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ORIGINAL ARTICLE

A Study to Assess the Knowledge and Perception of Practicing Dental Professionals Toward COVID-19 in Lucknow City

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Abstract

Introduction Coronavirus belongs to family of Coronaviridae, which primarily infect the upper respiratory and gastro intestinal tract of birds & mammals. It is an enveloped virus with positive—sense single—stranded RNA. Patients with COVID-19 are usually present with symptoms of fever, dry cough, myalgia, dysgeusia, nausea, diarrhoea, hyposmia and later it progresses into pneumonia. Dentists are at potential risk because they are in consistent exposure of blood and saliva, so they should have knowledge of COVID-19 infection, transmission & prevention for proper infection control practices.

Aims and Objectives The aim of the study is to assess the knowledge and perception of DHPs toward COVID-19.

Methodology A cross-sectional study was undertaken among practicing dental professionals in Lucknow city (U.P) India. A total of 302 Dental Health Practitioners (DHPs) participated in the study. Knowledge was assessed using self-administered, structured questionnaire. The questions were administered online through Google Forms by sending link to the registered Dentist through E-mail.

Results A total of 350 DHPs were participated in the study, among which 302 DHPs has given complete responses and was included in the analysis. Simple linear regression showed a significant relationship between knowledge with age of dentist ($p < 0.001$), qualification as MDS ($p = 0.025$), practice as private ($p < 0.001$), experience between 5 and 10 years ($p = 0.009$), and experienced more than 10 years($p = 0.006$). Correct answers in each sections of questionnaire were defined an internal consistency was assessed using Cronbach's alpha.

Conclusion Despite having high standard of knowledge, practices and perceptions DHPs around the world are in a state of anxiety and fear while working in their respective field due to COVID-19 impact. DHPs are advised to follow the guidelines for clinical recommendations given by health authorities like WHO, CDC, ADA and IDA.

Keywords COVID-19 · Community dentistry · Dental practitioners

Introduction

The epidemic of novel β-coronavirus (2019-nCoV) originated in seafood market of Wuhan city, Hubei Province, China which has become a global public health emergency with an increase in mortality and morbidity for not only China but also to the other countries of the world.

On Jan 8, 2020, a novel coronavirus was officially announced as a causative pathogen of COVID-19 by the Chinese Centre for Disease Control and Prevention [1]. On Feb 11, 2020 WHO named the novel viral pneumonia as "Corona virus disease (COVID-19),while the International Committee on Taxonomy of Virus suggested it name as Sars-CoV-2 due to its phylogenetic and taxonomic analysis [2]. WHO declared COVID-19 a pandemic on March 11, pointing "alarming levels" of spread, severity and inaction [3].

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Corona virus belongs to family of coronaviridae, which primarily infect the upper respiratory and gastro intestinal tract of birds and mammals [4]. It comprises of single, plus stranded RNA as their genome. By comparing the available genome sequence data for known corona virus strain, we can firmly determine that Sars CoV-2 originated through natural process [5]. One of the coronaviruses isolated from pangolins comprised s genome that was 99% similar to Sars CoV-2 indicating that the pangolins may be the intermediate host of 2019-n CoV [1].

The 2019-nCoV represent the typical coronavirus structure with the "spike protein" in the membrane envelope and it also expressed other polyproteins,glycoproteins, 3-chymotrypsin and papain like protease. The S-protein from coronavirus binds to the ACE2, CD 26 and EZRIN receptors of the host to facilitate entry into the target cells.

Patients with COVID-19 are usually present with the symptoms of fever, dry cough, myalgia, nausea, diarrhea, dysgeusia, hyposmia later it progress into pneumonia or acute respiratory distress syndrome. The individuals suffering from cardiovascular or immunosuppression disease are at higher risk.

Dentists' should have knowledge of COVID-19infection, transmission and prevention for proper infection control practices. Itis important that dentists are aware of the disease incubation period and that elective treatment is delayed until the incubation period has passed to reduce the risk of transmission [6].

Dental professionals should practice good hand hygiene and should do initial screening via telephone to identify suspected or confirmed cases. Respiratory history & travel history must be taken for the last 14 days. On arrival of the patient in dental clinics temperature should be taken using contact free thermometer or infrared thermal sensors. Every patient should be considered as potentially infected by the virus [7].

