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# Knowledge of COVID-19 and its implications in dental treatment, and practices of personal protective equipment among dentists: A survey-based assessment

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## Abstract:

**BACKGROUND:** Oral health-care providers are always at a risk of transmitting or acquiring airborne, saliva-borne, or blood-borne infections due to their proximity to the patient's mouth, contact with saliva, and handling of sharp instruments. The aim of this study was to evaluate the knowledge of the dentists regarding COVID-19, methods to prevent its transmission, and implications of COVID-19 in dental treatment.

**MATERIALS AND METHODS:** It was a cross-sectional online survey. There were 35 questions in total, divided into sections of knowledge of COVID-19, practices of personal protective equipment (PPE), and knowledge of implications of COVID-19 in dental treatment. Both convenience sampling and snowball sampling were used, so that maximal participation could be ensured. The results were analyzed using descriptive statistics and making comparisons among various groups. The data were summarized as proportions and percentages (%). All the associations were tested using the Chi-square test, ANOVA, and Pearson's correlation coefficient. Statistical analyses were performed using SPSS version 19.0.

**RESULTS:** 26.8% of respondents had a high knowledge, 61.5% had good knowledge, 10.1% had low knowledge, and 6 (1.5%) had nil knowledge about COVID-19. No significant association was found between qualification and knowledge level among the respondents ( $P = 0.053$ ). Both graduates and postgraduates had low knowledge regarding effective PPE components ( $P = 0.053$ ), donning ( $P = 0.888$ ), and doffing ( $P = 0.745$ ). Only 52.9% of postgraduates and 43.7% graduates answered correctly about the sequence of donning, and 47.9% of postgraduates and 46.1% of graduates had knowledge regarding correct doffing sequence of PPE. Furthermore, knowledge was low regarding the implications of COVID-19 in dental treatment.

**CONCLUSION:** Although the dentists were found to have high/good knowledge scores regarding COVID-19, there was a lack of knowledge regarding hand hygiene, proper use of PPE, and implications of COVID-19 in dental treatment. Thus, they need to be trained and sensitized regarding the same.

## Keywords:

Aerosol, COVID-19, dentists, personal protective equipment

## Introduction

Oral health-care providers are always at a risk of transmitting or acquiring airborne, saliva-borne, or blood-borne

infections due to their proximity to the patient's mouth, contact with saliva, and handling of sharp instruments.<sup>[1]</sup> Many respiratory diseases such as Legionnaires' disease and tuberculosis, and blood or

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saliva-borne infections such as hepatitis B or HIV are already known to be possibly transmitted during a dental procedure.<sup>[2]</sup>

The current COVID-19 outbreak has once again drawn the attention of the world toward this problem. The causative agent, severe acute respiratory syndrome (SARS)-CoV-2, is an enveloped, positive-sense, single-stranded RNA virus belonging to the family of coronaviruses, of the order, Nidovirales.<sup>[3]</sup> It is highly contagious, and the main route of transmission is through droplet inhalation from an infected person (direct contact) or coming in contact with a contaminated surface and subsequent contact with oral, nasal, or eye mucosa (indirect contact).<sup>[4]</sup>

The nature of most of the dental procedures is such that it generates a lot of aerosol and splatter and increases the risk furthermore. Not only the dentists and their auxiliary staff but also their patients are regularly exposed to the contaminated bioaerosols present in the dental clinics.<sup>[5]</sup> Unlike infected droplets from sneeze or cough, which settle down after some time, the aerosols being very small (<50  $\mu$ ) remain suspended for a long time, thus enhancing the risk of inhalation.<sup>[1,6]</sup> Moreover, dentist's proximity to the patient's oropharyngeal region makes even the breath from an infected person a cause to worry.<sup>[7]</sup>

Personal protective equipment (PPE) plays a significant role in not only protecting the health-care providers but also in preventing cross-infection, especially during the outbreaks of highly infectious contagious diseases.<sup>[8]</sup> Nonetheless, knowledge of use of proper PPE and the right way of donning and doffing is a significant challenge. Any mistake in this regard can be dangerous.<sup>[9]</sup> Thus, a thorough knowledge about PPE use and its correct translation into practice are of paramount importance to ensure the safety of health-care workers.

