



A scoping review of knowledge, attitudes, and clinical practices of dental professionals during the COVID-19 pandemic

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Abstract

Background: COVID-19 is a respiratory disease identified in December 2019 in Wuhan, China, and it has become one of the century's most significant public health concerns. Dentists are among the most exposed medical professionals to the risk of COVID-19 infection, and they must modify their routine clinical attitudes and behaviors. This study sought to assess the current status of dental professionals' knowledge, attitudes, and practices, as well as their adherence to COVID-19 pandemic guidelines.

Methods: A scoping review protocol was developed by searching scientific papers in EBSCO, MEDLINE, CENTRAL, Google Scholar, Web of Science, and Scopus electronic databases using "COVID-19" and "Dentistry" as key search terms to find relevant papers published until March 13, 2021. Two authors reviewed the potentially relevant articles in full. All cross-sectional or cohort studies that evaluated the knowledge, attitudes, or practices of dentists through questionnaires were selected for the review.

Results: The search strategy led to the identification of a total of 405 articles which were subsequently assessed for eligibility. By application of inclusion and exclusion criteria, the obtained results were further reduced to 25 citations. The results were organized into the following categories: knowledge (transmission, signs and symptoms, incubation period, etc), attitudes (protective measurements, occupational risk of infection), and practices (protective measurements, personal protective equipment, current status of dental treatments, etc).

Conclusion: The research study came to the conclusion that the majority of dentists have sufficient knowledge of COVID-19 infection and comprehend the significance of performing only emergency procedures and delaying elective procedures. Moreover, most of them believed that more awareness programs on COVID-19 prevention are needed for both the dental fraternity and the public.

Keywords: COVID-19, Dentistry, Knowledge, Attitude

Citation: Mousavi M, Ghasemianpour M, Sadeghipour M, Nouri N. A scoping review of knowledge, attitudes, and clinical practices of dental professionals during the COVID-19 pandemic. *J Oral Health Oral Epidemiol.* 2023;12(2):48-58. doi:10.34172/johoe.2023.09

Received: July 6, 2021, **Accepted:** January 3, 2022, **ePublished:** July 24, 2023

Introduction

The COVID-19 outbreak was initially detected in Wuhan, China, and has since become a significant global public health concern, prompting the World Health Organization (WHO) to announce COVID-19 a pandemic on March 11, 2020.¹

The coronavirus SARS-CoV-2 causes an acute respiratory syndrome known as COVID-19.² Sars-CoV-2 has a two-week incubation period. COVID-19 manifestations in patients generally include fever, cough,

and dyspnea and also anosmia, ageusia, and in a few instances, diarrhea.³

Airborne and direct contact transmission, along with the fecal-oral route, are the primary modes of infection for SARS-CoV-2.⁴ The dispersion and duration of particle suspension in the atmosphere are influenced by factors such as particle size, settling velocity, relative humidity, and airflow. The nuclei of droplets with a diameter < 5 µm, create aerosols with a traveling capacity greater than 1 m.⁵ 2019-nCoV can live on surfaces from a few hours



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up to several days.⁶

There is currently no established antiviral therapy or vaccine available. Implementing preventive measures is therefore crucial and essential for effectively managing this infection.⁷

A March 15, 2020 New York Times publication reported that dentists were identified as the occupational group with the highest risk of contracting COVID-19, surpassing the risk posed by nurses and physicians.⁸

Dentists are subjected to various pathogens present in the oral cavities and respiratory tracts of patients. In terms of the specificity of dental procedures, which entail proximity and direct contact with the face, as well as extended aerosol-generating procedures, dentists are among the healthcare professionals who face a heightened risk of contracting COVID-19.⁹

The pandemic situation is bringing many challenges to the dental community. There is an increased occurrence of psychological problems such as post-traumatic stress disorder among dentists.¹⁰ Moreover, in the present era, dentists encounter challenges in procuring necessary equipment due to financial constraints. Limited access to personal protective equipment and high expenses together with reduction in dental visits have led to serious financial problems among dentists.^{11,12}

Due to the global COVID-19 pandemic, dentists are required to modify their customary clinical attitudes and behaviors in the present day.¹ Public health administrators worldwide are actively engaged in efforts to reduce the transmission of the novel coronavirus (2019-nCoV) by distributing timely educational videos, informative brochures, and updates on social media platforms for healthcare professionals and the general populace.¹³ All published guidelines emphasize the use of filtered masks and face shields, social distancing, and hand hygiene.¹⁴ However, the extent to which the dental profession is cognizant of and follows these recommendations remains uncertain.¹⁵

The high rates of prevalence and morbidity and the higher risk of infection in dentistry indicate that the dental community in each country is facing a serious crisis.

