

Original Article

Knowledge, attitudes, and practices of dentists after the COVID-19 pandemic: A cross-sectional study

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ABSTRACT

Background: Dentists are at an increased risk of encountering cross-infections because of working in close proximity with oral mucosa and saliva making use of high-speed rotary instruments during treatment generating large amount of aerosols and splatter which in turn increases the probability of nosocomial spread of infections. The present study aimed to evaluate the knowledge, attitudes, and practices of dentists after the COVID-19 pandemic.

Materials and Methods: The present cross-sectional study was conducted using Google Forms wherein a well-structured questionnaire composed of a total of 25 closed-ended questions was distributed among practicing dentists through online mode. Step-wise linear regression analysis was done to determine the influence of independent variables on the knowledge, attitude, and practice scores of the participants. $P < 0.05$ was considered statistically significant.

Results: On analyzing the results, multiple linear regression analysis revealed no significant difference in the knowledge scores among the participants, while good attitude and practice scores were significantly associated with higher qualification of the participants. Another noteworthy finding in the study was the significant correlation observed between the various components of the knowledge, attitude, and practice scores among the participants ($P < 0.05$).

Conclusion: It could be concluded from the findings of the present survey that dentists were found to have good knowledge scores about the COVID-19 pandemic. They should, however, pay more emphasis on practicing tele-triaging and proper screening and should follow various guidelines and advisories issued from time to time by the competent authorities.

Key Words: Attitudes, COVID-19, infection control, knowledge, practices, universal precautions

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INTRODUCTION

The COVID-19 pandemic is the defining global health crisis and is the greatest challenge ever faced since World War II. The infection with a high mortality rate is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).^[1] The virus is mainly transmitted by humans to humans through respiratory droplets, direct physical contact, and contact with fomites. With this, the probability of air-borne transmission of the virus to the dentists and from them to others is certainly high during aerosol-generating treatment procedures.^[2] Considering the vital role of the body's immune system, elderly patients, infants <1 year and patients with chronic debilitating diseases, all possess a higher risk of getting infected.^[3] Dentists are at an increased risk of encountering cross-infections because of working in close proximity with oral mucosa and saliva making use of high-speed rotary instruments during treatment generating large amount of aerosols and splatter of saliva which in turn increases the probability of nosocomial spread of infections.^[4] Emerging from Wuhan, China, the infection spread rapidly all over the world and this outbreak was soon declared a Public Health Emergency of International Concern by the World Health Organization (WHO).^[5] Later, due to continual escalation in the numbers of the affected countries, cases, and casualties, the WHO declared COVID-19 as a global pandemic.^[6] Although the mortality associated with COVID-19 infection has been reported to be low off-late, it has high infectivity and spreading potential.^[7] Owing to the fact that the COVID-19 pandemic is fast and catastrophic, many countries had to implement lockdown worldwide in an attempt to control the spread of the infection. Following the universal norms, societal and governmental advisories issued by competent authorities from time to time during the active phase, most of the dental practitioners and hospitals had closed operations across the world, while only emergency and urgent treatment procedures were advised to be attended to. Meanwhile, the WHO, the Centers for Disease Control and Prevention (CDC), and various governmental and nongovernmental authorities had issued several clinical guidelines to ensure safer clinical practices and to raise awareness and preparedness of practicing dentists regarding the prevention and control of infection in the COVID-19 pandemic.^[8,9] Furthermore, despite the availability of these guidelines, majority of the dentists were reluctant

and fearful of treating patients in such situations due to which the extent to which this knowledge was put into practice and such practices actually reduced COVID-19 cross-infections was certainly unclear.^[10] Understanding the knowledge, attitudes, and practices of the practicing dentists, thus, becomes the need of the hour to fill this gap of knowledge during this catastrophic pandemic. This will enable us to find possible risk factors, predict outcomes of planned behavior, and also, aid in providing recommendations for future pandemic situations. The present study was planned with a similar intent and with an aim to evaluate the knowledge, attitudes, and practices of dentists after the COVID-19 pandemic and to provide recommendations for the preparedness of dentists to combat such pandemics in future.

