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Assessment of Awareness amongst Dental Practitioners Regarding Aerosols in Dentistry and Its Impact on Public Health in the Covid Era

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ABSTRACT

Background: Dental care includes aerosol-generating procedures that can increase viral transmission. The pandemic offers an opportunity for the dental profession to shift more toward nonaerosolizing, prevention-centric approaches to care and away from surgical interventions. In this study we aim to determine the awareness amongst dental practitioners about the hazards that aerosol generation pose, and the exposure to which can be a causative agent to the occurrence of several respiratory illness including COVID.

Materials and Methods: A validated questionnaire study comprising of 15 questions, was done for the assessment of awareness of aerosols in dentistry and its impact on public health during the Corona virus pandemic among 201 dental practitioners for duration of 6 months.

Results: The results indicate that most of the practitioners were aware of the various protocols issued by health organizations and had willingly implemented the standard operating procedures within their practices.

Conclusion: In this current pandemic situation several advisories have been generated by national as well as international boards, the adherence to these protocols is imperative to control the spread of SARS-CoV-2.

Keywords: NIL

The novel coronavirus (COVID-19) has spread its tentacles around the world. The World Health Organization (WHO), in March 2020 professed COVID-19 as a pandemic.^[1,2] Dentists stand at a high risk of exposure to this disease due to their clinical set up use of ultrasonic scalers and handpieces which produce aerosols.^[3] as well as close proximity to the patient's oral cavity.

Aerosols

The terms "aerosol" and "splatter" in the dental environment were used by **Micik and colleagues**.^[4] **Hinds** defined an aerosol as "a suspension of solid or liquid particles suspended (for at least a few seconds) in a gas.^[5] **The International Commission on Radiological Protection (ICRP)** estimated that particles between 1to 10 μ m or < 0.5 μ m deposit in

the tracheobronchial region, whereas particles $\leq 5 \mu m$ enter the lower airways during oral inhalation. The size and penetrability of the aerosol needs to be determined so as to select an appropriate face mask, while its settling characteristics impact the decisions made for the nature and time of surface decontamination.

Aerosols and infections

Airborne spread of infections forms a potential route for the spread of infection in a dental office. SARS-CoV-2 is a severe flu-like illness, the primary mechanism is through aerosolized droplets produced by coughing or other means.^[6] The Centers for Disease Control and Prevention, or CDC, and the ADA have recommended that aerosol-producing

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procedures should be avoided in patients with active SARS.^[7,8]

Sources of airborne contamination during dental treatment

- 1. Dental instrumentation,
- 2. Saliva and respiratory sources, and
- 3. The operative site.^[9]

The most visible aerosols are produces by dental handpieces, ultrasonic scalers, air polishers and air abrasion units. **Harrel et al** demonstrated aerosol production from small amounts of liquid placed at the operative site in vitro, with the use of ultrasonic scaler without a coolant.^[10,11]

Thus in this study we aim to determine the awareness amongst dental practitioners about the hazards that aerosol generation pose and the exposure to which can be a causative agent to the occurrence of several respiratory illness including COVID. In this current pandemic situation several advisories have been generated by national as well as international boards, the adherence to these protocols is imperative to control the spread of SARS-CoV-2.

MATERIALS AND METHODS

A questionnaire study was done for the assessment of awareness of aerosols in dentistry and its impact on public health during the Corona virus pandemic among dental practitioners. This questionnaire based survey and was conducted in December 2020 for a duration of 6 months. It was an online questionnaire consisting of 15 questions which used Google Forms to accumulate data from 201 dentists who were randomly selected as study subjects for the study.

The data collected were subjected to Statistical analysis using SPSS 21.0 (IBM, Chicago, United States). Descriptive statistical analysis, was used to analyze statistical significance difference in the response between different groups. Statistical significance was set at P < 0.05.

RESULTS

The number of participants and their demographic details are given in **Table 1**. A total of 201 dentists (117 males; 84 females) participated in this study. The male subjects (58.2%) were in majority when compared to female subjects (41.7%).