This study conducted a comprehensive literature review on the present state of education, perspectives, and professional practices throughout the dental community as a whole, as well as dentists' commitment to COVID-19 pandemic protocols.

Methods

A scoping review protocol was developed using the guideline of Arksey and O'Malley. This review followed five stages outlined in the guideline:

Stage 1: Identifying research questions

The following questions guided this scoping review: What

is the dentists' perception of COVID-19 in the pandemic situation? How did dentists react to the pandemic professionally? What is the current status of the dental community in this challenging condition?

Stage 2: Identifying relevant studies

A systematic search was conducted in EBSCO, MEDLINE, CENTRAL, Google Scholar, Web of Science, and Scopus electronic databases using the key search terms "COVID-19" and "Dentistry." The search was last updated on March 13, 2021. The only search filter applied was articles published in English. After completing the process of study selection (Stage 3), we proceeded to conduct a thorough search of the references listed in the selected studies.

Stage 3: Study selection

Two authors separately screened the citation titles and abstracts, afterwards reviewed possibly relevant articles in full. Articles with available abstracts exactly relevant to the search terms and in the dental field were assessed. All descriptive studies, including cross-sectional or cohort studies that evaluated the knowledge, attitudes, or practices of dentists using questionnaires were selected for the review.

Editorials, manufacturer-supported publications in the field of dental education, and studies with students and patients as their study subjects were excluded. Titles were screened again to remove duplicate records and select the studies that exactly met all the aforementioned criteria. In the event that consensus regarding the inclusion of an abstract or full article could not be achieved between the two reviewers, a third reviewer was consulted for further evaluation.

Stage 4: Data charting process

A data charting electronic form was collaboratively developed by the two reviewers to ascertain the variables to be extracted. The two researchers autonomously extracted data and consistently updated the data-charting form. The following data points were taken out: general data (title, year of publication, author's name, and country), methodological data (research design, setting, sample, and questionnaire items), and results data (knowledge on aspects of the infection, attitudes of dentists toward the dentistry during COVID-19 pandemic, clinical practices, and protective behaviors). No formal evaluation of the primary studies was conducted for this scoping review.

Stage 5: Summarizing results

The results were organized into the following categories: Knowledge (transmission, signs and symptoms, incubation period, diagnosis and treatment, virus survival on surfaces, and sources of instruction), attitudes (protective measurements, occupational risk

of infection, management and control of the pandemic situation, and professional activity during pandemic), practices (protective measurements, personal protective equipment, current status of dental treatments, and present challenges in dentistry). The review was conducted in accordance with the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) extension for scoping reviews.

Results

A total of 1364 records were obtained through the searching process. Of these records, 378 articles were excluded after duplicate check. By screening the remaining articles, 581 records, including editorials, manufacturer-supported publications in the field of dental education, and studies with students and patients as their study subjects, were excluded. Of the 405 remaining articles, 25 descriptive

studies, including cross-sectional or cohort studies which evaluated the knowledge, attitudes, or practices of dentists using questionnaires, were investigated in this review (Figure 1). After screening the questionnaires, the articles were categorized into three groups and 14 subgroups based on their subject (Figure 2). The geographical distribution of different studies is shown in Table 1. Most of the studies were conducted in Italy and India.

Knowledge

Transmission

In most of the studies,^{7,13,16-20} the respondents had enough knowledge about routes of transmission, with 60.9% to 94% of dentists choosing the correct answer to the related questions. After droplets, more frequent answers related to sources of transmission were direct contact (91.4%), saliva (91%), contaminated surfaces (87.6%), wearing the