Dental patients and professionals are exposed to pathogenic microganisms that can be transmitted in dental settings through inhalation of airborne microganisms that remain suspended in the air for long periods, direct contact with blood, oral fluids, patient materials, contact of conjunctival, oral and nasal mucosa droplets, coughing & talking without a mask from infected patients. The best protection for the dental practitioners is heightened sense of awareness, avoiding unnecessary contact with patients that may have coronavirus [8].

Emergency dental care should be provided with advice on strict personal protection measures to reduce and avoid production of droplets and aerosols, use of high-volume aspiration has been recommended [9].

The Centre for Disease Control and Prevention has recommendations for dental office infection control to prevent the spread of disease [10]. Because there is neither definite treatment nor vaccine so prevention and infection control practices are crucial for Dental Health Practitioners. The global containment strategy includes the rapid identification of laboratory-confirmed cases and their isolation and management either in a medical facility or at home.

India is still suffering from outbreaks of COVID-19, and the battle to control the infection continues, especially within healthcare facilities. Dentist should be updated about the information on current Sars CoV-2 knowledge and infection control practices on a wider scale to identify existing gaps and set ideal measures to address training deficiencies. Therefore, the aim of this study was to assess COVID-19 knowledge among dental practitioners in Lucknow city (U.P.) India.

Objectives

1. To assess awareness about the procedures concerning prevention &infection control from COVID-19 in dental office.
2. To identify factors associated with recommended management practices of patients.

Materials and Methods

A cross-sectional study was undertaken among practicing dental professionals in Lucknow city (U.P) India. A total of 302 Dental Health Practitioners (DHPs) participated in the study. Knowledge was assessed using self-administered, structured questionnaire. The questions were administered online through Google Forms by sending link to the registered Dentist through E-mail.

Exclusion Criteria

- DHPs not willing to participate in the study
- DHPs who are not registered with U.P. Dental Council.
- DHPs who have given the incomplete responses.

Inclusion Criteria

- DHPs willing to participate in the study
- Dentist who are registered with U.P. Dental Council
- Dentist working in Private & public sectors in Lucknow city regardless of their specialties.

- Approval of the study was obtained from institutional research and ethics committee.
- Informed consent was obtained from all the dentists before starting of the study. The eligible and willing participants received the structured questionnaire via E-mail and complete anonymity and confidentiality were assured.

Study Area

The survey was conducted on the dentist practicing in private & public sectors in Lucknow city, (U.P) India.

Study Design

A cross-sectional study was undertaken for 2 weeks in the month of April2020 among Dental Health Practitioners in Lucknow city(U.P.)India. Study participants were active practicing members registered with U.P. State Dental Council.

Sample Size Calculation

The required sample size was calculated to be 263 dentists based on the following assumptions: margin of error = 5%, confidence level = 95%percentage of dentists with correct knowledge (78%) of Corona that can be prevented by good hygiene practices. However, data are collected from 302 respondents.

Sampling Technique

A list of registered Dental Practitioners was taken from U.P. State Dental Council office, with proper application of keeping the contacts and names to be kept confidential. A simple random sampling technique was used to select the Dental professionals. Then the dental professionals were contacted and aim of the study was explained to them completely to make their full participation. Link of the survey was sent via E-Mail to the DHPs who are willing to participate in the study on Google forms.

Pilot Study

The pilot study was conducted on 30 DHPs to check the validity of questionnaire. The respondents were also asked for feedback whether they have any difficulty in answering the questions or any ambiguity to what sort of answer were required. Based on the feedback a few modifications have been made so as to make understanding of the questionnaire easy. The participants of pilot study are excluded in the final analysis.

Data Collection Tool

Based on previous studies on MERS-CoV a self-structured questionnaire was developed in English language to assess the knowledge of Dental Health Professionals in Lucknow city, (U.P.)India about COVID-19, using WHO, Centre for Disease control(CDC)& MOH India as the scientific basis for the questionnaire and assuring that dentist responses should be kept confidential.

31 questions were included in the study which is divided into three parts. First part includes the personal information like (age, qualification, years into practice, area of employment), whereas second part consist of 26 self-structured, closed-ended questionnaire to assess the knowledge and of dental practitioners regarding reservoir, source of transmission, clinic features, signs & symptoms, incubation, prevention, management, ADA specifications and about government policies and third part consist of 5 questions about perception where a respondent have been asked to select YES or NO.

