**Title:** Knowledge, Attitude, and Practice of Dentist in Southern State of India During Corona Virus Disease-19

**Authors:** Ahila Singaravel Chidambaranathan[1,*], Muthukumar Balasubramanium[1], Aravind Kalambettu[2]

1. *Department of Prosthodontics, SRM Dental College, Bharathi Salai, Ramapuram, SRM Institute of Science and Technology, Chennai, TamilNadu, India.*
2. *Faculty of Dentistry, AIMST University, Kedah, Malaysia.*

To appear in: ***Health in Emergencies & Disasters Quarterly***

**Received date:** 2025/01/09

**Revised date:** 2025/08/26

**Accepted date:** 2025/09/07

**First Online Published:** 2025/12/08

**Please cite this article as:**

Singaravel Chidambaranathan A, Balasubramanium M, Kalambettu A. Knowledge, Attitude, and Practice of Dentist in Southern State of India During Corona Virus Disease-19. Health in Emergencies & Disasters Quarterly. Forthcoming 2026. Doi: http://dx.doi.org/10.32598/hdq.2026.663.1

## ABSTRACT

**Background:** Corona virus disease affected health professionals and humans around the globe. World health organization announced as pandemic on 11th March 2020.Hence the purpose of the research was to evaluate knowledge, attitude, and practice of dentist in southern state of India during Covid-19 lockdown.

**Materials and Methods:** A descriptive online questionnaire based survey was executed on knowledge, attitude, and practice of dentist in southern state of India during October 2020 to December 2020.It was a self-directed, unidentified questionnaire comprised of 25 restricted questions with 4 possible answers.The participants were recruited using non-probability availability sampling and total 40 clinical dental students, interns, practicing dentist, dental specialists and academician were included.

**Results:** The questionnaire contained personal information (5), knowledge (7), attitudes (6) and practices (6) questions. 60% of the respondents belonged to 20-30 years while 30% between 31 and 45 years old.

**Discussion:** The participants were 59% undergraduates,30% postgraduates,7% academician,3.6% academician and private practitioner. Most of them aware of SARS-CoV2 belonged to RNA virus, route of imparting was through respiratory droplets, the effectiveness of hand washes and sanitizers in killing the virus evoked mixed response, while only 66.6% respondents said that it was effective in killing the virus.

**Conclusion:** The practicing dentist and academician had enough knowledge to manage COVID-19 situation very well compared to students and interns. Hence, the academician should conduct regular online classes to make the students and interns to sensitize the importance of Personal Protective Equipment (PPE) kit, N-95 mask, sterilization, hand sanitization and vaccination during COVID-19.



**Keywords:** Covid-19, Dentist, Communicable diseases, Pandemic.

## 1.Introduction

The novel coronavirus disease 2019 (COVID-19) is a viral infection that started in Wuhan, China, and has produced pneumonia in worldwide [1]. COVID-19 is spawn by SARS-CoV-2 virus that is a single stranded RNA with spike protein, nucleic capsid, and envelope membrane [2]. COVID-19 had troubled many health professionals around the world [3].

Dentists are the highest risk health professionals; hence the safety is not only to the patient, but also to safeguard themselves from the virus to prevent transmission [4]. Carriers as well as patients with critical illness may report for dental treatment at outpatient. The fear of rising cross-infection from dental practice has made the dentists to stay in home quarantine but the livelihood of the dentist depends on dental clinics for finance [5].

In this setting, dental procedures, in which many droplets and aerosols, containing microorganisms from an infected individual, could be generated, are at high risk of cross-infection between patients and dentists [6-8]. Covid-19 is a pandemic and affecting the health professionals worldwide alarmingly. So, the dentist should have basic knowledge about the route of transmission, course of the infection, virulence, self-defence of the health professionals against the infectious disease is very important to practice. COVID-19 virology is to focus on knowledge gaps in dental settings. Till date there is no research on the knowledge of the dentist to do safe dental practice dentistry and avoid cross contamination during Covid - 19. Hence the practical purpose of the study was to evaluate the knowledge, attitude, and practice of dental practitioners in southern states of India. A hypothesis was formulated that clinical dental students, interns, academician, private practitioners had the same knowledge about COVID-19.