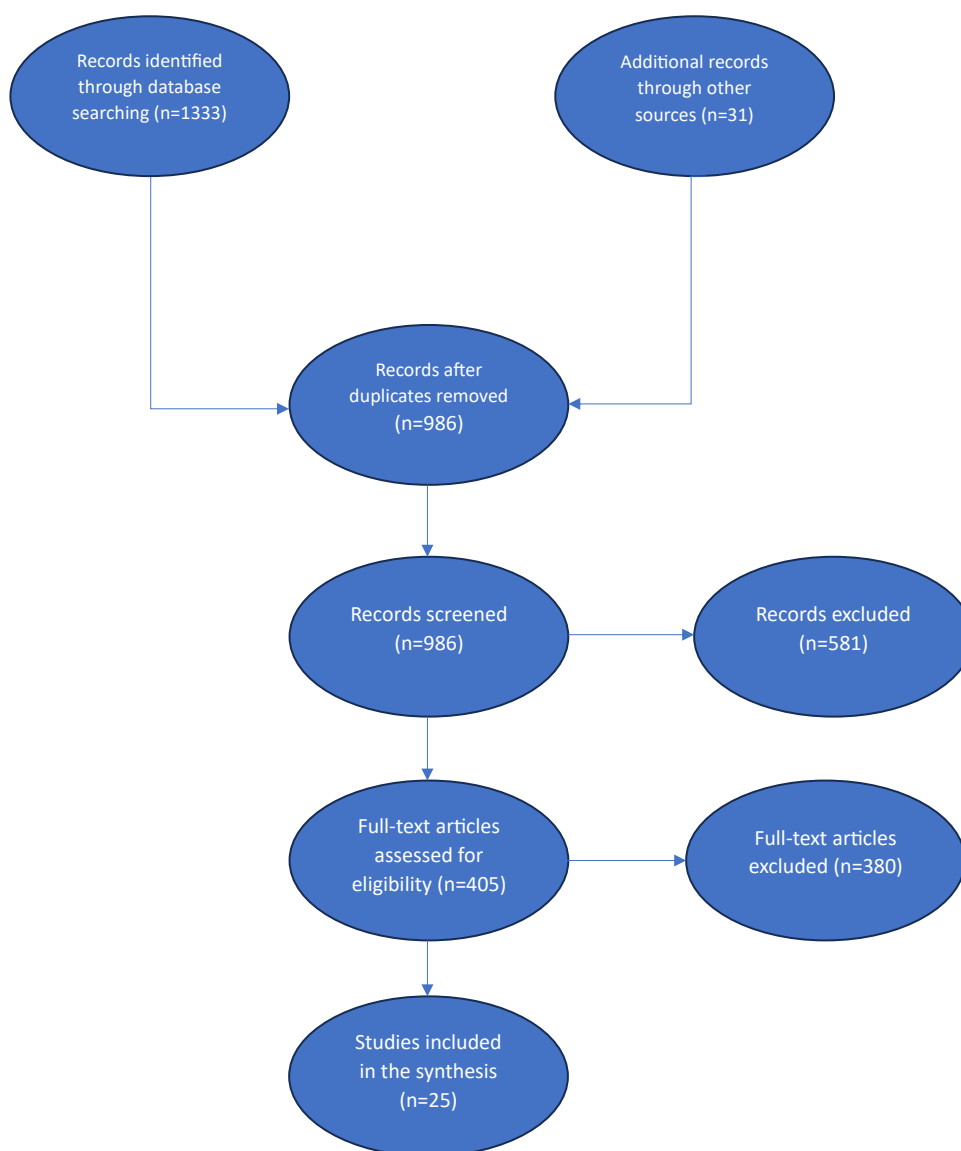


Figure 1. Method of searching and selecting the articles

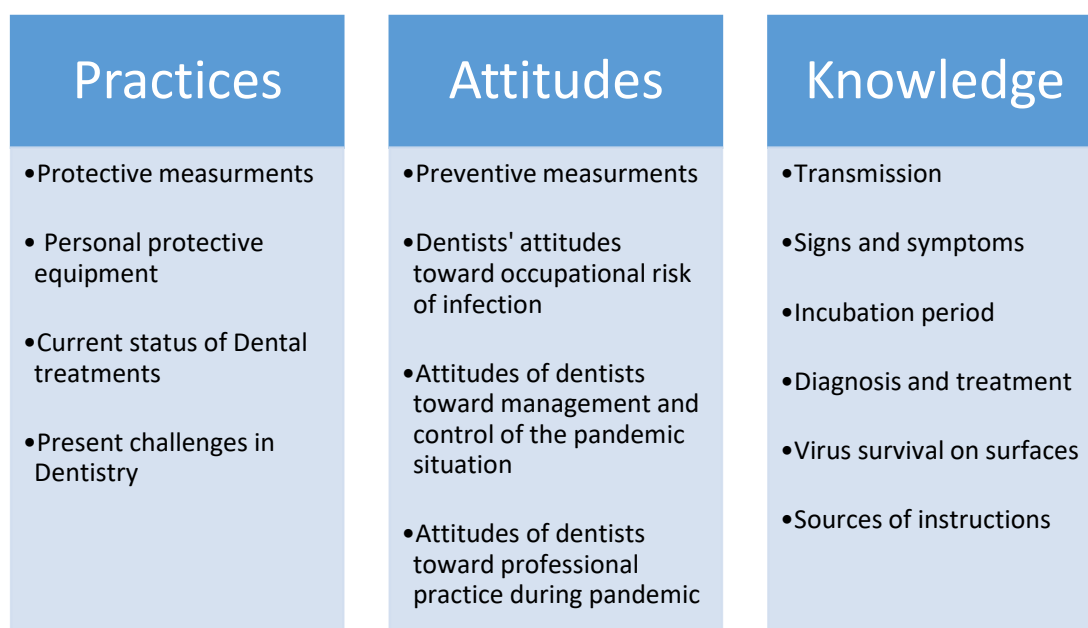


Figure 2. Subjects of articles

Table 1. Geographical distribution of studies

| Country | First Author | Sample size | Date of Study |
|--|---------------------------|-------------|----------------------------------|
| India | Singh Gambhir | N=215 | March, 2020 |
| Italy | Maria Grazia Cagetti | N=4308 | April, 2020 |
| Italy | Alessandra Putrino | N=535 | February 2020 to March 2020 |
| Worldwide* | Shaur Sarfaraz | N=401 | May 14, 2020 to May 20, 2020 |
| Saudi Arabia | Mir F.A. Quadri | N=706 | March 2020 |
| Andhra, Pradesh, and Telangana states in India | Kavalipurapu Venkata Teja | N=300 | March 2020 |
| Poland | Monika Tysiąc-Miśta | N=875 | April, 2020 |
| India | Faizal C Peedikayil | N=1235 | April, 2020 |
| Pakistan | Khalid Almas | N=343 | April-May 2020 |
| Istanbul, Turkey | Güzide Pelin Sezgin | N=267 | April, 2020 |
| Italy | Rossana Izzetti | N=3254 | 6th-13th of April |
| Jeddah, Saudi Arabia | Talal Qadah | N=1023 | Between February and March, 2020 |
| USA | Cameron G. Estrich | N=2195 | June 2020 |
| Indonesia | Armelia Sari Widyarman | N=632 | June, 2020 |
| Saudi Arabia | Ruba M. Mustafa | N=269 | 7th of March - 3rd of April 2020 |
| Egypt | Mariam Mohsen Aly | N=216 | August 2020 |
| Italy | Giuliana Bontà | N=2798 | May, 2020 |
| Nepal | Mukesh Kumar Sah | N=227 | March 10 to 25, 2020 |
| Lebanon | Zeina Nasser | N=358 | April 2020 |
| Iran | Hanie Ahmadi | N=240 | June 10 to 25, 2020 |
| Saudi Arabia | Mona Rajeh | N=521 | April 2020 |
| Turkey | Gülsüm Duruk | N=1958 | March 16 to 20, 2020 |
| India | Niraj Kinariwala | N=403 | May 3 to 5, 2020 |
| The Northern Italy Districts of Modena and Reggio Emilia | Ugo Consolo | N=356 | April 2 to 21, 2020 |
| Worldwide** | Lara G. Bakaeen | N=1251 | March 28 to April 10, 2020 |

* The majority of the study participants lived in Pakistan (43.9%).

** Most participants practiced in Europe (37.8%) and the Eastern Mediterranean regions (29.2%).

same clothes (84.7%), and handshaking. The common mistake among them was believing that the disease could be transmitted via sneezing (90%) and water (54.25%).¹³