MATERIALS AND METHODS

The present cross-sectional study was conducted using Google Forms to create online forms and survey. Dentists practicing all across the world participated in this survey. The study was conducted for 6 months from June 1, 2022 to November 30, 2022. An informed consent was obtained from all the participants before the start of the study, while ethical clearance was obtained from the Institutional Ethics Committee through Institutional Ethics Committee Letter approval no. SDDC/IEC/01-41-2022 before the start of the study. Moreover, participation in the survey was kept voluntary, while subjects who expressed any kind of unwillingness to participate were excluded from the study. A well-structured questionnaire composed of a total of 25 closed-ended questions was formulated and validated through intra-class correlation with a strong correlation of 0.74. The online survey link was circulated through social media and E-mail among all the known contacts of practicing dentists from various parts of the world, while a total of 1200 dentists were contacted for this, out of which 861 submissions were recorded with a response rate of 71.7%. The questionnaire comprised of questions assessing the demographic profile, and the knowledge, attitudes, and practices of practicing dentists in the COVID-19 pandemic. Demographic details included four questions on gender, qualification, experience, and work sector of the participants. Furthermore, knowledge and attitudes sections comprised 5 questions each, while the practices section comprised 10 questions, with one question wherein information about the source of information about the COVID-19

pandemic was asked. The present study was done on dentists practicing all across the world and who could be reached through social media and through the online mode. Attributing to incomplete responses or, no response to the questionnaire, the number of participants was kept on a little higher side to avoid a lack of required numbers of the participants for validation of the results. Independent variables for the present study included gender, qualification, experience, and work sector of the participants, while the dependent variables included the knowledge, attitude, and practice scores of the subjects.

Statistical analysis used

Data collected were entered into spread sheets and analyzed using Statistical Package for Social Sciences (SPSS) version 21.0 (IBM, Chicago, IL, USA). Descriptive analysis was presented in the form of mean and standard deviation. Step-wise linear regression analysis was done to determine the influence of independent variables such as gender, qualification, experience, and work sector on the dependent variables including the knowledge, attitude, and practice scores of the participants. Pearson's correlation analysis was done to assess the correlation between the knowledge, attitude, and practice scores among the subjects. $P < 0.05$ was considered statistically significant. The formula used to calculate sample size was:

Single proportion – Absolute precision

Expected Proportion = 0.725 (72.50% of knowledge)

Precision (%) = 3

Desired confidence level (%) = 95

Sample size (n) = 851

Formula used:

$$n = \frac{Z^2 pq}{d^2}$$

Where, Z = Standard normal variate value ($Z = 1.96$ at 5% alpha error)

d = Margin of error = 3%

$P = 72.50\%$, $q = 100 - 72.50 = 27.50\%$

RESULTS

A total of 1200 dentists were contacted, out of which 861 submissions were recorded with a response rate of 71.7%. Out of these 861 dentists, 537 male and 324 female participants responded with the filled

questionnaire. By academic qualification, maximum numbers of the participants were found to have postgraduate qualification (81.8%). Furthermore, majority of the participants had <5 years of work-related experience (46.1%), while 36.8% of the participants had 5–10 years of experience, and 17.1% of the participants had more than 10 years of work experience in the present survey. Among these, 66.1% of the participants had their own practices, while 33.9% of the participants were in government jobs. The findings of the present study, also, suggested that Internet (50.8%) was the primary source of information regarding the COVID-19 pandemic followed by the social media sites (31.0%) [Table 1]. On further analysis of the results, the present study suggested that most of the dentists (82.1%) were aware of the possible modes of transmission of SARS-CoV-2, while only two-thirds of the dentists were fully updated with the current guidelines and advisories issued by various agencies on infection control protocols (71.7%). Likewise, only 75.5% of the dentists were fully aware of the possible signs and symptoms of COVID-19 infection, while an equal number of dentists (74.2%) were aware of the high-risk category of patients in the pretext of the COVID-19 outbreak. To add to the concerns was the finding that 17.8% of the dentists were not fully aware of the methods of proper donning and doffing of personal protective equipment (PPE) with 15.9% of the dentists having no idea about the same [Table 2].

Table 1: Demographic profile of participants (n=861)

| Variable | n (%) |
|---|------------|
| Qualification | |
| Undergraduate | 157 (18.2) |
| Postgraduate | 704 (81.8) |
| Gender | |
| Male | 537 (62.4) |
| Female | 324 (37.6) |
| Work sector | |
| Government | 292 (33.9) |
| Private | 569 (66.1) |
| Work experience (years) | |
| <5 | 397 (46.1) |
| 5–10 | 317 (36.8) |
| >10 | 147 (17.1) |
| Source of information regarding COVID-19 pandemic | |
| Internet | 437 (50.8) |
| Social media | 267 (31.0) |
| Television | 115 (13.4) |
| Newspapers | 42 (4.9) |