## 2.Materials and methods

### Study design and participants

A cross-sectional study was conducted among the dental practitioners of southern parts of India using google survey form to accumulate the data from October 2020 to December 2020**.**The study was approved by the Institutional Review Board (SRMU/M&HS/SRMDC/2020/S/036). The participants were selected using a non-probability convenient sampling method whoever agreed to take part were included in the study. The sample size was calculated using software G*power version 3.1.9.4. 2 Heinrich-Heine Universitat. The power of the study was 80% and the estimated sample size was 140 participants. The inclusion criteria were dental clinical students, interns, various dental specialist, general dental practitioners, and academician and the exclusion criteria were preclinical undergraduate students, clinical practitioners, and academician above 60 years old.

### Data collection

The datas were collected online and analysed using SPSS Version 23 (IBM Corporation, Armonk, NY, USA). The descriptive analysis was done through online. The questionnaires were anonymous to maintain the privacy and confidentiality of the information gathered for the research. Self-directed unidentified questionnaire digital copy was prepared with participants details (age, gender, and professional experience) and informed consent was obtained in electronic format for data anonymization. The second section comprises 7 questions covered the knowledge about type of COVID-19, attachment site, mode of transmission, incubation period, effectiveness of hand wash and sanitizers, composition of sanitizer and immunity, third part consists 6 questions related to attitude which comprised of mode of start of dental procedure, change of mask frequency, use of PPE kit, difficulties in wearing PPE kit, mode and duration of disinfection of handpiece, and the fourth part consists of 6 questions related to practice such as after rapid testing of patient, thermal testing , disinfection method of clinics and instruments, self-precaution and protection and the action is taken if become positive.

**Table.1** Demographic data of the participants

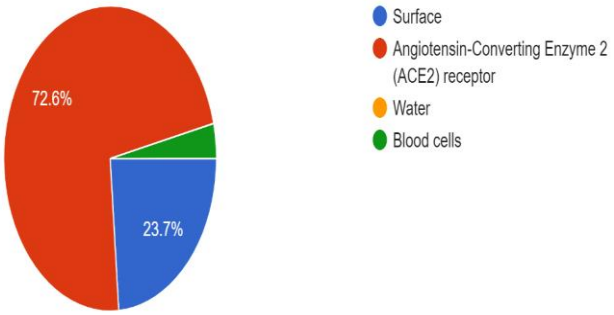
| S. No | Age of respondents | | Occupation of the respondents | | History of Chronic Illness | |
|---|---|---|---|---|---|---|
| | Age group | Percentage | Occupation | Percentage | Illness | Percentage |
| 1 | 20 – 30 years | 59.3 | UG student | 34 | Diabetes | 3.1 |
| 2 | 31-45 years | 30 | PG student | 19.1 | Hyper tension | 0.9 |
| 3 | 46 – 55 years | 7.1 | Academician | 0.8 | Other illness | 3.1 |
| 4 | >55 | 3.6 | Private Practice | 12.8 | No illness | 92.9 |
| | | | Private practice and confined to college | 22 | | |
| | | | Academician (confined to college) | 11.3 | | |

**3.Results**

The distribution of the occupation of the respondents shows that the survey had an almost equal representation from various groups like student community, academicians, and private practitioners. This wide distribution would further strengthen the results of the study by covering the knowledge, attitude, and practice (KAP) among the different groups of dentists. (Table.1)

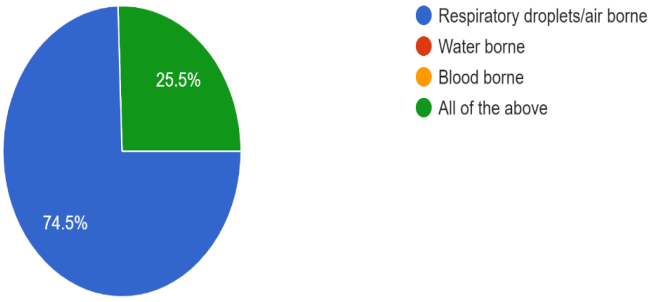
The results showed that most of the respondents were aware that the SARS-CoV2 belonged to RNA virus family, while a small minority (8%) were under the misconception that it was a DNA virus. This highlights the ignorance of these respondents and underlines the need to stay updated with the knowledge regarding this new epidemic. Similarly, only about 73% of the respondents knew that the receptor binding attachment site of spike protein was ACE-2

receptor. Another group comprised of 23% identified that the virus attached at the surface of the cells. (Graph.1)