Signs and symptoms

The basic knowledge of respondents in different studies^{16,17,21} about signs and symptoms was acceptable as 82.5% to 87% answered correctly. However, the level of knowledge about signs and symptoms was less than their knowledge about routes of transmission. Moreover, studies asked fewer questions about signs than transmission routes. The most common answers chosen by respondents were fever (99.32%), cough (97.07%), dyspnea (97.07%), fatigue (89.35%), and myalgia (74.88%).

Incubation period

Few studies asked about the incubation period.^{16, 17,19} In one of these studies in Saudi Arabia, the knowledge of respondents was good and 96.19% of them chose the right answer (2-14 days). Nevertheless, in the other two studies conducted in Saudi Arabia and Lebanon, the level of knowledge of respondents about the incubation period was not acceptable as 38% to 56% of them knew nothing about the incubation period. It seems that there is no consensus between the results of studies in Saudi Arabia.

Diagnosis and treatment

Only one study evaluated the knowledge of dentists in the field of diagnostic tests and 67% of respondents knew enough about it.²² In addition to questions about tests, there were some questions about current available therapies in some studies. On average, 75% of respondents thought supportive therapies are the best treatment.¹⁷ Moreover, 82.19% of dentists had enough knowledge about available medicines. Nonetheless, in one study, only 42% of respondents answered the questions about vaccination correctly.²¹

Virus survival on surfaces

In a worldwide study, the knowledge of dentists about virus survival on surfaces was evaluated and respondents did not have enough knowledge.²³ Only 1.6% of the respondents were aware of survival time on objects up to 9 days. Furthermore, 17.9% of them were aware of survival on papers and tissue paper up to 30 minutes, and just 11.9% of participants knew that coronavirus can survive on plastic surfaces and stainless steel up to 7 days.