To combat the present situation and to be prepared for any such situation in the future is a big challenge for the dental community. For this, they should have knowledge about the nature of the disease, and what changes this disease demands in the existing treatment practices. Thus, the present study was undertaken to evaluate the knowledge of the dentists regarding COVID-19, the use of PPE, and its implications in dental care.

## Materials and Methods

The main instrument for collecting data was an online questionnaire using Google Forms <https://docs.google.com/forms/d/1LSfNzmvka6aO9HQs1IUgp9ZaaNTA5i59zG7yUT5kUVk/edit>. The study population consisted of dental graduates and postgraduates of India. The first section of the form was a declaration, stating that participation in this survey was

voluntary, data will be used for this research only, and results will be kept confidential. The study was designed to keep the anonymity of the responders in mind, and no identification markers such as name or e-mail address were required. The study duration was 15 days (between 5th April 2020 to 20th April 2020). Both convenience sampling (researchers themselves contacted dentists to participate in the study) and snowball sampling (the participating dentists were asked to forward the questionnaire to their colleagues) were used, so that maximal participation could be ensured. The survey participants were selected conveniently based on contact list (e-mail, phone, and Facebook) of the investigators. The survey was shared among participants via e-mail and various social media platforms such as Facebook and WhatsApp. Responses from those who had completed at least a bachelor's degree were included, and the rest were excluded.

There were a total of 35 questions. Knowledge of COVID-19 section consisted of 16 questions on knowledge about etiopathogenesis and epidemiology of COVID-19; practices section consisted of 11 questions on the practice of personal protection equipment and hand hygiene; and knowledge of implications in dental treatment section consisted of 8 questions. A pilot study of questionnaire was conducted among 25 dentists to validate the survey, and the questions, which were incomprehensible or ambiguous, were removed from the final survey. Items were evaluated for the internal reliability using Cronbach's alpha. Cronbach's alpha coefficient was 0.643, indicating the internal reliability.

The results were analyzed using descriptive statistics and making comparisons among various groups. Data was summarized as proportions and percentages (%). All the associations were tested using the Chi-square test. Statistical analyses were performed using SPSS version 19.0 (SPSS Inc., Chicago, IL, USA).  $P < 0.05$  was considered statistically significant.

## Results

A total of 413 responses were collected. Forms that were incomplete, duplicate, or filled by someone other than a dental graduate were excluded. Finally, a total of 403 forms were assessed.

### Demographics

Out of the total 403 respondents, 284 (70.5%) were graduates, while 119 (29.5%) were postgraduates. Of these, 93 (23%) respondents were in a government job, and 249 (61%) were in private practice. The scores were categorized as high knowledge (score >75%), good knowledge (score between 50% and 74.9%), and low (score < 50%). Two hundred and forty-eight (61.5%)

respondents had good knowledge, while only 108 (26.8%) had a high knowledge level. Forty-one (10.1%) respondents had low knowledge and 6 (1.5%) respondents had nil knowledge about COVID-19. Although it seems that the respondents with higher qualifications were in more proportion among higher overall knowledge of COVID-19, no significant association was found between qualification and knowledge level among the respondents ( $P = 0.053$ ). 34.5% of postgraduate respondents scored a high score, while only 23.6% of graduate respondents achieved this. 69 (58.0%) of postgraduate respondents and 179 (63.0%) graduate respondents showed good knowledge score. 11.3% of graduate respondents and 7.6% of postgraduate respondents scored <50%, and 2.1% of graduate respondents scored nil [Table 1].