Statistical Analysis

Statistical analysis was done using SPSS version 22.0 (IBM Corp). The result was expressed in percentages. Multiple variable linear regression analysis was carried to assess the association of participants demographics and professional characteristics with the knowledge scores.

Correct answers in each section were defined & internal consistency was assessed using Cronbach's alpha which was found to be 0.73. Scores were created by counting correct responses, knowledge of virus transmission, identification of patient infected with infection, history taking practices relevant to CoV-2. Regression models were developed to assess the exposure and outcome variables.

Results

A total of 350 DHPs were participated in the study, among which 302 DHPs have given complete responses and were included in the analysis.

Table1 Characteristics of participants by Covid19 knowledge

		Mean	N	Std. dev	Min	Max	*p* value*
Age	< 30	18.7	110	2.93	12	26	
	31–45	21.4	160	2.94	13	26	
	45 above	23.1	32	1.96	18	26	< 0.001
Qualifications	BDS	19.5	144	2.96	12	26	
	MDS	21.6	158	3.15	13	26	< 0.001
Type of practice	Government	22.3	84	2.90	15	26	
	Private	19.9	218	3.09	12	26	< 0.001
Years into practice	< 5 years	19.0	124	3.09	12	26	
	5–10 years	20.7	80	3.16	13	26	
	> 10 years	22.4	98	2.37	16	26	< 0.001
Total		20.6	302	3.22	12	26	

*F test

SocioDemographic Characteristics (Table 1)

On the basis of age, the knowledge of participants about COVID-19 is more in the practitioners who are 45 or above as compared to participants who are below that age. The participants who are in between 31 and 45 years have more knowledge about it than participants who are less than 30 years of age. A significant difference in the response was observed in the age ($p < 0.0001$) as shown in Table 1.

On the basis of qualification dental practitioners who have Master's of Dental Surgery (mean21.6, SD 3.15) have more knowledge than Bachelor of Dental Surgery. A significant difference was observed in the response between graduates and post graduates ($p < 0.001$) as shown in Table 1.

DHPs who are practicing in government sector have more knowledge about COVID-19 transmission and precautions to be taken during dental procedures than the DHPs who are working in private sector ($p <$ o.001) as shown in Table 1.

DHPs who have more experience i.e., more than 10 years have more knowledge about COVID-19 (mean 22.4, SD 2.37) than DHPs who have less experience ($p < 0.001$) as shown Table 1.

Knowledge Regarding COVID-19 (Table 2)

When asked about the infectious strain of COVID-19, 118 (39%) of DHPs have correctly reported the strain. 268 (88.7%) have correctly reported about the transmission of disease and 294 (97.4%) have reported correctly about the transmission of disease through respiratory droplets, contacts and fomites.

150 (49.7%) about one third of the DHPs have correct knowledge about the intermediate host of COVID-19. The majority of the participants have reported 298 (98.7%) that fever, cough, sore throat, shortness of breath as symptoms, 291 (96.4%) have given correct response for its spread by sharing cups or plates, washrooms and shaking hands.

Additionally, 266 (88.1%) of participants reported correctly about transmission of disease by not following social distancing. Almost all of the DHPs have correctly reported about the ADA specification to postpone all the elective procedures for the next three weeks of COVID-19 outbreak.

The majority of the DHPs, 290 (96%) reported that hand washing with soap and water for 20 secs and alcohol-based rub is most important protection for the dentist and the staff. About 263 (87.1%) of DHPs have given the correct response that wearing of PPE can help prevent transmission of disease from active or suspected cases of COVID-19.

Almost all the DHPs 297 (98.3%) have correctly reported that respiratory and travel history within past 14 days is mandatory. 274 (90.7%) of dentist have correctly reported that we should use contact free thermometer to measure the temperature of all patient's coming to clinic.

Almost most of the DHPs 289 (95.7%) have reported correctly that disposable diagnostic aids and instruments should be used during dental procedure.

Approximately, one third of the dentists have correctly reported that 1% hydrogen peroxide and 0.2% povidone iodine is more effective pre-procedural mouth rinse than chlorhexidine.

68.5% (207) of DHPs have correctly reported that high speed hand piece with anti-retraction valve can reduce the black flow of bacteria and viruses in the tubes of dental units. 202 (66.9%) of DHPs have reported correctly that the use of rubber dam with high valve saliva ejector cannot reduce the production of droplets and aerosol.