Aerosols in the dental operatory

Based on the given questionnaire, 97.5% of the practitioners are aware of aerosols being generated in the dental office and 93.5% of the practitioners were aware that aerosols can be generated by both direct as well as indirect exposure from infected patients by the medium of droplets. 88.1% practitioners were aware of all the various aerosol generating procedures in the dental operatory, whereas 24.9% of them were aware of only ultrasonic scalers to be the In the pandemic era the agent for aerosols. knowledge of the spread of infectious agents via aerosols is pivotal. 76.6% of the study population, were aware of the various diseases encountered due to aerosol inhalation. SARS-CoV-2 poses as a health hazard in the present times and this recognized by 23.4% of dental practitioners, when compared to tuberculosis.(Table 2)

Virus particles and protocols

A study conducted by Wang et al. (2004) examined the oral cavity of SARS patients and found large amount of SARS-CoV RNA in their saliva $((7.08 \times 10^3)$ to (1.28×10^8) copies/mL), suggesting the possibility of coronavirus transmission through oral droplets. This fact is acknowledged by 98.5% of the dentists, and a majority of 63.2% dentists were aware of the levels of viral titres of SARS-CoV RNA present in the saliva which serves as a viral reservoir.^[44] 59.7% of the dentists reported that they had received information regarding dental protocols from websites of national health bodies like Ministry of Health and Family Welfare whereas 79.1% of individuals reported to have obtained the information from International Health organizations such as WHO, ADA and other professional organizations. 68.7% practitioners were aware of the rapid review guidelines issued by COCHRANE on May 2020. (Table 3)

Dental clinic modifications and precautions

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A majority of dentists (70.6%) reported that they had modified their dental clinic by segregating it into different sections to prevent transmission of COVID-19. 59.7% reported to have introduced teleconsultation and thereby triaged the patients, as opposed to 7.5% of dentists. A majority of 63.7% dentists have reported the use of atraumatic restorative techniques while 45.3% continued the use

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of rotary instruments by generating minimal aerosols. ADA has enlisted the dental emergency procedures to be executed during the COVID-19 pandemic, which has been implemented by the study population. (TABLE 4)

Implementation of precautionary measures

Various reviews recommend the use of preprocedural mouthwashes in dental practice to reduce SARS-CoV-2 viral load and to reduce cross-infection.^[13] 58.7% of the dentists reported that they used preprocedural mouthrinse using chlorhexidine as compared to 37.3% who used pre procedural mouth rinse containing 0.2% povidone-iodine. Aerosol dispersion should be minimised by adjusting dental treatment procedures, 57.2% reportedly used rubber dam for isolation and 32.8% advocated the use of aerosol box for the same. 79.1% practitioners are aware of surface contamination via aerosols and thereby routinely disinfect surfaces.

84.1% dentists have reported the use of entire PPE for clinical treatment procedures, 82.6% and 77.1% have reported the usage of N-95 masks and gloves at all times, respectively. Whereas 22.9% and 32.3% advocated the use of only goggles and face shields respectively. Respirators provide protection against aerosols and thereby the knowledge of them is essential for dental practitioners. 60.7% of the population is aware of the various kinds of respirators available, as compared to 40.8% being aware of only N-95 masks and 27.4%, being aware of mouthmask respirator only and 19.9% were aware of HEPA filters and full face respirators.(TABLE 5)

DISCUSSION

Kampf et al have reported that the endemic human coronavirus (HCoV) can persist on inanimate surfaces like metal, glass or plastic for up to 9 days and also stay suspended in human secretion, and undergo onward transmission^[14] (Kramer et al., 2006; Otter et al., 2013)^[15,16] to either the eyes, nose, or mouth, resulting in cross infections.(Otter et al.. 2013). Therefore surface disinfection is imperative. 1 min disinfection by agents such as 62% alcohol, 0.5% hydrogen peroxide or 1,000 ppm (0.1%) sodium hypochlorite can effectively reduce SARS-CoV-2 transmission, and this protocol has been found to be followed by 79.1% of the dentists.

Water coolants combined with blood and saliva creates bioaerosols which serve as reservoir for bacteria, fungi, and viruses (Grenier, 1995; Jones and Brosseau, 2015)^[17,18] and can travel for more than six feet (Kutter et al., 2018)^[19].

In the present study, dentists were aware of the advisory issued by various dental associations through websites of various health bodies and the majority of the clinical practices were shut to provide the best oral healthcare. Ministry of Health and Family Welfare, Indian Dental association (IDA) which has been referred to by 59.5% of the dentists whereas 79% of the dentists referred to international bodies such as CDC, ADA, UN Guidelines and BDA Guidelines in order to restart their practices and maintain aseptic measures.

Guo et al have reported that in light of pandemic, 94.6 % of the dental visits were mostly for emergency treatments. A majority of dentists in this study opted to provide teleconsultation and triaging of patients for emergency needs and also modified their dental clinics by sectioning their clinic and segregating their staff to prevent cross infections.

