.	0.863
	No	147	88.6	156	89.1	
How long can you wear mask comfortably	Less than 1 hour	24	14.4	23	13.1	0.939
	1-5 hours	91	54.8	97	55.4	
	More than 5 hours	51	30.7	55	31.4	
Which type of mask are you using	Cloth mask	101	60.8	115	65.7	0.351
	Surgical mask	65	39.2	60	34.3	
	Respirator	0	0	0	0	
	Any other	0	0	0	0	
Which type of mask do you prefer	Disposable	65	39.2	60	34.3	0.351
	Re-useable	101	60.8	115	65.7	
For reusing how do you decontaminate your mask	Washing	90	54.2	101	57.7	0.620
	Disinfect	0	0	0	0	
	Boiling Water	0	0	0	0	
	Combination	11	6.6	14	8	
	Dispose Off	65	39.2	60	34.3	

Out of 341 responders, all (100%) declared face masks wearing. When it was asked Are you aware about the reason for wearing mask in the COVID times, all the patients except one had answered correctly. All the patients except 2 were aware about the correct way of using mask. However very few patients (11.14%) were aware about the term Mask Mouth. Majority of participants were wearing cloth mask comfortably for 1-5 hours and prefer re-usable mask. Washing with soap and water is preferred method to decontaminate the mask.

Table 3  
Showed problems faced by patients on prolong use of mask

Difficulties	Yes	%	No	%	P value
Headache	60	17.6	281	82.4	0.031*
Breathing difficulty	236	69.2	105	30.8	0.000*
Speaking difficulty	141	41.3	200	58.7	0.000*
Rash/Itching on Face	91	26.7	250	73.3	0.005*
Mental stress	31	9.1	310	90.9	0.145
Pain on ear lobe	155	45.5	186	54.5	0.000*
Sore throat	64	18.8	277	81.2	0.027*
Bleeding and swollen gums.	168	49.3	173	50.7	0.000*

Increased thirst	22	6.5	319	93.5	0.226
Increased dryness of mouth	40	11.7	301	88.3	0.093
Foul breath/ Halitosis	118	34.6	223	65.4	0.001*
Dry and cracked lips/Chilitis	27	7.9	314	92.1	0.176
Increased mouth ulcers	28	8.2	313	91.8	0.168
Increase fungal infection	21	6.2	320	93.8	0.238
Do you feel your cheeks and lips gets stick on your orthodontic brackets	24	7	317	93	0.205
Difficulty in wearing removable appliance	25	7.3	316	92.7	0.195
Difficulty in maintaining oral hygiene of appliance	100	29.3	241	70.7	0.003*
Feeling uncomfortable due to presence of appliance	206	60.4	135	39.6	0.054*
Do you face such problems before COVID times	26	7.6	315	92.4	0.185
Would you like to discontinue or the treatment due to problems faced by you because of prolong use of mask	11	3.2	330	96.8	0.400
Would u like your orthodontist to counsel you regarding maintenance of orthodontic appliance because of prolong use of mask	165	48.4	176	51.6	0.000*

Table 3 showed Difficulties faced by patients on prolong use of mask and the difficulties which were significant statistically are Breathing difficulty, swollen gums, Speaking difficulty, sore throat, pain on ear lobe, Rash on face or Itching on face, Foul breath/ Halitosis, Difficulty in maintain oral hygiene of appliance and feeling uncomfortable due to presence of appliance etc. Out of all reported problems, difficulty in breathing (69.2%) and feeling uncomfortable due to presence of appliance(60.4%), Swollen gums (49.3%), pain on ear lobe(45.5%) and difficulty in speaking(41.3%) appeared to the most common one, followed by foul breath/ Halitosis (34.6%), Difficulty in maintaining oral hygiene (29.3%), itching on face /rash on face (26.7%), sore throat (18.8%),and headache (17.6%).

## Discussion

As a basic non-pharmaceutical intervention measure, wearing a mask is an effective means of preventing respiratory infectious diseases (Benkouiten et al., 2014). In our study cloth mask is used by majority of patients (60.8%), although there is no enough strong evidence that cloth masks may be only slightly less effective than surgical masks in blocking emission of particles. However, they are thought to be 5-fold more effective than not wearing face protection and may provide some protection if well designed and used correctly (Javid et al., 2020; Davies et al., 2013; Chughtai et al., 2020).

In our study the most common problem faced by the patients was difficulty in breathing which was seen in 69.2% of patients. This finding is similar to the results of Matusiak et al. (2020), Scheid et al. (2020), and Matuschek et al. (2020), who reported difficulty in breathing the most common one among all reported

inconveniences and significant respiratory compromise in patients with severe obstructive pulmonary disease.

This breathing difficulty may be attributed due to thick barriers provided by the manufacturing companies; the manufacturing companies may require further research to reduce the thickness of the layers of the mask (Mary et al., 2020). In our study 41.3% had answered that they had speaking difficulty after wearing mask and they remove mask while speaking but this attitude should be changed as this would increase the risk of infection (Kelkar et al., 2013).

The other problems such as the pressure lesions in the nasal bridge (erythema, erosion or ulceration) (41%), erythema (19%), urticaria (3%), and aggravation of pre-existing skin problems (4%) such as acne and seborrheic dermatosis were reported by the (Marraha et al., 2021). However in our study feeling uncomfortable due to presence of appliance(60.4), pain on ear lobe(45.5%) foul breath/ Halitosis (34.6%), Difficulty in maintaining oral hygiene (29.3%), sore throat (26.7%) and headache (17.6%) was reported (Marraha et al., 2021).

The study done by Matusiak L et al showed in 7.7 % cases reported itching on face however in our study 49.3 % cases reported Itching on face, this may be due to higher temperature and humidity on the surface of facial skin caused by expired air and the perspiration (Foo et al., 2006; Gheisari et al., 2020), Itch can induce scratching and thus lead to inappropriate use of face masks, which could compromise their effectiveness and reduce the protection they offer (Szepietowski et al., 2020).

### **Limitations**

This study has some limitations. The current study focused on the problems faced by orthodontic patients after wearing a face mask. It is important to acknowledge that there may be broader associations and implications of wearing a face mask which are not discussed in this study.

### **Conclusion**

Measures to prevent infections are necessary in the current pandemic. Face masks have been considered a first step to prevent and contain the spread of the disease. Different types of masks are available on the market for this purpose. Simple masks covering mouth and nose are primarily used to prevent transmission by holding back droplets. Though there are many problems faced by the orthodontic patients still potentially life-saving benefits of wearing face masks seem to outweigh the discomforts caused by mask wearing.

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