**Graph.1** knowledge about attachment of Covid-19 virus to human cells

As reference to the route of transmission of the virus, 74.5 % of the respondents identified respiratory droplets, which is correct with the current information available, while about 25.5 % considered that the virus could be transmitted either through air, water, or blood. This shows the wide awareness regarding the mode of spread of the disease. Surprisingly, while most of the respondents considered that the incubation was period of the virus was 2 weeks, a substantial number of about 12% thought that it was 1 week. (Graph.2)

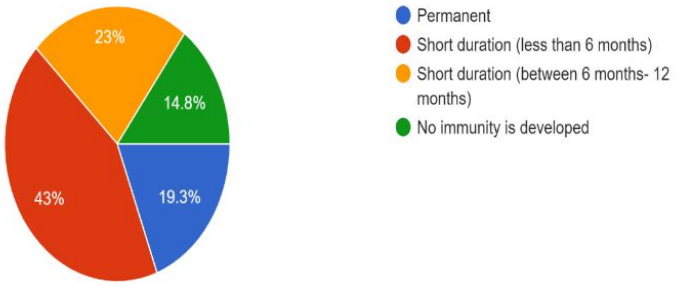



**Graph.2** Knowledge about route of transmission of Covid 19

The question regarding the effectiveness of hand washes and sanitizers in killing the virus evoked a mixed response. While only 66.6% of the respondents said that it is effective in killing

the virus, the rest were skeptical about its effectiveness. Only 33.8% of the respondents correctly knew that the hand washes recommended by WHO could be either ethanol or propanol based while a substantial percentage opted for either the combination of ethanol, hydrogen peroxide and glycerol, or propanol, hydrogen peroxide and glycerol.

About 66% of the respondents consider that the immunity acquired post-covid infection is short lived, and a quarter percentage of these people think that it is for a period between 6 and 12 months. Surprisingly, a few respondents (about 19.3%) thought that the covid infection confers permanent immunity to the individuals. (Graph.3)



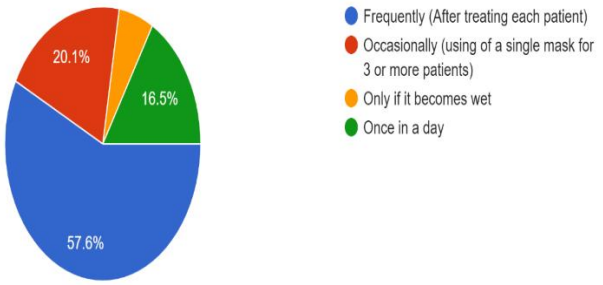

**Graph.3** Knowledge about immunity after Covid 19 infection

**Attitude towards choice of PPE during the pandemic**

50% of the respondents preferred using N-95 masks, while about 37% preferred the use of respirators with the N-95 masks while performing dental procedures. The use of three-layered masks was popular with 17% of the respondents. Although, world-wide, N-95 masks have been promoted as being vital for health professionals and highly effective in minimizing the transmission of the virus through droplets.

The next important objective was to assess the attitude of the dentists on the frequency with which they change their masks. While 57% suggest that it is mandatory to change masks after

treating every patient, about 20% would use change their mask after seeing three or more patients. (Graph.4)




**Graph.4** Practice of changing mask during practice

When the patient is sitting on the dental chair, more than 80% of the dentists prefer to advise the patient to use a mouth wash prior to any procedure while about 8% of the respondents preferred to provide PPE to the patients. The use of mouth wash would be necessary to minimize the viral count in the airotar droplets at the time of dental procedures.

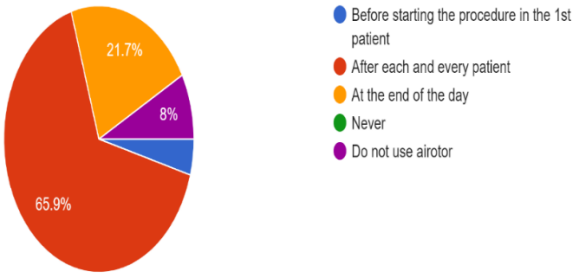
**Maintaining the operatory room and precautions for personnel**

Following the correct protocol in maintaining the operatory room is essential for the safety of both the clinic staff as well as the patients. In this regard, 68.8% of the dentists believed in maintaining sufficient ventilation through windows and doors, while about 21% preferred the use of HEPA filters. A small percentage of the respondents preferred to limit the use of air conditioners to the operatory room alone.