Application of rubber dam during cavity preparation showed a significant reduction in the spread of microorganisms by 90%. (Cochran et al., 1989)^[21] and also reduce splashes. (Dahlke et al., 2012)^[22] It has been reported by Samaranavake et al that the use of rubber dam significantly helps in minimizing the inhalation of infective aerosols by dental personnel.^[23] In our study, 57.2% of the dentists preferred to use rubber dams for all restorative and endodontic cases.

Recent publications have reported that oral rinsing reduces the microbiological load in aerosols during healthcare generated dental procedures.(Marui et al., 2019)^[24] 58.7% dentists reportedly chlorhexidine mouthwashes use preprocedurely. It has been proven to be effective against several infectious viruses, though recent in vitro studies have showed that it insufficiently inactivates SARS-CoV-2 (Kampf et al., 2020). Ather et al., 2020 and Peng et al., 2020^[25,26] in separate studies have suggested that 1% hydrogen peroxide oral rinse may be useful in reducing the risk of transmission of SARS-CoV-2 via aerosols, though only 10.4% dentists use it in routinely. Povidineiodine has been suggested to be useful for both oral

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and nasal disinfection against SARS-CoV-2 (**Kirk et al., 2020; Loftus et al., 2020; Rørslett et al., 2019**) and has been noted to be used by 37.3% practitioners.^[27,28,29]

Aerosol boxes, are available in the form of a transparent barrier between the patient and the healthcare personnel, and may prove to be useful when prescribed protection equipment such as masks and eyewear are unavailable. (Maniar and Jagannathan., 2020)^[30] 32.8% dental practitioners seemed to be aware of the use of aerosol boxes in dentistry and aimed to use them in their practices.

Since the respiratory tract is the main portal of entry of the virus, the respiratory tract should be shielded (**Jin et al., 2020**).^[31] Therefore, it is pivotal to wear respiratory protection during aerosol generating procedures in patients infected with SARS-CoV-2 (WHO, 2020). PPE should comply with the international standards.^[80] 84.1% dentists used an entire PPE while treating patients in the dental office and subsequently 82.6% and 77.1% dentists advocated the all-time use of N-95 masks and gloves operatory respectively. The mucous in the membranes of the eyes are also a possible portal of entry (Adhikari et al., 2020).^{[32]¹} Therefore, face shields provide the advantage of protection from splashes (Lindsley et al., 2014).^[33]

In research on protection against fine particles, N95equivalent respirators showed 9% total leakage, whereas for medical face masks leakage was 22%– 35% (**Steinle et al., 2018**).^[34] Based on this survey a majority of 60.7% dental practitioners recognized the different types of respirators available. Adequate saliva as well as aerosol extraction using high volume evacuation is important to minimise aerosol production (Devker et al., 2012; Narayana, et al, 2016).^[35,36]

Embracing nonsurgical, nonaerosolizing caries prevention and management will be critical in a focused approach on surgical intervention and prevention. Evidence-based materials include dental resin sealants, glass ionomers as sealants or as part of atraumatic restorative treatment performed with hand instruments without generating aerosols, thereby reducing the risk of viral transmission. These methods expand access to preventive and restorative care for vulnerable populations, especially in such times of a pandemic.

CONCLUSION

We concluded that oral healthcare professionals prevent the transmission or acquisition of the novel viruses while simultaneously providing dental care to the patients. It is mandatory for the dentist to train the dental staff for protection against coronavirus. Dentists should train their dental staff for teledentistry, donning and duffing of PPE kit, proper sterilization and disinfection of the instruments and dental clinic and proper disposal of biomedical waste to prevent infection and protect themselves, patients, and dental teams from increasing threat from emerging novel viruses and pandemics by inculcating latest research, studies, and situations while being equally concerned about their patient's needs.

TABLES:

Profile		Number (n=201)	Percentage (%)
Gender	Male	117	58.2
	Female	84	41.7
Speciality	General Dentist	84	41.7
	Prosthodontist	17	8.4
	Endodontist	13	6.4
	Pedodontist	18	8.9
	Periodontist	17	8.4
	Public Health		
	Dentist	13	6.4
	Orthodontist		
	Oral Maxillofacial	07	3.4
	surgeon		
	Oral Radiologist	14	6.9
	Oral Pathologist		
		11	5.4
		7	3.4
Type of Practice	Private Practice	81	40.2
	Private Hospital	44	21.8
	Government Hospital	37	18.4
	PHC / CHC	16	7.9
	Government College	23	11.4

Participants and demographic characteristics (Table 1)