Sources of instructions

In almost all studies in different regions, questionnaires asked about sources of information and instruction. There were different sources for different countries (Table 2). Common sources of information were WHO guidelines, Ministry of Health, professional organizations, television,

social media, and CDC (Centers for Disease Control and Prevention) guidelines.^{7,18-21,24-26}

Attitude

Protective measurements

Many studies focused on the knowledge and attitudes of patients about protective measurements and their adherence to guidelines. In total, 70% of respondents believed that they had enough knowledge.²⁷ In different studies, a lot of questions were designed in fields such as surface disinfection, hand hygiene, mouthwash, and personal protective equipment.^{2,16,18,20,21,23,27-29} About 66.5% of dentists in a study completely agreed with frequent disinfection of contaminated surfaces in the clinic, and 46% preferred ethanol 75%–80% for this purpose.²³ Half of the respondents knew that sodium hypochlorite is the best choice for infected waste materials.

In a worldwide study, only 22.6% of dentists chose povidone iodine. Besides, 23% of the dentists used 0.7% hydrogen peroxide and 36.9% of them chose 1.5% hydrogen peroxide as mouthwash to reduce virus load.²³ However, in another study in Istanbul, a high percentage (92.8%) of dentists emphasized the use of mouthwash before treatment.⁷ They chose chlorhexidine (67.1%), H₂O₂ (52%), and povidone iodine (43.1%) as suitable chemicals for this aim. Regarding hand hygiene in the worldwide study, just 33.8% of respondents believed in washing hands for 20 seconds with soap and water. However, in the study in Istanbul, 67.4% of dentists knew this.

Furthermore, 86% of dentists had an acceptable attitude toward the use of personal protective equipment.¹⁶ Approximately 93% of them declared that gloves and face masks were changed for each patient.¹⁶ In a study conducted in Egypt, 83% of dentists believed that surgical masks are insufficient for the prevention of infection and 81% of them believed in using filtered masks.¹⁸

Dentists' attitudes toward occupational risk of infection

The possibility of COVID-19 infection is an important matter for dentists. Therefore, many studies evaluated dentists' attitudes about this risk. A high percentage of dentists (50% to 89%) believed dentistry is a high-risk profession.^{23,25,27,30}

Half of the dentists believed that clinical standards need to be altered because of the pandemic and clinical activities should be stopped until the termination of this situation. In addition, 58% of them believed that reopening dental offices would lead to an increase in the occurrence of infection.³¹

In a study in the north of Italy, 2% of dentists were confident enough they would be able to prevent the infection in dental clinics while these dentists were from regions with a higher prevalence of disease.²⁷ Those dentists who had stopped their professional activities

Table 2. Different sources of information for different countries

| Region | Sources of instructions |
|--|--|
| India | WHO (59.5%) |
| Italy | Italian institutions (37.6%) |
| Andhra, Pradesh, and Telangana states in India | National health authorities and WHO (60%), Google (30%) |
| India | WHO/ICMR websites (49%), professional organizations (40%) |
| Istanbul | Ministry of Health, Turkish Dental Association, and internet/YouTube |
| Egypt | CDC or WHO guidelines (72.2%) |
| Lebanon | WHO (73.7%), Ministry of Public Health (MOPH) (52.8%), TV (44.7%), CDC (19%) |
| Jeddah, Saudi Arabia | Social media (39.78%), workplace (33.24%) |
| Several Regions of Saudi Arabia | Website of the Ministry of Health (35.7%), social media (27.6%), TV (19.5%) |

believed in higher occupational risk for dentists.

Attitudes of dentists toward management and control of the pandemic situation

Dentists had different attitudes about the preventive infection control measures mentioned in guidelines. In a worldwide study, only 31.9% of the participants believed in the efficacy of protocols.²³ Similarly, in a study conducted in three states of India, 38% of the respondents believed in the insufficiency of available protocols in their country.²⁵ However, 90% of dentists agreed on efficacy of personal protective equipment for disease control. In a study in Saudi Arabia, 57.2% of the respondents believed that there should be specific treatments for COVID-19 infection, but the rest of them thought that the disease period should pass for the symptoms to subside.¹⁶

Attitudes of dentists toward professional activity during pandemic

Four articles assessed the attitudes toward treating dental patients during the pandemic. Indian dentists believed that the dental community has an important role in the reduction of the spread of the virus.²⁵ Accordingly, 60% of them thought restorative treatments and dental procedures generating more aerosol had high risk of infection. This risk was just 35% for surgical interventions. Finally, 40% of them believed that all dental treatments should be postponed until the end of these conditions.²⁵

In a study in Pakistan,³² researchers asked about treating patients with high fever and one of these conditions: no respiratory symptoms, respiratory symptoms, and COVID-19 positive diagnosis. Only 15.5% of dentists felt comfortable treating patients who did not show respiratory symptoms, while 38.4% advised them to stay at home and self-isolate. Furthermore, 60.8% of the respondents thought that such patients should be isolated and the infection control department should be notified. In the event of a confirmed diagnosis of COVID-19, the majority of participants (86.7%) concurred that it is essential for patients to undergo isolation and be duly reported.