### Knowledge about COVID-19

In the study, a high knowledge score (>90%) was observed for the items such as ‘When/where COVID-19 originated’, ‘What is COVID 19?’ ‘SARS-CoV-2, and modes of transmission’; while the items ‘ICMR advises testing for COVID-19 for,’ and ‘which pre-procedural mouthwash to be used’ were poorly answered (approximately 16% answered correctly). Figure 1 shows the distribution of correct and incorrect answers to all questions. There was no significant difference between graduate and postgraduate respondents regarding knowledge of COVID-19, except the question about how many strains of coronavirus are there, where postgraduate respondents scored correctly significantly more than graduate respondents ( $P = 0.032$ ) [Table 2].

### Practices of PPE and hand hygiene

Both graduates and postgraduates had low knowledge regarding effective PPE components ( $P = 0.053$ ),

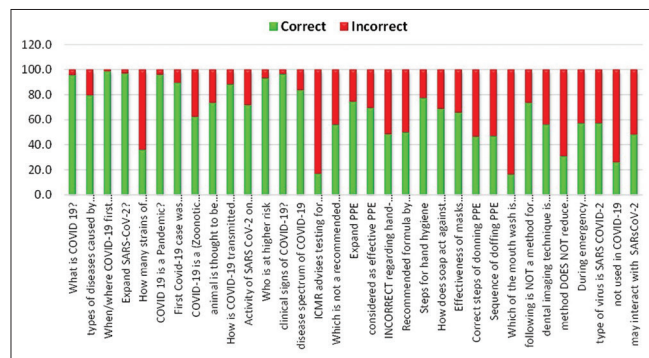


Figure 1: Percentage of correct/incorrect responses for various questions

Table 1: Association of academic qualification with overall knowledge level about COVID-19

Qualification	Percentage score categories				$\chi^2$	P
	75%- 99.9% (high), n (%)	50%- 74.9% (good), n (%)	<50% (low), n (%)	Nil score, n (%)		
Postgraduates	41 (34.5)	69 (58.0)	9 (7.6)	0	7.68	0.053
Graduates	67 (23.6)	179 (63.0)	32 (11.3)	6 (2.1)		
Total	108 (26.8)	248 (61.5)	41 (10.2)	6 (1.5)		

donning ( $P = 0.888$ ), and doffing ( $P = 0.745$ ). Only 52.9% of postgraduates and 43.7% of graduates answered correctly about sequence of donning, and 47.9% postgraduates and 46.1% of graduates had knowledge regarding correct doffing sequence of PPE. Postgraduate respondents scored better for how soap acts on SARS-CoV-2 ( $P < 0.001$ ) and steps for hand hygiene (0.028) [Table 3].

Majority (64.8%) of the respondents agreed that masks should be worn every time we go out, but only 33% agreed that gloves should be worn when we step out of the home.

### Knowledge about implications in dental care

Postgraduate respondents performed better regarding the implications of COVID-19 in dental health care. Specifically, they scored significantly better for what mouthwash should be used as a preprocedural rinse ( $P < 0.001$ ), though only 25.2% of postgraduates and 12.3% of graduates could tell that 1% hydrogen peroxide is an agent of choice for this situation. Postgraduate respondents scored better than graduates regarding dental imaging technique recommended ( $P < 0.001$ ), what method should be used for endodontic emergency ( $P < 0.001$ ), and methods for reducing aerosol ( $P < 0.001$ ) [Table 4].

### Correlation between knowledge of COVID-19, practices of personal protective equipment and hand hygiene, and implications of COVID-19 in dental treatment

The correlations between knowledge and practices, knowledge and dental implications, and practice and dental implications were positive and highly significant ( $P < 0.001$ ) with maximum between dental implications and practice ( $r = 0.455$ ) and minimum between dental implications and knowledge ( $r = 0.338$ ) [Table 5].