Almost more than half of the DHPs reported correctly that 4-handed technique is beneficial for controlling

Table 2 Levels of Covid19 knowledge among dental practitioners in Lucknow City

	Correct answer	*n*	%
The infectious strain of 2019-n CoV is β CoV	Yes	118	39.1
The transmission of 2019-n CoV occurs from animals to humans through blood	No	268	88.7
Transmission of 2019-n- CoV occurs through respiratory droplets, contacts & fomites	Yes	294	97.4
The intermediate host of COVID-19 are pangolins	Yes	150	49.7
Fever, cough, sore throat, tiredness, shortness of breath are the symptoms of COVID-19	Yes	298	98.7
2019-n CoV can spread by sharing cups or plates, washrooms, shaking hands	Yes	291	96.4
Social distancing may not affect transmission of disease	No	266	88.1
The incubation period of individuals affected with 2019-n- CoV is 1–14 days	Yes	299	99.0
ADA has recommended dentist to postpone all the elective procedures for the next three weeks	Yes	258	85.4
Teledentistry must be used to assess the urgency of patients' need	Yes	291	96.4
Hand washing with soap & water for 20 secs and use of sanitizer is most important protection for the dentist and the staff	Yes	290	96.0
PPE module may not be followed by dentist	No	263	87.1
Respiratory and travel history of all the patients within past 14 days is necessary	Yes	297	98.3
Contact free forehead thermometer should be used to measure the temperature of all patients coming to dental clinic	Yes	274	90.7
Disposable diagnostic aids & instruments should be used during dental procedure	Yes	289	95.7
Chlorhexidine is more effective pre procedural mouth rinse than 1% Hydrogen peroxide& 0.2% povidone -iodine	No	112	37.1
High speed hand pieces with anti-retraction valve can reduce the backflow of bacteria & viruses in the tubes of dental units	Yes	207	68.5
Use of rubber dams &high-volume saliva ejector cannot reduce the production of droplets and aerosols	No	202	66.9
Is 4-handed technique beneficial for controlling infection in dental clinic	Yes	224	74.2
Intraoral radiographs can be performed in the COVID-19 positive patients	No	226	74.8
Chemo-mechanical method of pulp exposure is better than air abrasion or ultrasonic instrumentation	Yes	245	81.1
Hydroxychloroquine can be used as a prophylactic drug	No	80	26.5
Suspected or confirmed COVID-19 infected patients should pe treated in negative pressure treatment rooms/AIIRs (airborne infection isolation room)	Yes	283	93.7
The medical waste of COVID-19 disease treated suspected/confirmed patients are disposed in yellow bag with gooseneck ligation	Yes	256	84.8
Quarantine is different from Isolation	Yes	263	87.1
COVID-19 is man-made disease created in laboratory	No	167	55.3

The responses for the knowledge-based questions were "Yes", "NO" and "do not know". For the questions assessing the knowledge of COVID-19, those have corrected responses as 'Yes' a score of one was and zero for the incorrect response for'No' and for "do not know" response. Similarly, for those have correct response as 'No' and zero for the incorrect response 'Yes' and for "do not know" response. The total score was calculated with a minimum of zero and maximum nine

infection in dental clinic, extraoral radiographs are better than intraoral radiographs and chemo-mechanical method of pulp exposure is better than air abrasion or ultrasonic instrumentation.

80 (26.5%) approx. one-third of the DHPs have reported "NO" for the use of hydroxychloroquine (HCQ) as a prophylactic drug. 283 (93.7%) of dentist have reported correctly about the suspected and confirmed COVID-19 infected patients should be treated in Negative Pressure Treatment Rooms/AIIRs (Airborne Infection Isolation Room).

256 (84.8%) have reported that medical waste of COVID-19 infected patients should be disposed in yellow bag with gooseneck ligation.

263 (87.1%) of DHPs agrees that quarantine is different from isolation.

167 (55.3%) have correctly reported that COVID-19 is not a manmade disease in laboratory.