In a global study encompassing 49 countries, 92.3% of

respondents acknowledged the need to use a N95 mask when interacting with a patient who has been diagnosed with or is suspected of having COVID-19, but only 50% were aware of the recommendations for extended versus limited use of the mask. 13% of those who participated were neutral,³³ and 13.3% did not agree or firmly disagree with “referring an existing or probable COVID-19 patient rather than treating them,” revealing that nearly one quarter of those asked did not share this viewpoint.³³

Practices

Protective measures

There are different reports about regional protective measures.

According to a study conducted in India, 94.2% of dentists utilized alcohol rub or water with detergent to sanitize their hands following treating patients.²¹ Moreover, 86.2% of the participants routinely cleaned and disinfected surfaces. Meanwhile, just 35.2% of the respondents performed weekly fumigation of the dental office, and just 32.4% daily disinfection of the lab work area.

In the northern region of Italy, the delay of the appointments so as not to crowd the waiting room was the most commonly adopted measure taken before the patient’s arrival. Frequent ventilation of the waiting room and the operators’ hand washing before and after each procedure were also the most commonly taken measures.²⁷ Dentists from the areas with the highest COVID-19 prevalence took measures less frequently.

In another study conducted in May 2020 in Italy on 2798 dentists, 69% of the participants took all measurements such as phone triage, frequent hand washing, and using proper protective equipment, such as disposable gowns, filtered masks, and gloves.²⁸

Another study in Italy in April 2020, with a sample size of 3254 also reported similar results, but just 25% of dentists recorded the patient’s temperature. Hand washing for 40 seconds, phone triage, evaluating patients, using mouthwash before treatment, and ventilation were adopted by more than 90% of the respondents. Half of the patients were treated with two pairs of gloves, and four-

handed techniques were applied in 38% of the cases.³⁴

In the United States, all dentists currently in practice have reported implementing rigorous disinfection protocols for all equipment and surfaces that are frequently touched. Additionally, they are diligently monitoring the temperatures of both staff members and patients, conducting thorough screenings to identify potential cases of COVID-19 among patients, promoting physical distancing measures in waiting areas, and ensuring that all staff members are equipped with appropriate face masks.¹⁵

The predominant supplementary infection control measures included the utilization of masks by staff members and the implementation of office disinfection protocols after each patient encounter. The infection control measures that were less frequently reported included implementing physical modifications to the healthcare facility and supplying patients with facial protective masks.

In a study in Egypt, similar to the one in Italy, temperature was recorded in 25% of cases. Furthermore, only 24.5% of the respondents reported the use of rubber dam isolation and less than half reported the use of high-volume suction. Nevertheless, the vast majority of them consistently adhered to the universal precautions of infection control. They adhered to the practice of performing hand hygiene with soap and water or sanitizer prior to and following patient care, as well as refrained from providing dental treatment to patients exhibiting suspicious symptoms.¹⁸

A study from Lebanon found that 41% of the patients did not follow adequate precautionary measures against COVID-19. Nevertheless, the majority of dental professionals implemented suitable precautionary measures in their clinics, such as consistently replacing gloves after attending to each patient (100%), sanitizing their hands with alcohol-based hand rubs or soap and water (98.9%), and cleansing their hands both before and after treating patients (98.9%). The utilization of alcoholic disinfectants and masks in the waiting rooms (66.8%) and the implementation of personal protective equipment by the assistant (65.9%), along with the regular disinfection of all surfaces, chairs, and doors in the waiting room using chloride solution or any other type of sterilizer (62.8%) every two hours, were among the observed clinical procedures.¹⁹ In northern Italy, in the districts of Modena and Reggio Emilia, the majority of respondents reported reducing the number of patients in the waiting room and telephone screening to exclude those with COVID-19-related symptoms while body temperature measurement received the lowest frequency of preference (21.3%).²

Personal protective equipment

a. Accessibility

Articles published in the initial months of the pandemic

reported some difficulties for dentists to access the necessary equipment.

Two studies in India evaluated the rate of access to preventive equipment. 78% of Indian dentists reported a lack of mouth masks and head caps, according to one study.²⁵ They believed this shortage was due to unavailability or increased usage by the general population. In the alternative investigation, a significant proportion of the participants (61.5%) had refrained from acquiring personal protective equipment (PPE), and a similar percentage (55%) reported unavailability of N95 masks.³⁵ In a medical study conducted in Iran during the initial months of the pandemic, approximately 50% of the participants reported the necessity of purchasing personal protective equipment (PPE) at significantly elevated costs.³¹ Similarly, in a worldwide study among 49 countries, 86% of the dentists had difficulties in finding PPE.³³

b. Use of PPE

The most commonly used types of PPE in dental clinics were face masks, protective shields, and gloves. Dentists believed that they should increase and modify PPE. Nonetheless, 10% of the respondents in the north of Italy had not yet changed the equipment they used before the pandemic.²