### Discussion

The 21<sup>st</sup> century has witnessed many fatal viral outbreaks such as SARS in 2002–2004, Middle East respiratory syndrome in 2009 (MERS), and presently the COVID-19, which has now taken the form of a pandemic.<sup>[10-13]</sup> As compared to other professionals, COVID-19 is more hazardous to the dental surgeons, as oral health-care providers require to be in a very close proximity to patient’s breathing space during dental treatment. The

**Table 2: Difference between knowledge of COVID-19 among graduates and postgraduates respondents**

Type	Questionnaire item	PG (n=119), n (%)	UG (n=284), n (%)	$\chi^2$	P
Knowledge	What is COVID-19?	117 (98.3)	267 (94.0)	3.46	0.063
	Types of diseases caused by coronavirus?	92 (77.3)	227 (79.9)	0.35	0.555
	When/where COVID-19 reported first time?	119 (100.0)	278 (97.9)	2.55	0.110
	Expand SARS-CoV-2?	116 (97.5)	274 (96.5)	0.27	0.604
	How many strains of coronavirus?	52 (43.7)	92 (32.4)	4.67	0.031
	COVID 19 is a pandemic?	116 (97.5)	270 (95.1)	1.20	0.273
	First COVID-19 case was registered in India	108 (90.8)	251 (88.4)	0.49	0.485
	COVID-19 is a (zoonotic disease?)	70 (58.8)	181 (63.7)	0.86	0.354
	Animal is thought to be associated with COVID-19?	91 (76.5)	205 (72.2)	0.79	0.374
	How is COVID-19 transmitted from human to human?	106 (89.1)	248 (87.3)	0.24	0.624
	Activity of SARS-CoV-2 on different mediums	84 (70.6)	204 (71.8)	0.06	0.801
	Who is at higher risk	111 (93.3)	263 (92.6)	0.06	0.812
	Clinical signs of COVID-19?	114 (95.8)	273 (96.1)	0.02	0.878
	Disease spectrum of COVID-19	101 (84.9)	235 (82.7)	0.27	0.874
	ICMR advises testing for COVID-19 for Which is not a recommended Specimen	22 (18.5) 73 (61.3)	45 (15.8) 151 (53.2)	0.42 2.27	0.516 0.132

**Table 3: Difference in practices of graduates and postgraduates respondents**

Type	Question	PG, n (%)	UG, n (%)	$\chi^2$	P
Practice	Expand PPE	90 (75.6)	209 (73.6)	0.18	0.670
	Considered as effective PPE	80 (67.2)	199 (70.1)	0.32	0.573
	Incorrect regarding hand hygiene?	63 (52.9)	132 (46.5)	1.40	0.236
	Recommended formula by the WHO for hand hygiene	44 (37.0)	156 (54.9)	10.81	0.001
	Steps for hand hygiene	100 (84.0)	210 (73.9)	4.81	0.028
	How does soap act against SARS-CoV-2	96 (80.7)	180 (63.4)	11.62	0.001
	Effectiveness of masks against viruses from least to highest protective	85 (71.4)	179 (63.0)	2.62	0.106
	Correct steps of donning PPE	63 (52.9)	124 (43.7)	2.90	0.088
	Sequence of doffing PPE	57 (47.9)	131 (46.1)	0.11	0.745

PPE=Personal protective equipment, PG=Postgraduate, UG=Undergraduate

**Table 4: Difference in knowledge regarding implications of COVID-19 in health care**

Type	Question	PG, n (%)	UG, n (%)	$\chi^2$	P
Health care	Which of the mouth wash is most effective	30 (25.2)	35 (12.3)	10.29	0.001
	Following is not a method for reducing aerosols	93 (78.2)	203 (71.5)	1.92	0.166
	Dental imaging technique is recommended during COVID-19 outbreak	92 (77.3)	133 (46.8)	31.59	<0.001
	Which method does not reduce cross infection	59 (49.6)	64 (22.5)	28.93	<0.001
	During emergency endodontic procedure, preferably used	101 (84.9)	128 (45.1)	54.15	<0.001
	Type of SARS virus causing COVID-19	62 (52.1)	167 (58.8)	1.54	0.215
	Drug not used in COVID-19	28 (23.5)	76 (26.8)	0.46	0.499
	May interact with SARS-CoV-2	59 (49.6)	134 (47.2)	0.19	0.660