Perception (Table 3)

Almost all298(98.7%) of the DHPs reported that general population apart from health professional have major role in prevention of COVID-19. 300 (99.3%) agrees that government and private health sectors should work together for prevention of COVID-19 and 297 (98.3%) of the DHPs reported that government should take more steps for

Table 3 Perception question excluded from the knowledge section

General population apart from health professionals have major role in prevention of COVID-19	Yes	298	98.7
Private as well as government health sectors should work together for prevention of COVID-19	Yes	300	99.3
More steps should be taken by the government for health education, prevention and treatment of COVID-19 like diseases	Yes	297	98.3
Media is creating panic rather than awareness	Yes	230	76.2
Are you satisfied by the behavior of individuals during quarantine period	Yes	78	25.8

Health education, prevention and treatment of COVID-19 disease.230 (76.2%) of DHPs agrees that media is creating panic more than awareness. 78 (25.8%) of DHPs are only satisfied by the behavior of individuals during quarantine.

Association Between Knowledge and Demographic Variables (Table 4)

Simple linear regression showed a significant relationship between knowledge with age of dentist ($p < 0.001$), qualification as MDS ($p = 0.025$), practice as private ($p < 0.001$), experience between 5 and 10 years ($p = 0.009$) and experience more than 10 years ($p = 0.006$). The slope coefficient for ages was 0.084 so the age of dentist increases by 0.084 unit of knowledge for each extra years of age. The R^2 value was 0.311 so 31.1% of the variation in knowledge can be explained by the model containing age, education, type of practice and years of experience as shown in Table 4.

Discussion

This study provides an insight on the level of knowledge and perception of DHPs practicing in Lucknow city about on infection control with a special emphasis on COVID-19 during the time of outbreak in 2020.The transmission of COVID-19 poses a great risk to the people who comes in close contact with an infected person such as relatives and health care workers. The distance between working field and dentist is 35–40 cm, and certain procedures are very time-consuming, which puts the dentist at higher risk of contracting COVID-19 [12].

There are four genera of corona virus that cause the infectious diseases in humans and vertebrates. The α and β-CoV mainly infect the mammals and vertebrates while Υ and δ infect the birds. On the basis of phylogenetic analysis based on viral genome COVID-19 belongs to β-CoV. There are two main routes of transmission of COVID-19 that includes direct transmission via sneezing, coughing, inhalation of respiratory droplets, through contacts with nasal, oral and ocular mucosa and fomites and indirect transmission through saliva. It uses ACE2 receptors for cell invasion, ACE2 receptors are abundantly present in respiratory tract and salivary glands and they are considered as main targets of corona virus infection and i.e., why it can promote human to human transmission. It can also spread through sharing cups or plates, washrooms and shaking hands. COVID-19 spreads mainly among people who are in close contact (within about 6 feet) for a prolonged period. Spread happens when an infected person coughs, sneezes and droplets from their mouth and nose are launched in the air and lands in the mouths and noses of people.

Table 4 Results of multiple linear regression analysis

Variables	Regression coefficient (β)	Std. error	Standardized coefficients	t	p value
(Constant)	17.431	0.973		17.915	0.000
Age in years	0.084	0.031	0.225	2.726	0.007
Qualification as MDS	0.797	0.353	0.124	2.261	0.025
Private practitioner	−1.362	0.378	−0.19	−3.606	0.000
Experience between 5 and 10 yrs	1.106	0.42	0.152	2.634	0.009
Experience more than 10 yrs	1.591	0.57	0.231	2.792	0.006

Simple linear regression showed a significantrelationship between knowledge with age of dentist ($p < 0.001$), qualification as MDS ($p = 0.025$), practice as private ($p < 0.001$), experience between 5 and 10 years ($p = 0.009$) and experience more than 10 years ($p = 0.006$). The slope coefficient for ages was 0.084 so the age of dentist increases by 0.084 unit of knowledge for each extra years of age. The R^2 value was 0.311 so 31.1% of the variation in knowledge can beexplained by the model containing age, education, type of practice and years of experience

DHPs in this study could identify the main symptoms of COVID-19, which helps dentists to recognize the threat and take the necessary actions and is considered essential in the management and control of the spread of the disease [11].

In the present study it was found that the DHPs have knowledge about the intermediate host of COVID-19. A study done by research team from South China Agricultural University has invested more than 1000 metagenomic samples from pangolins and found that 70% pangolins contained β-CoV and one of the coronavirus they isolated from the pangolins comprised a genome that was very similar with that from 2019-n CoV, the genome sequence similarity was 99% indicating that pangolins are the intermediate host of COVID-19 [2].