Over less than half the respondents chose to take multi-vitamins to boost their immunity as a self-precaution against COVID-19 prior to starting their dental practice. About 24% of the respondents did not prefer to take any prior precautions. The survey regarding the use of PPE among these dental health practitioners elicited mixed response with about 43.7% using changing their PPE kit for each patient, while about 31.7 % sticking with one PPE for one day.

On the other hand, about 16.7% of the dentists would use PPE only for selective patients while around 8% of the dentists do not use the PPE kit. Most of the dentists feel that the level of discomfort during operation increases upon the donning of the PPE. About 30% of the respondents experience increased sweating while working with PPE.

In the survey, about 70% of the respondents chose to sterilize their handpiece after every patient, while only 21.7 % preferred sterilizing at the end of the day. The attitude of the latter group needs to be discouraged and this attitude could be attributed to either ignorance or negligence. Their come our duty then to create awareness and instill the urge of sterilizing the handpieces and burs after operating on each patient. Interestingly, about 8% of the respondents did not use airotor handpiece during pandemic time to minimize the risk of aerosol generation and thereby minimized the risk of viral transmission. At the same time, about 68.4 % preferred to sterilize their airotor handpieces through autoclave while 20% preferred using 10% povidone iodine solution. (Graph.5)



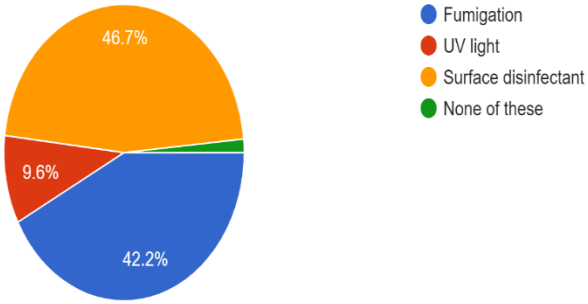

**Graph.5** Practice of sterilizing hand piece during practice

**Practice during Covid-19**

Interestingly, only about 24 % of the respondents mandate the checking of the temperature of each patient visiting their clinics. Most of the dentists did not check the temperature unless the patient´s with Covid-19 symptoms. The use of infra-red thermal scanners in detecting asymptomatic COVID-19 patients is debatable. Considering the incubation period of the virus,

it would wise to follow a SOP in the dental clinic where every visiting individual (patients as well as their attenders) shall be approached assuming that they are SARS-CoV-2 positive. Hence, the use of thermal scanners may not be very helpful in detecting COVID-19 carriers.

Finally, the topic of method of disinfection of the dental clinic also showed mixed results with an almost equal number of respondents opting for either fumigation or the use of a surface disinfectant. Only 9.6% of the respondents chose UV light. (Graph.6)




**Graph.6** Practice of disinfecting dental equipment's and rooms

Upon exposure to COVID-19 patient, about 57.9 % of the respondents preferred to wait and watch for the onset of manifestations of COVID-19 as they felt that their chances of infection is minimized due to the usage of PPE. However, about 38% preferred to isolate themselves through self-quarantine. 55% of the surveyed population believed that vaccination is a permanent cure for COVID-19 and 26.4% think that developing herd-immunity is our best bet in overcoming the infection. While 12 % felt that maintaining personal hygiene is very important to minimize the spread of infection and the rest believed that maintaining social distancing would be effective in reducing the infection rate.

## 4.Discussion

Ever since the first reported case in India in January 2020, the authorities are on alert to minimize the spread of COVID 19 infection. The cause of COVID-19 is a SARS virus of

2003[9]. COVID-19 was substantial social concern globally because of its high transmissibility. The virus can be transmitted through airborne droplets, saliva, bodily fluids, and faeces, but airborne droplets is the major route of transmission [10,11].

Since dental treatment can involve considerable saliva or blood splatter from the patient, it can carry a high risk of virus transmission [12,13]. In India had the highest incidence of infection, assessing the level of dental students and practicing dentist's information about COVID-19 is a productive step in limiting the disease. In this study the respondents are clinical dental students, interns, general dental practitioners, faculties, and dental specialists of south India who were executing dental procedures and the protocols they followed for prevention, and their awareness and knowledge about the present COVID-19 pandemics was assessed.