PG=Postgraduate, UG=Undergraduate

**Table 5: Correlation between knowledge and practices**

Correlations	Knowledge score		Practice score	
	Pearson correlation	P	Pearson correlation	P
Practice score	0.450	<0.001	-	-
Dental implications score	0.338	<0.001	0.455	<0.001

preparedness of the oral health-care providers for any such outbreak will largely depend on their knowledge of the etiology, routes of transmission, and ways to prevent transmission of the disease.

The results of the present study showed that majority of the respondents (61.5%) had a good knowledge, while

only 26.8% had high knowledge. If section-wise results were seen, both graduates and postgraduates scored comparably well regarding knowledge of COVID-19, its epidemiology, etiology, and routes of transmission, but regarding specific implication in dental care, postgraduate respondents scored better. The reason for this may be that there is a plethora of general information

regarding COVID-19 on media (both print and electronic), social-media, and internet, and knowledge is also gained by discussions among peers, family, and friends. Thus, all of the respondents scored well, but specific technical questions need specific knowledge to answer them correctly.

Proper use of PPE is an integral part of infection control and prevention of cross-infection. While the consistent and correct use of PPE and its doffing ensures disease transmission in health-care settings, any error may lead to contact with a pathogen. In situations of high-consequence infectious diseases, there is a definite need for PPE training and adherence to doffing protocols, rather than just a rely on PPE to keep us safe.<sup>[14]</sup> In the present study, the difference in knowledge between graduates and postgraduates regarding effective PPE components, donning, and doffing of PPE was not significant, and both scored low. Phan *et al.*<sup>[15]</sup> conducted a study where they evaluated the use of proper PPE and doffing methods among health-care workers. They concluded that 90% of observed doffing was incorrect, with respect to the doffing sequence, doffing technique, or use of appropriate PPE. Common errors were doffing gown from the front, removing the face shield or the mask, and touching potentially contaminated surfaces and PPE during doffing.

Removal of PPE is a time-taking and complicated procedure, with studies showing that there are high rates of doffing errors even with essential PPE, and that gap exists between knowledge and correct technique of doffing PPE. The less<sup>[16,17]</sup> than acceptable knowledge in the present study also suggests that more training and simulation exercises could help fill the gap between desired performance and actual practice. Interactive learning methods, including active learner involvement using simulations that include feedback on performance, have proven to be superior to traditional learning methods such as watching educational videos, attending webinars, or learning PPE guidelines. Simulation training familiarizes health-care workers to actual clinical situations, thus making them more confident and correct in their approach.<sup>[18]</sup> In recent years, the use of ultraviolet fluorescence markers has proven to be a successful method of assessing compliance with hand hygiene and contamination of the environment and equipment.<sup>[19,20]</sup> Most of the studies conducted have evaluated the knowledge and practices of health-care workers such as doctors, nurses, and medical students. Still, studies evaluating the PPE practices of oral health-care providers are lacking. Hence, more research is needed to assess dental students, clinicians, and assisting staff to evaluate their knowledge and conduct the required training sessions accordingly.