Knowledge about respiratory disease contagion was noticed in other studies to be lower among dentist than among other health care providers, despite the proximity of patient to provider present in dental care. [11] In the present study, the DHPs have proper knowledge to identify the symptoms of COVID-19 which helps to recognize the threat and take necessary actions to control spread and management of disease. As the majority of the patients experiences dry cough, malaise, fatigue, shortness of breath and other atypical symptoms like muscle pain, confusion, headache, sore throat, diarrhea and vomiting. Among patients for whom CT (Computed topography) of chest has been done showed bilateral pneumonia, with ground glass opacity and bilateral patchy shadows. Patients of old age, hypertension, diabetes and other chronic diseases are at higher risk and show poor prognosis.

It is essential for a DHPs to know the exact incubation period because of its role in determining the safe period to treat symptomatic patients. The incubation period of COVID-19 has been estimated at 5 to 6 d on average, but there is evidence that it could be as long as 14 d, which is now commonly adopted duration for medical observation and quarantine of exposed persons [1]. The post infection period makes it challenging for medical staff to recognize the existence of COVID-19 infection which could increase the transmission of the disease during these lay periods therefore asymptomatic patients are a great threat to dentist and dental staff. So, the DHPs should have high level of awareness and integrity to deal with the disease and able to control and manage its spread.

In the present study most of the DHPs are aware of ADA recommendation to postpone all the elective procedures and perform emergency dental procedures only with standard precautions so as to prevent transmission of disease in their offices. Closing of the dental practices during the pandemic can reduce the number of affected individuals, but it will increase the suffering of patients in need of urgent dental care and i.e., why ADA has given a standard guideline for DHPs to start the practice and manage the patients in urgency.

DHPs in the present study are aware of performing phone triage to determine the real need of emergency treatment like hemorrhagic events, trauma, abscess. This will definitely reduce the contact period between patients and the health care provider. Patients should be asked regarding respiratory and travel history for the last 14 days; they should be allowed to visit the dental office only if the entire questionnaire is in negative. Upon patient's entry into the dental office data collection on patient's history is repeated, body temperature must be taken with contact free thermometer or infrared thermal sensors. If body temperature is >37.5 °C postpone the treatment and patient must be referred to designated hospitals. In this context, recording properly the travel history of the patient prior to any treatment becomes paramount. In the study done by Kamate et al. [12] 96.2% of the dentist reported including the travel history while recording the history of the patient and this was important in timely diagnosis, which could prevent further propagation of infection [12]. In developing countries, purchasing extra PPE (gowns, gloves, etc.) and the cost of the fumigation/sterilizing of the dental clinic can impact the dental clinician financially; hence, incorporating the travel history can help significantly reduce the transmission as well as the burden of the disease. International travelling has sharply increased over the past few years due to declining air fares, easy accessibility, flexible timings, and an increasing number of airports, which in turn is contributing to traveler–associated infections (especially respiratory infections) [12].

In this study it was found that DHPs have given that attention to hand hygiene with soap and water for 20 secs and use of sanitizer before, during and after dental procedure. In the study conducted by Kamate et al. [12] Alarmingly, only 43.8% of the dentists reported that their staff were sensitized as per the WHO guidelines for the prevention of COVID-19 [12]. This is because fecal-oral route is considered one of the COVID-19 transmission routes and they should take extreme caution to avoid contact with their own facial mucosa surfaces, including mouth, eyes and nose during dental procedures. In the present study majority of DHPs reported that we should treat the COVID-19 suspected and infected patients in Negative pressure rooms as they use lower air pressure to allow outside air into the segregated environment. This trap and keeps potentially harmful particles within the negative pressure room by preventing internal air from leaving the spores. So, we must isolate patients in NPR (negative pressure rooms) and AIIRs (airborne infection isolation rooms).

Dentists response to prevention measures was better for personal protective equipment and disinfection and

sanitation procedures than for measures applied to dental staff or patients, such as special clothing or ventilation. PPE can provide protection and reduce the risk of nosocomial infection and cross transmission in the dental setting. The use of PPE along with protective glasses, face shields, masks, gloves, shoe covers, head caps in the routine dental practice has now become mandatory to prevent operator from contamination with blood and saliva while treating patients because asymptomatic patients can be potentially contagious. Single use disposable diagnostic aids and instruments are acceptable and highly recommended alternative if they are used only once and disposed of correctly.