There was no significant difference between pre-pandemic and the pandemic in usage of gloves, but the most important alteration was an increase in the usage of filtered masks and disposable gowns in India.²⁶ In the United States, participants reported they typically replaced masks after visiting multiple patients each day.¹⁵

In the worldwide study among 49 countries with the majority of the respondents from Europe and the Eastern Mediterranean, just 20.5% of the respondents reported the use of N95 masks although they were mostly aware of the importance of these masks in the prevention of infection.³³

Current status of dental treatments

Almost all dentists reacted to the pandemic in the same manner, but with slight differences in how they responded (Table 3). The majority of them closed their offices or limited their activities to emergency treatments, and only a small percentage of them continued working as before.

Aerosol-generating procedures such as crown preparation or oral procedures using scalers were reduced significantly.²⁵ Instead, the treatment of pulpitis, prosthesis de-cementation, and abscess treatment were the most common urgent treatment procedures provided by dentists.³⁴ Moreover, dentists focused on preventive care more than before. In the northern districts of Italy, 96.1% of the respondents guaranteed telephone availability for dental emergencies.²

In Andhra, Pradesh, and Telangana states in India,

Table 3. Professional activity during pandemic

| Region | Providing emergency treatment | No activity | Providing elective treatment |
|--------------------|-------------------------------|-------------|------------------------------|
| India ^a | 8.5% | | |
| India ^b | 50% | | |
| India ^c | | 84.3% | |
| Pakistan | 91.2% | 6.5% | |
| Italy | 99.7% | | |
| USA | 91.1% | | |
| Iran | | 46% | 30% |

^a The Tri-city (Chandigarh, Panchkula, and Mohali)

^b Andhra, Pradesh, and Telangana states

^c Kannur, Delhi

only 35% of the participants were delivering emergency endodontic therapies.²⁵ In another study in India with a sample size of 1235, 3% of the dentists were carrying out aerosol-generating dental procedures.²⁶ In the Istanbul investigation, 66.3% of the dentists chose the response, “When an extraoral abscess and localized pain are present, I prescribe antibiotics and anti-inflammatory drugs and postpone the procedure until after the pandemic,” when they were asked about their analgesic choices, a large proportion of these individuals (85.9%) chosen paracetamol.⁷

The main reason to postpone clinical activities was the fear of contracting COVID-19 either for dentists or their families.¹⁷ In a study, half of the dentists were not confident enough about commencing their professional activities at the end of the pandemic and one-third of them were hesitant about it.³⁵ The underlying factors for this seem to be either individual well-being or economic considerations.

In the Regenia and Modena states in Italy, 535 dentists participated in a study in February and April 2020. Prior to the pandemic, an average of 6 to 15 patients were seen per day, but this decreased to 0 to 5 patients on a weekly basis in 90% of the cases.² Similarly, in another study in Italy with a sample size of 3254, the average number of visits decreased to 5.7 patients per day.³⁴

In the third study in Italy with a sample size of 535 conducted in February 2019, at the beginning of the pandemic, 50% of the dentists did not report any decrease in the number of patients.²⁰

Present challenges in dentistry

Financial issues were mentioned as one of the major problems for the dental community (47.4%), followed by psychological problems (33.8%), social challenges (14.9%), and behavioral challenges (3.9%).³²

In a global survey of 49 countries, around three-quarters of dentists (73.6%) “strongly agreed” that it had a noticeable effect on their earnings, and 77% of them anticipated government compensation.³³

Demographic data

Demographic data were collected in all surveys. Frequent questions included gender, years of practice, specialty type, and clinic type. In all surveys, specialists had more significant knowledge and attitudes than general practitioners. Besides, those health care workers who worked in hospitals had more knowledge regarding different aspects of COVID-19.

In most studies, it was reported that more experience of clinical activity led to better knowledge and attitudes toward the pandemic.

There are different results among studies regarding gender. Most of the studies showed there was no significant difference between males and females but in some studies, females had a higher level of knowledge than males.^{7,23}

The results of all included studies are summarized in Table 3.

Discussion

The COVID-19 pandemic has imposed new challenges to the dental community. Dentists are directly exposed to pathogens of the oral cavity and respiratory tract. Therefore, they are at higher risk of being infected. Dental practitioners must modify their customary clinical attitudes and behaviors. In this review, the knowledge, attitudes, and practices of dentists all over the world were investigated in published articles.