Similarly, lack of knowledge among both graduate and postgraduate respondents could be seen regarding hand

hygiene practices. It is a well-known fact that failure to comply with hand hygiene is a significant cause of hospital-acquired infections. At present, the World Health Organization's recommendations, defining 5 crucial moments of hand hygiene and 6 practical hand rubbing steps, have been adopted universally.<sup>[21]</sup> It was seen that 15% of total respondents missed the fact that cleaning the wrists is also included in hand hygiene protocol. SARS-CoV-2 virus is known to spread by touching surfaces contaminated with sneeze droplets, saliva, or body fluids of a COVID-19-positive patient and also can be inanimate surfaces for up to 9 days.<sup>[22]</sup> During dental treatment, a dentist or auxiliary staff is at the risk of touching many surfaces on which aerosol or droplets may have settled, for example, dental chair handles, dental chair unit light handle, surgical trolleys, instrument trays, disinfectant containing bottles, dental instruments (handpieces, scalars, hand instruments, and rotary instruments), and other equipment in the vicinity of the dental procedure area. Thus, rigorous, repeated, rightly-done hand hygiene protocol is very critical to prevent self and cross-infection.

Regarding its specific implications to dental treatment protocols, a quite low score was seen regarding the appropriate mouthwash to be used as a preprocedural rinse in view of the present outbreak. Majority (61.2%) of the respondents marked 0.12% chlorhexidine as the answer, as it is the most popularly used mouthwash for all routine procedures. As proven in earlier SARS and MERS outbreaks, and because the human coronavirus is vulnerable to oxidation, hydrogen peroxide solution and 0.02% povidone iodine are believed to be potentially effective against SARS-CoV-2 too.<sup>[4]</sup> Preprocedural rinsing is an effective, though often ignored method to reduce the microbial load of the aerosols.<sup>[23]</sup> The aerosols generated during dental procedures contain not only common oral bacteria (such as *Streptococcus* species, *Actinomyces* species, and *Fusobacterium nucleatum*), but also certain pathogenic bacteria (such as *Mycobacterium tuberculosis*, *Legionella pneumophila*, and *Staphylococcus* species) and viruses (HIV, hepatitis B virus, hepatitis C virus, herpes simplex virus, influenza virus, and rhinovirus), among other infectious agents.<sup>[24]</sup> These microorganisms can remain suspended in aerosols and retain infectivity for long periods and pose a risk to be inhaled or transmitted via direct contact with conjunctiva, nasal, or oral mucosa of the dentists and their staff.

Furthermore, it was seen that graduate respondents were less knowledgeable than postgraduates regarding preferable imaging techniques and preferred treatments during COVID-19 outbreak. The American Dental Association (ADA), in its guidelines, has advised on the use of extraoral imaging techniques such

as orthopantomogram or cone-beam computed tomography in the current situation as there are more chances of coughing and coming in contact with saliva during the intraoral imaging.<sup>[4,25]</sup> Furthermore, the ADA suggests avoiding the use of high-speed rotary cutting handpieces and take up chemomechanical methods of caries excavation to reduce aerosol. Peng *et al.*,<sup>[22]</sup> opined that the use of dental handpieces without antiretraction function should be prohibited during the epidemic period of COVID-19 as the antiretraction high-speed dental handpiece can significantly reduce the backflow of oral bacteria and HBV into the tubes of the handpiece and dental unit, thus reducing the chances of cross-infection.

### Limitations

The present study was an attempt to assess knowledge of only a select population of dentists. Larger sample size with a wider geographical distribution would be more useful to come to a definite conclusion about the knowledge and practices of the dentists regarding COVID-19. Although the survey was kept without any identification markers and respondents were assured of confidentiality of the results, and most of the questions were not related to one's behavior, still social desirability bias is a limitation of survey studies. Furthermore, another limitation of a survey study is that it solely depends on the respondent's compliance with answering the questions honestly.

### Conclusion

Not only adequate knowledge regarding a disease but also translation of knowledge into practice is crucial to combat COVID-19. The present survey found that there were lacunae in knowledge regarding hand hygiene, proper use of PPE, and implications of COVID-19 in dental treatment. There is a need for interactive, hands-on, and active learning-based training sessions to bring knowledge into practice and habit.

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### Conflicts of interest

There are no conflicts of interest.

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