A preoperative mouth rinse with oxidative agent have been suggested in surgical procedures in the literature, chlorhexidine has been reported to have an effective virucidal activity on enveloped viruses, such as HSV 1& 2, HIV, CMV, Influenza A, parainfluenza, Hepatitis B (Park et al.1989; Bernstein et al. 1990; Baqui et al.2001; Eggers et al. 2018). At present, there is lack of systematic data on the use of chlorhexidine mouth rinses for the reduction of microbial load related to SARS-CoV-2. [13] However, the oxidative agents like 1% hydrogen peroxide H202, 0.2% povidone iodine are highly recommended as they significantly reduce the microbial load in patient's saliva.

The coordination in between the dentist and the assisting team is the key factor to achieve good practice, sterilization and also to conserve the time during the procedure. All these particular things can be achieved by incorporating and improving the 4-handed dentistry. [14] Dental hand pieces utilize high-speed gas to rotate with running water, which leads to the generation of a considerable number of droplets and aerosol mixed with the patient's saliva or blood. [15] The high-speed dental handpiece without retraction valves may aspirate and expel the debris & fluid during dental procedures, most importantly microbes including bacteria and viruses may contaminate the water, air tubes and cause cross-contamination within the dental unit, thus anti retraction high speed dental hand piece can significantly reduce the backflow of oral bacteria and viruses into the tubes of hand piece. Therefore, the use of handpiece without anti retraction valves should be prohibited during the pandemic.

In the present study it was found that the DHPs agree that rubber dam should be used whenever possible as this will significantly reduce the spread of microorganisms. Using rubber dam with high volume saliva ejector reduces the generation of droplets and aerosols or spatter mixed with patient's saliva and blood. If not possible to use rubber dams for any reason, manual tools such as Carisolvs or hand scalers are preferable [15]. Conventional caries removal is done by the use of a drill on a high-speed hand piece to gain access to the carious lesion as a result there is a generation of spatter, aerosols contaminated with saliva and blood as compared to chemo mechanical method like Caridex (chemical got ability to dissolve carious dentin) which is more beneficial at the time of COVID-19 outbreak as applying of which can dissolve the carious dentin and prevent the exposure of DHPs from aerosols[16]. Intraoral radiographs are the most common radiographic technique in dental imaging, but it can stimulate saliva secretion, coughing and gag reflex hence extra oral radiographs like panoramic radiograph and cone beam CT are appropriate during COVID-19 outbreak.

In the study done by Gendrot et al. in the year 2020 it was found that Hydroxychloroquine, which is used in autoimmune diseases such as rheumatoid arthritis and lupus, has also demonstrated in vitro antiviral activity against SARSCoV-2 with an EC50 of 0.72 μ M. Hydroxychloroquine was found to be more potent than chloroquine phosphate (EC50 5.47 μ M). Preliminary clinical data showed that hydroxychloroquine at 600 mg daily cured 70% of patients (n = 20) at day 6 after the first drug intake. The efficacy of hydroxychloroquine was improved by combining this drug with azithromycin, an antibiotic with antiviral properties against other RNA-viruses such as Zika virus [17].

The Indian Council of Medical Research, under the Ministry of Health and Family Welfare, has recommended chemoprophylaxis with hydroxychloroquine (400 mg twice on day 1, then 400 mg once a week thereafter) for asymptomatic health-care workers treating patients with suspected or confirmed COVID-19, and for asymptomatic household contacts of confirmed cases. The document states "its use in prophylaxis is derived from available evidence of benefit as treatment and supported by preclinical data." Although some in-vitro evidence supports the antiviral activity of hydroxychloroquine and its precursor chloroquine, there is no peer-reviewed publication that evaluates either drug for exposure prophylaxis of SARS-CoV-2 infection. Even for treatment of diagnosed cases, only one small study reported faster nasopharyngeal viral clearance, with no data for clinical improvement. This evidence, or the lack thereof, hardly justifies state-endorsed, widespread use of hydroxychloroquine for prophylaxis [18]. After high risk or moderate risk exposure to COVID-19, hydroxychloroquine did not prevent illness compatible for confirmed infection when used as postexposure prophylaxis within 4 days after exposure [19].