The practicing dentists are at the highest risk of infection due to direct exposure and close contact to saliva, blood, and other body fluids. In India, the dentist affected by coronavirus should follow infection control is required in their work place [14]. Therefore, dental auxiliaries and patients are become infectors and transmitters of COVID 19 infection [15,16]. Based on the reasons above, the Dental Council of India and the Indian Dental Association have promptly given advisories to practicing dentists, which suggested them to protect themselves and should be cautious about spread of COVID 19 infection [17,18].

CDC suggested to post pond the elective surgeries, procedures, and low priority procedure and execute tele-dentistry. Also recommended the dentist to update with the vaccine doses, provide guidance like posted signs, instructions when scheduling appointments for patients and visitors.[19]

There has been no evidence for definite treatment for COVID-19, and handling of COVID-19 was mainly supportive [19]. The present appeal for COVID-19 is to limit the source of

infection; use prevention and control measures to minimize the risk of transmission; and avail early diagnosis, quarantine, and supportive care for the affected patients [20,21].

The current research results showed that most of the participants are aware of the SARS-CoV2 belonged to RNA virus family, the mode of transmission of the virus was through respiratory droplets, the effectiveness of the use of hand washes and hand sanitizers in killing the virus evoked a mixed response, while only 66.6% of the respondents said that it is effective in killing the virus. This result was confirmed by the previous study [19,22]. About 66% of the respondents consider that the immunity acquired post-covid infection the respondents preferred using N-95 masks, In this regard, 68.8% of the dentists believed in maintaining sufficient ventilation through windows and doors, while about 21% preferred the use of HEPA filters.

In clinics that have good air circulation with fresh air constantly brought through breeze, most of the generated aerosols remain suspended in the air and thereby increases the risk of infecting the subsequent patient who is subjected to dental treatment. Hence, some have advocated the use of HEPA filters in the dental operatory to minimize the transmission of the virus. The previous literature mentioned about the HEPA air purifiers to prevent contamination [23,24].

The survey regarding the use of PPE among these dental health practitioners elicited mixed response with about 43.7% using changing their PPE kit for each patient. Attempt to minimize the transmission of disease have been significantly more effective like quarantine, increasing social distance, reduction of displacement, and strict adherence to basic hygiene which confirmed with the previous study results. [25,26] Air washing process sucks air in the room and directs to disinfection bath and uninterrupted operation is done to minimize the germs in the room air forever.[25] The goal in management of COVID-19 disease was to protect the medical personnel and reduce financial burden to the hospitals. Protecting the health of medical staff against infectious diseases is another issue that can help meet the challenge of reducing the number of specialists in disease control.

Limitations of the study are convenience sampling limits generalizability and chances for self-reporting biases.

## 5.Conclusion

The authors concluded that the practicing dentist and academician had enough knowledge to manage the covid 19 situation very well compared to the students. Hence, the academician should conduct regular online classes to make the students and interns to sensitize the importance PPE kit and wearing N-95 mask after each patient, sterilization of instruments after the procedure, hand sanitization and vaccination during COVID-19. Maintaining inter personal distance, and vaccination will prevent transmission of Covid 19 from patient to dentist. Also, recommending WHO recommended sanitiser for frequent hand applications of dentist after every patient and mouth wash before start of any dental procedure will minimize the risk of COVID 19.

**Ethical Considerations:** This study was conducted according to the guide line of ethical committee of SRM Dental College, Ramapuram. (SRMU/M&HS/SRMDC/2020/S/036)

**Authors contributions:** All authors equally contributed to prepare this article

**Acknowledgement**: Nil

**Financial support**: Nil

**Conflict of Interest Statement**: The authors declared that there is no conflict of interest.

## References


[1] Khader Y et al. Dentists awareness, perception, and attitude regarding COVID-19 and infection control: Cross-sectional study among Jordanian dentists. JMIR Public Health Surveillance 2020; 6(2): e18798-102.[DOI: 10.2196/18798] [PMID:https://pubmed.ncbi.nlm.nih.gov/32250959 ][PMCID: PMC7147327]