Table 2: Knowledge, attitudes, and practices of participants in wake of COVID-19 pandemic (n=861)

| Variable | Option | n (%) |
|--|-----------------|------------|
| Knowledge | | |
| Are you aware of the possible modes of transmission of SARS-CoV-2? | Yes | 707 (82.1) |
| | No | 4 (0.5) |
| | Not fully aware | 150 (17.4) |
| Are you aware of the signs and symptoms of COVID-19 infection? | Yes | 650 (75.5) |
| | No | 35 (4.1) |
| | Not fully aware | 176 (20.4) |
| Are you aware of the high-risk category of patients in the pretext of COVID-19 outbreak? | Yes | 639 (74.2) |
| | No | 22 (2.6) |
| | Not fully aware | 200 (23.2) |
| Are you updated with the current guidelines on infection control protocol? | Yes | 617 (71.7) |
| | No | 28 (3.3) |
| | Not fully aware | 216 (25.1) |
| Are you aware of proper donning and doffing of the PPE? | Yes | 571 (66.3) |
| | No | 137 (15.9) |
| | Not fully aware | 153 (17.8) |
| Attitudes | | |
| Do you think that dentists can play role in spreading awareness regarding COVID-19 outbreak? | Yes | 764 (88.7) |
| | No | 11 (1.3) |
| | May be | 86 (10.0) |
| Do you think that physical distancing and masks are important for the patients sitting in the waiting area? | Yes | 740 (85.9) |
| | No | 6 (0.7) |
| | May be | 115 (13.4) |
| Do you think that PPE is effective in preventing COVID-19 infection? | Yes | 681 (79.1) |
| | No | 143 (16.6) |
| | May be | 37 (4.3) |
| Are you afraid of performing aerosol generating treatment procedures? | Yes | 641 (74.4) |
| | No | 174 (20.2) |
| | Sometimes | 46 (5.3) |
| Are you following Ayush Guidelines for boosting your immunity? | Yes | 546 (63.4) |
| | No | 186 (21.6) |
| | Sometimes | 129 (15.0) |
| Practices | | |
| Are you practicing tele-triaging? | Yes | 348 (40.4) |
| | No | 456 (53.0) |
| | Sometimes | 57 (6.6) |
| Are you recording travel history of each patient? | Yes | 732 (85.0) |
| | No | 44 (5.1) |
| | Sometimes | 85 (9.9) |
| Are you recording body temperature for all patients? | Yes | 525 (61.0) |
| | No | 329 (38.2) |
| | Sometimes | 7 (0.8) |
| Are you taking informed consent from all patients regarding the possible risk of contracting COVID-19 infection during hospital visit? | Yes | 709 (82.3) |
| | No | 124 (14.4) |
| | Sometimes | 28 (3.3) |
| Do you ensure hand washing/sanitization of patients visiting the hospital? | Yes | 818 (95.0) |
| | No | 9 (1.0) |
| | Sometimes | 34 (3.9) |
| Are you maintaining appropriate physical distancing in your waiting area? | Yes | 732 (85.0) |
| | No | 44 (5.1) |
| | Sometimes | 85 (9.9) |
| Are you using PPE during operative procedures in all patients? | Yes | 734 (85.2) |
| | No | 127 (14.8) |

Contd...

Table 2: Contd...

| Variable | Option | n (%) |
|--|---|------------|
| Have you taken prophylactic medications to prevent COVID-19 infection? | Yes | 732 (85.0) |
| | No | 129 (15.0) |
| When do you disinfect your operating room? | 1-after each patient | 305 (35.4) |
| | 2-once every day after finishing all patients | 556 (64.6) |
| | Yes | 775 (90.0) |
| Do you take shower and follow guidelines for segregation of clothes after reaching home? | No | 9 (1.0) |
| | Sometimes | 77 (8.9) |

SARS-CoV-2: Severe acute respiratory syndrome coronavirus 2, PPE: Personal protective equipment

A positive finding of the present study, though, was that majority of the dentists (88.7%) accepted their role in spreading awareness regarding the COVID-19 outbreak, while 85.9% of the dentists agreed to the fact that physical distancing and mask are important for the patients sitting in the waiting area. Another significant finding of the present study was that a huge number of the dentists (79.1%) agreed that PPE is effective in preventing COVID-19 infection. To proceed further, around two-thirds of the dentists (74.4%) were afraid of performing aerosol-generating treatment procedures during the pandemic, while a majority of them (63.4%) were, also, found following Ayush Guidelines for boosting immunity [Table 2]. Mixed responses were recorded about practices regarding COVID-19 wherein, though, most of the dentists were found recording the travel history of the patients (85.0%) and were taking informed consent from all patients regarding the possible risk of contracting COVID-19 infection during hospital visit (82.3%), very few of them were practicing tele-triaging (40.4%), and only 61.0% of the dentists were recording body temperature for all the patients. Another notable finding of the present study was that majority of the dentists were following universal precautions including proper hand hygiene (95.0%), physical distancing (85.0%), and using PPE during operative treatment procedures (85.2%). To add to the surprise, 85.0% of the dentists agreed that they have taken prophylactic medications to prevent COVID-19 infection, though, only 35.4% of the dentists were disinfecting their operating room after each patient, while the majority (64.6%) agreed that they were disinfecting the operating room once every day after finishing all the patients [Table 2]. On analyzing the results further, multiple linear regression analysis revealed no significant difference in the knowledge