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TAB	LE 2: QUESTIONS	n	%
Q1. What is the mode of transmission of COVID-19 in dental clinics?			
a	Direct exposure to respiratory secretions, blood or saliva	8	4
В	Indirect contact with contaminated surfaces or instruments	3	1.5
С	Mucosal contact with infection-containing droplets and aerosols caused by coughing or talking without mask	12	6
D	All of the above	188	93.5
Q2. <i>A</i>	Are you aware of Aerosol generating procedures (AGP's)	1	1
А	Yes	196	97.5
В	No	8	4
Q3. Which of the following AGP's are you aware of?			
А	Ultrasonic and Sonic Scalers	50	24.9
В	Air Polishing	30	14.9
С	Air-Water Syringe	40	19.9
D	Tooth Preparation With Air Turbine Handpiece	39	19.4
Е	Tooth Preparation With Air Abrasion	26	12.9
F	All of the above	177	88.1
G	None of the above	1	0.5
Q.4 Which of the following diseases are you aware of to be caused by aerosol generation?			
А	Tuberculosis	41	20.4
В	Legionella pneumoniae	17	8.5
С	Pneumonic Plague	7	3.5
D	Influenza	34	16.9
Е	Severe Acute Respiratory Syndrome (SARS-CoV and MERS-CoV)	47	23.4
F	All of the above	154	76.6

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TAB	LE 3: QUESTIONS	n	%
Q5. Does the transmission of virus particles take place through the saliva of infected Covid patients?			
А	Yes	198	98.5
В	No	4	2
Q6. I	f Yes. Are you aware of the viral load in saliva titres?		
А	1.2x10 ⁸		63.2
В	10 ¹⁰		19.9
С	10 ¹¹		15.9
Q7. From where did you get information regarding the protocols to be followed while performing dental procedures?			
А	National guidelines - Ministry of Health and Family Welfare, IDA.	120	59.7
В	International guidelines – WHO, ADA, UN Guidelines, BDA Guidelines	159	79.1
С	Others	3	1.5
Q8. Are you aware of the COCHRANE RAPID REVIEW guidelines for restarting dental procedures in the Covid era?			
А	Yes	138	68.7
В	No	65	32.3

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TAB	LE 4: QUESTIONS	n	%
Q9.]	If yes, how have you modified your dental clinic for COVID-19?		
А	Teleconsult and Emergency Procedures	120	59.7
В	Have made segregations for sterilization room, changing room, consultation area, working area and kept clinic well ventilated.	142	70.6
С	The consultation area and working area are in the same room	16	8
D	No, I haven't made any modification	15	7.5
Е	Others	32	15.9
Q10. How have you modified your dental procedures?			
А	Use of atraumatic restorative technique for restoring cavities	128	63.7
В	continue to use rotary instruments but generate minimum aerosols	91	45.3
С	Others	49	24.4
Q11. Which of the following non- aerosol generating emergency procedures are being implemented by you?			

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153 76.1 А Localized abscess drainage 103 В Dry socket 51.2 35.8 Operculectomy С 72 Prosthesis causing irritation to soft tissues 109 54.2 D Е 92 45.8 Incipient occlusal caries

TAB	LE 5: QUESTIONS	n	%
Q12. Which preprocedural mouthrinse do you give the patient before starting dental			
proce			
A	Pre-procedural mouthrinse containing chlorhexidine.	118	58.7
В	Pre procedural mouth rinse containing 0.2% povidone-iodine.	75	37.3
С	Pre procedural mouthrinse containing 1% hydrogen peroxide	21	10.4
D	No preprocedural mouthrinse to the patient.	18	9
Q13. What are the professional measures taken by you to reduce aerosol generation against COVID-19?			
А	Use of rubber dam for isolation	115	57.2
В	Aerosol protection box	16	32.8
С	Routinely disinfect surfaces which come in contact with the patient	159	79.1
D	Use of entire PPE kit while examining patient's oral cavity	169	84.1
Е	Wear N-95 mask at all times	166	82.6
F	Use of gloves at all times	155	77.1
G	Use of only goggles	46	22.9
Н	Use of only face shield	65	32.3
Ι	Others	16	8
Q14.	Types of respirators you are aware of?		1
А	N-95	82	40.8
В	Mouthmask respirator	55	27.4
С	HEPA Filter respirator	40	19.9
D	Full face respirator	40	19.9
Е	All of the above	122	60.7
Q15. Do you feel that Aerosol Generation has a translational impact on Public Health?			
А	Yes	197	98
В	No	4	2

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