[2] Chen Y, Liu O, Guo D. Emerging coronaviruses: genome structure, replication, and pathogenesis. Journal of Medical Virology 2020;92(4):418-23. [DOI: 10.1002/jmv.25681] [PMID:https://pubmed.ncbi.nlm.nih.gov/31967327] [PMCID: PMC7167049]

[3] Zhang Z et al. Protecting healthcare personnel from 2019-nCov infection risks: lessons and suggestions. Frontiers in Medicine 2020;14(2):229-31. [DOI: 10.1007/s11684-020-0765-x] [PMID: https://pubmed.ncbi.nlm.nih.gov/32212058] [PMCID: PMC7095352]

[4] Chang D, Xu H, Rebaza A, Sharma L, Dela Cruz CS. Protecting health-care workers from subclinical coronavirus infection. The Lancet Respiratory Medicine 2020;8:e13. [DOI: 10.1016/S2213-2600(20)30066-7] PMID: https://pubmed.ncbi.nlm.nih.gov/32061333/ [PMCID: PMC7128440]

[5] Raza M, Jain S, Sharma P, Kmar P, Shetty D, Juneja A. Awareness related to covid 19 among dental health-care students and professionals of national capital region: A cross sectional study. Indian Journal of Dental Science 2020;12:209-15. **[**DOI: 10.4103/IJDS.IJDS_107_20] [https://journals.lww.com/ijds/fulltext/2020/12040/awareness_related_to_covid_19_among_dental.5.aspx]

[6] Meng L, Hua F, Bian Z. Coronavirus disease 2019 (COVID-19): Emerging and future challenges for dental and oral medicine. Journal of Dental Research 2020; 99:481-7. [DOI: [10.1177/0022034520914246] [PMID: https://pubmed.ncbi.nlm.nih.gov/32162995] [PMCID: PMC7140973]

[7] Sabino-Silva R, Jardim AC, Siqueira WL. Coronavirus COVID-19 impacts to dentistry and potential salivary diagnosis. Clinical Oral Investigation 2020; 24:1619-21. [DOI: 10.1177/0022034520914246] [PMID: https://pubmed.ncbi.nlm.nih.gov/32078048] [PMCID: PMC7088419]

[8] Peng X, Xu X, Li Y, Cheng L, Zhou X, Ren B. Transmission routes of 2019-nCoV and controls in dental practice. International Journal of Oral Science 2020;12(9);1-6. [DOI: 10.1038/s41368-020-0075-9] [PMID: https://pubmed.ncbi.nlm.nih.gov/32127517] [PMCID: PMC7054527]

[9] Wu F, Zhao S, Yu B, Chen YM, Wang W, Song ZG, et al. A new coronavirus associated with human respiratory disease in China. Nature.2020,03;579 (7798):265-69. [DOI:10.1038/s41586-020-2008-3] [PMID: https://pubmed.ncbi.nlm.nih.gov/31967327]

[PMCID: PMC7094943]

[10] Lu CW, Liu XF, Jia ZF. SARA-CoV2 transmission through the ocular surface must not be ignored. The Lancet. 2020 ;395(10224):e39. [DOI: 10.1016/S0140-6736(20)30313-5]. [PMID: https://pubmed.ncbi.nlm.nih.gov/32035510] [PMCID: PMC7133551]