scores among the participants, while good attitude and practice scores were significantly associated with higher qualification of the participants [Table 3]. Furthermore, a significant correlation was observed between the various components of the knowledge, attitude, and practice scores among the participants ($P < 0.05$) using Pearson's correlation coefficient analysis [Table 3].

DISCUSSION

Dentists pose a high risk of getting infected due to proximity with the patient's oral cavity and also, due to prolonged exposure to aerosols due to time-consuming dental treatment procedures.^[11] In this context, precautionary measures including wearing gloves, protective clothing, goggles, and face mask are imperative in effectively dealing with the patients minimizing the risk of transmission of infections and cross-infections.^[12] Furthermore, the ongoing pandemic of COVID-19 made it necessary for the dentists to multiply their alarms corresponding to the critical situation they are in and to put efforts in following and implementing related infection control protocols and recommendations. The present survey provides an insight into the level of knowledge, attitudes, and practices of dentists on infection control with special emphasis on the recent COVID-19 outbreak. The findings of the present study suggested that the primary source of information regarding the COVID-19 outbreak was mainly the Internet (50.8%) followed by social media sites (31.0%), television (13.4%), and newspapers (4.9%) which is in agreement with the results obtained in the study conducted by Kamate *et al.*^[13] and Gupta *et al.*^[14] who reported that most of the knowledge gained by the dentists is through Internet to be closely followed only by social media during the recent COVID-19

Table 3: Association between demographic variables and knowledge, attitude and practice scores among participants and Pearson's correlation analysis between knowledge, attitude, and practice scores

| Variable | Predictor | Correlation | SE | t | P |
|-----------|-----------------|-------------|-------|--------|---------|
| Knowledge | Constant | 5.261 | 0.357 | 14.754 | 0.001** |
| | Work sector | 1.253 | 0.206 | 6.066 | 0.001** |
| Attitude | Constant | 6.441 | 0.371 | 17.356 | 0.001** |
| | Work experience | -0.459 | 0.093 | 4.958 | 0.001** |
| | Qualification | 0.499 | 0.177 | 2.812 | 0.005* |
| Practice | Constant | 6.271 | 0.283 | 22.171 | 0.001** |
| | Qualification | -0.442 | 0.115 | -3.859 | 0.001** |
| | Work experience | -0.236 | 0.060 | -3.927 | 0.001** |
| | Work sector | 0.273 | 0.094 | 2.911 | 0.004* |

* $P < 0.05$ - Statistically significant, ** $P < 0.001$ - Statistically highly significant. SE: Standard error

| Variables | r | P | Correlation |
|--------------------|-------|---------|-------------------------------|
| Knowledge×Attitude | 0.349 | 0.001** | Positive moderate correlation |
| Knowledge×Practice | 0.321 | 0.001** | Positive moderate correlation |
| Attitude×Practice | 0.298 | 0.001** | Positive weak correlation |

Correlation is significant at 0.01 level (two-tailed), ** $P < 0.001$ - Statistically highly significant

and Zika virus (ZIKV) pandemics. In contrast to the findings of these studies, Fatiregun *et al.*,^[15] however, reported television as the primary source of information (73.6%) among the senior health-care workers in Nigeria during the influenza A (H1N1) pandemic. Furthermore, majority of the dentists were well aware of the possible modes of transmission, and the prominent signs and symptoms of COVID-19 infection due to massive fear generated during the pandemic which increased curiosity and the need for containment of the infection. Similar observations were made in the studies conducted by Khader *et al.*,^[10] Srivastava *et al.*^[16] and Teja *et al.*^[17] A notable and alarming finding of the present study, though, was that only two-thirds of the dentists were fully updated with the current guidelines and advisories issued by various agencies on infection control protocols with the remaining dentists with a lacuna towards the same which could possibly be due to the psychological stress due to the outbreak or, their family members being contracted with COVID-19 infection. In addition, approximately 33.7% of the dentists had a lack of proper knowledge regarding the proper donning and doffing of PPE advised to be used during the conduct of dental treatment procedures. A positive finding, though, of the present study was that almost all dentists agreed that they could help spread awareness regarding the COVID-19 disease and that physical distancing and PPE were effective in preventing COVID-19 cross-infections. The results of the present study were in agreement with the findings of the study conducted by Kamate