The most common type of questionnaire used in the six regions defined by the WHO, was KAP (knowledge, attitudes, and practices). Most of the studies were performed in Italy and India and the rest were concentrated more on the Eastern Mediterranean and Southeast Asia. The rates of mortality and prevalence of COVID-19 in these areas were also higher than other regions. It seems that in these areas, evaluation of attitudes and practices of dentists to establish the necessary protocols was a high priority in health care systems. In this review article, different aspects of KAP were reviewed in a specific sequence. First, the knowledge of dentists and the sources of instructions were reviewed. Second, their attitudes toward the pandemic situation and available information were evaluated. Finally, the adherence of dentists to the published protocols and the current status of dental practices were reviewed.

It seems that the dental community has enough knowledge about different aspects of COVID-19. Although there are continuous alterations in guidelines, the basic knowledge of dentists about routes of transmission, signs and symptoms, diagnostic tests, available therapies, and preventive measures seems to be good. Only in one study, the respondents did not know enough about the survival of the virus on different surfaces. This can be due to frequent discovery of new evidence about this issue. There is yet no certainty about the possibility of

transmission via contaminated surfaces.²³

Regarding preventive measures, studies reported an increase in the use of H₂O₂ mouthwash compared to chlorhexidine. This indicates that instructions have been efficient, and dentists seem to be up-to-date. Although in vitro studies have concluded that H₂O₂ mouthwash is more effective than CHX due to its oxidative effects, more human studies should be performed to provide strong evidence on the effectiveness of mouthwash in the pandemic.³⁶⁻³⁸

Regarding sources of information, dentists used guidelines of professional organizations such as WHO, which played a more important role than social media. However, for analyzing this field, cultural variations and social media situations in each society should be taken into consideration. The vast majority of dentists were of the opinion that there is a significant risk of COVID-19 transmission in dentistry. However, according to the results of studies conducted in high prevalence areas, it seems that dentists in these regions have less concern about this pandemic. Moreover, those dentists who stopped working had more serious concerns and attitudes about the risk of being infected in dentistry.

Most of the dentists indicated that available protocols are sufficient enough to control the disease. Nevertheless, in a study conducted in three cities of India, the results were different.²⁵ This can be due to the fact that Indian dentists are besieged by substandard, poor-quality, and heavily overpriced PPE kits, and this may be one of the reasons for their responses. Furthermore, a substantial portion of dental clinics in India lacked adequate facilities for optimal donning and doffing of PPE.³⁵

Dentists in different surveys reported similar preventive approaches. Hand hygiene, surface disinfection, social distancing in the waiting room, triage, use of masks, gloves, gowns, and face shields, and ventilation were most commonly adopted measures. Temperature recording, use of rubber dams, and high-volume suction were the measures less frequently taken by dentists. It seems that infection control approaches in dentistry are reforming in response to COVID-19. After the increase in the prevalence of AIDS and hepatitis, the usage of gloves became a routine measure in dental offices and protocols for control of blood-borne infections gradually became more effective. However, for air-borne infections, there has been no official guideline in dentistry yet. Thus, infection control measurements are expected to change with the discovery of new evidence.³⁶

Most dentists postponed their clinical activities or limited them to urgent procedures. Few of them continued to treat dental patients. It seems that for dentists, the health condition of themselves and their families is more important than other aspects of their professional lives. Closure of dental offices, reduction in visits, and decrease in the number of dental treatments have led to serious

financial problems in the dental community. On the other hand, oral health-related quality of life in society may become worse. A lot of dentists hesitate to open their clinics after the pandemic. One study reported that 26% of the dentists were willing to treat patients who were positive for or suspected of COVID-19. Three factors influence the reopening of dental clinics in each society: oral health needs, financial issues, and dentists' attitudes toward their own health.

Strength and Limitations

Strengths: A comprehensive understanding of the available evidence using specific keywords in line with the research question and using the result of the study in the design of future studies and unanswered practical questions with the approach of reviewing conditions similar to the covid epidemic are the strengths of this study.

Limitations: It is possible that due to the impossibility of using all search engines and the addition of articles after conducting a systematic search, a similar study had not been mentioned and reviewed in this article.

Conclusion

The majority of dentists have sufficient knowledge of COVID-19 infection and comprehend the significance of performing only emergency procedures and delaying elective ones. In addition, the majority believed that COVID-19 prevention awareness programs are required for both the dental community and the general public. Many of the survey respondents limited their activities to emergency remedies in accordance with the most recent recommendations.

Acknowledgements

We are grateful to the Journal of Oral Health and Oral Epidemiology for their valuable assistance in editing and improving the manuscript text.

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Competing Interests

The authors hereby state that there are no medical conflicts of interest pertaining to the publication of this manuscript.

Data Availability Statement

The authors confirm that the data supporting the findings of this study are available within the article and its supplementary materials.

Ethical Approval

Ethical approval was not necessary for this review.

Funding

The study did not receive any dedicated grant from any funding agency in the public, commercial, or not-for-profit domains.

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