[11] Belser JA, Rota PA, Tumpey TM. Ocular tropism of respiratory viruses. Microbiology and Molecular Biology Review 2013 ;77(1):144-56. [DOI: 10.1128/MMBR.00058-12] [PMID: https://pubmed.ncbi.nlm.nih.gov/23471620] [PMCID: PMC3591987]
[12] Kampf G, Todt D, Pfaender S, Steinmann E. Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. Journal of Hospital Infection 2020 ;104(3):246-51. [DOI:10.1016/j.jhin.2020.01.02] [PMID: https://pubmed.ncbi.nlm.nih.gov/32035997] [PMCID: PMC7132493]
[13] Chen J. Pathogenicity and transmissibility of 2019-nCoV-a quick overview and comparison with other emerging viruses. Microbes and Infection;2020 ;22(2):69-71. [DOI: 10.1016/j.micinf.2020.01.004] [PMID: https://pubmed.ncbi.nlm.nih.gov/32032682] [PMCID: PMC7102641]
[14] Peng X, Xu X, Li Y, Cheng L, Zhou X, et al. (2020) Transmission routes of 2019-nCoV and controls in dental practice. International Journal of Oral Science 12: 1-6. [DOI:10.1038/s41368-020-0075-9] [PMID: https://pubmed.ncbi.nlm.nih.gov/32127517] [PMCID: PMC7054527]
[15] Meng L, Hua F, Bian Z. Coronavirus disease 2019 (COVID-19): Emerging and future challenges for dental and oral medicine. Journal of Dental Research 2020; 99:481-7. [DOI: 10.1177/0022034520914246] [PMID: https://pubmed.ncbi.nlm.nih.gov/32162995] [PMCID: PMC7140973]
[16] Sawhney A, et al. Aerosols how dangerous they are in clinical practice. Journal of Clinical and Diagnostic Research 2015;9: ZC52-7. [DOI: 10.7860/JCDR/2015/12038.5835] [PMID: https://pubmed.ncbi.nlm.nih.gov/26023644] [PMCID: PMC4437160]
[17] Preventive Guidelines for Dental Professionals on the Coronavirus Threat. Available from: https://www.ida.org.in/pdf/IDA. Recommendations for dental professionals on the Coronavirus threat. [efaidnbmnnnibpcajpcglclefindmkaj/https://www.ida.org.in/pdf/IDA_Recommendations_for_Dental_Professionals_on_the_Coronavirus_Threat.pdf]
[18] Dental Council of India. Available from: [http://dciindia.gov.in/Admin/News Archives/ L.No.8855].
[19] Infection Control Guidance: SARS-CoV-2. 2024. https://www.cdc.gov/covid/hcp/infection-control/index.html
[20] World Health Organization. 2020. Mar 13, Clinical management of severe acute respiratory infection when COVID-19 is suspected https://tinyurl.com/s23yv4p.

[21] Wang D et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. Journal of American Medical Association 2020 ;323 (11):1061-69. [DOI:10.1001/jama.2020.1585] [PMID: https://pubmed.ncbi.nlm.nih.gov/32031570] [PMCID: PMC7042881]

[22] Prem K, Liu Y, Russell TW, Kucharski AJ, Eggo RM, Davies N. The effect of control strategies to reduce social mixing on outcomes of the COVID-19 epidemic in Wuhan, China: A modelling study. The Lancet Public Health 2020;5:e261-70.[DOI:10.1016/S2468-2667(20)30073-6] [PMID: https://pubmed.ncbi.nlm.nih.gov/32220655][PMCID: PMC7158905]

[23] Christopherson DA, Yao WC, Lu M, Vijayakumar R, Sedaghat AR. High-efficiency particulate air filters in the Era of COVID-19: Function and efficacy. Otolaryngoloy and Neck Surgery 2020 ;163(6):1153-55.[DOI: 10.1177/0194599820941838] [PMID: https://pubmed.ncbi.nlm.nih.gov/32662746]

[24] Obitková D, Mráz M, Pavlík E. Virus removal by high-efficiency air (HEPA) filters and filtration capacity enhancement by nanotextiles: a pilot study. Folia Microbiology (Praha). 2024 ;69(2):459-64. DOI: 10.1007/s12223-024-01137-4] [PMID: https://pubmed.ncbi.nlm.nih.gov/38353790][PMCID: PMC11003890]

[25] Prem K, Liu Y, et al. The effect of control strategies to reduce social mixing on outcomes of the COVID-19 epidemic in Wuhan, China: A modelling study. The Lancet Public Health. 2020; 5(5):e261-70. [DOI:10.1101/2020.03.09.20033050] [PMID: https://pubmed.ncbi.nlm.nih.gov/32220655][PMCID: PMC7158905]

[25] Rafieepour A, Masoumi Gh, Dehghani A. Health responses during the COVID-19 pandemic: An international strategy and experience. Health in Emergencies and Disasters Quarterly. 2021; 6(3):147-160. [DOI:10.32598/hdq.6.3.310.1] [http://hdq.uswr.ac.ir/article-1-344-en.html]

[26] Domres B, et al. Ability of the so-called APURO air washing process to disinfect germs like COVID-19 in the indoor air and on surfaces. Health in Emergencies and Disasters Quarterly. 2021; 6(4):197-198. [DOI:10.32598/hdq.6.4.3] [http://hdq.uswr.ac.ir/article-1-395-en.html]