et al.^[13] The threat of the pandemic made all dentists alert and as found in the current survey, most of the dentists were afraid of doing heavy aerosol-generating treatment procedures without proper safety protocols because such procedures posed a higher risk of cross-infections.^[18] Triaging is applied in disaster situations and emergency healthcare settings.^[19] Thus, in the current situation, it has been recommended by various advisories from competent authorities to follow tele-triaging in symptomatic patients to avoid unnecessary exposure along with the need to prioritize cases.^[16,20] Despite these recommendations, though, it was found in the present survey that very few dentists (40.4%) were actually practicing tele-triaging because in most parts of the world before the COVID-19 pandemic, patients had direct access to the dentists and now in the present situation since dentists as well as the patients were relatively new to this idea, were slowly adapting to the tele-way of communication. Recent travel history may place a patient in the high-risk category. In the present survey, it was found that 85% of the dentists were recording the travel history of all the patients reporting to them, especially, in symptomatic cases to avoid undue exposure. Similar results were obtained in the study conducted by Kamate *et al.*^[13] who found that 92.6% of the dentists recorded travel history as a screening protocol to aid in the diagnosis and prevention of disease transmission in their study. Furthermore, as per the CDC guidelines on infection control protocols, universal precautions are supposed to be followed at all times, irrespective of the pandemic

or, epidemic status. This becomes all the more significant in the current scenario when the dentists need to follow strict protocols to avoid infections in the wake of postpandemic period, especially, when the patients and the social norms have already outgrown the guidelines and recommendations laid during the COVID-19 pandemic period thinking that the pandemic is over. The use of PPE including the FFP3 masks which are proven to be the most effective, followed by FFP2/N95 masks, gloves, gowns, protective glasses, visors, and headgear caps is of utmost importance during any dental procedures generating heavy aerosols. In the present study, dentists demonstrated good practice management regarding hand washing, physical distancing, disinfection of operating room, and taking shower and clothes segregation after reaching home. On establishing the association between the educational qualification of the participants and the knowledge, attitude, and practice scores, it was observed that there was no significant difference in the knowledge scores among the under- and postgraduate dentists, while the dentists with higher qualifications (postgraduates) reported better and significant attitude and practice scores as compared to the undergraduate participants. This can be explained by the fact that during postgraduation, learning is basically in evidence and performance-based methodology which significantly improves the attitudes and quality of practice by the students. The above-mentioned findings were, though, in contradiction with the findings of the studies conducted by Kamate *et al.*^[13] during the COVID-19 pandemic and Gupta *et al.*^[14] during the ZIKV pandemic because in these studies, the authors had reported higher knowledge scores among the higher qualified dentists as well.

Limitations of the present study

Despite the findings introduced here, it is important to emphasize that the present survey did have certain limitations with one of them being the smaller sample size used in the study. Moreover, responses were recorded from varied data sources, while it could have been more focused with a multivariate analysis from the countries which were badly hit by the pandemic. Again, data were collected from participants who were active on social media sites and could access the facility during the shorter period of data collection which could have resulted in selection bias and sampling error preventing the generalizability of the results because the representation of subjects

who were not very well-versed with and those who were not very active on social media could not be included.

CONCLUSION

Adequate knowledge, a positive attitude, and evidence-based practice protocols are a must for surviving in pandemics. In the present study, dentists were found to have good knowledge, attitude, and practice scores which are important to combat COVID-19. Furthermore, it was observed that both the under- and postgraduate dentists carried identical knowledge scores, though, attitude and practice scores were more for postgraduate dentists. Based on the results obtained in the present study, therefore, the following recommendations could be made including the need for the practicing dentists to involve themselves more in spreading awareness regarding the COVID-19 pandemic through various platforms. In addition, dentists should incorporate tele-triaging in their practices. They should screen, isolate, and refer potential high-risk, and symptomatic COVID-19 cases to higher centers for appropriate care. Furthermore, dentists should be updated thoroughly with new information regarding the disease and should follow universal precautions and the various guidelines and advisories issued from time to time by competent authorities including the WHO, CDC, and various other authorities. This becomes all the more important so that we as a whole (dentists, community, and nation) survive and pass through this difficult phase of pandemic, as well as be ready to face any such pandemic or, epidemic in future without loss of human lives.

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Conflicts of interest

The authors of this manuscript declare that they have no conflicts of interest, real, or perceived, financial or non-financial in this article.

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