In the present study it was found that DHPs have adequate knowledge about disposal of medical/infectious waste of COVID-19 infected individuals including disposable PPE that should be transported to the temporary storage facility and should be disposed in double layer yellow color medical waste package bags with 'gooseneck ligation'. We should handle equipment's soiled with blood,

body fluids, secretions in such a manner to prevent skin and mucous membrane exposure, contamination of clothing and transfer of pathogens to other patients. Reusable tools and equipment must be properly pre-heated, cleaned, sterilized and properly stored until the next use.

Majority of the DHPs have a proper knowledge about difference between quarantine and isolation in the present study. Isolation and quarantine are public health practices used to protect the public by preventing exposures to people who have or may not have a contagious disease. Quarantine is to separate and restrict the movement of people who were exposed to a contagious disease to see if they become sick. These people may have been exposed to a disease and do not know it, or they may have the disease but do not show symptom whereas isolation separates sick people with a contagious disease from people who are not sick.

In the present study more than half of the DHPs agree that COVID-19 is not created in laboratory. Study done by Scripps Research Institute states that the evidence of natural evolution was supported by data on SARS-CoV backbone and its overall molecular structure. If someone seeking to engineer a new corona virus as a pathogen, they would have constructed it from backbone of a virus known to cause illness. But the scientists found that SARS-Cov-2 backbone differed substantially from those of already known corona viruses and mostly resembled to viruses found in bats and pangolins. The Sars-CoV-2 spike protein was so effectively binding the human cells infect, that the scientist concluded that it was the result of natural selection and not the product of genetic engineering. "These two features of the virus, the mutations in the RBD portion of the spike protein and its distinct backbone rules out laboratory manipulation as a potential origin of Sars-CoV-2" said Anderson. In other scenario the virus evolved its current pathogenic state through natural selection in a non-human host and then jumped into humans as the previous coronavirus outbreak have emerged with humans contracting the virus after direct exposure to Civets (SARS) and camels (MERS) [5].

Majority of the DHPs in the present study have a perception that general population apart from health professional can play a crucial role in prevention of C0VID-19. As, the outbreak of COVID-19 has drastically changed the social life of individuals, since all mass gatherings and social events are being avoided to reduce the risk of transmission thus general population apart from health professionals have major role in prevention of COVID-19 by following the 'precautionary' instructions like maintaining social distancing of at least '6 feet' from others, promoting cough etiquettes, hand hygiene, placing a face mask. They should give priority to testing and treatment to optimize safety in current situation and they should address to the concerned authorities about transmitting of virus and someone in the family members are showing symptoms of it.

Almost all of the DHPs agree that private and government health sectors should work together for prevention of COVID-19. This will ensure that private laboratories or hospitals will not make any profit or lose any money, they should consider it as a national service. From diagnostic testing facilities, to hospital care, to health care personnel, there is at least much capacity in the private sector than government sector thus working together increase testing exponentially.

Majority of the DHPs (98.3%) have a perception that more steps should be taken by government for health education, prevention and treatment of COVID-19. So far government's testing protocol is limited to those who had travel history to COVID-19 affects countries or those who had come in contact with symptomatic people. The medical infrastructure in the country needs to be prepared for any possible influx of patient's on account of COVID-19. Isolation facilities should be prepared in every public & private hospitals along with adequate trained manpower and resources pools for ventilators and ICUs (Intensive care unit). The government maintained that as the burden was rising progressively, it was important to break the chain of transmission by strictly following social distancing protocols.

During the development of a new strain of an infectious agent, there might not be enough data available in scholarly journals and/or textbooks, and hence dentist might access trusted sites like the ones of the Centers of Disease Control and Prevention (CDC), WHO or the websites of health ministries of their respective countries for information [12]. Social media has always played a crucial role in spreading awareness and knowledge about public health, however, it has also been misused for spreading fake news, hatred and creating racism during epidemics and civic unrest. In the present study (76.2%) of the dentist believed that media has spread that transmission of virus through air and its survival on different surfaces created a panic, though people started wearing mask, but many lack the knowledge about their appropriate disposal which was evident from actions such as frequent touching to mask, use of same mask for more than a day, reuse of disposable mask and throwing the mask on the road or in regular dustbins. Due to existing medico pluralism in India, messages containing fake claims about use of herbal and immunity booster medicines, religious and spiritual ways of prevention and treatment are widely circulated which added to confusion. The panic was also added by escalating the fake news of mass killing of people in China which resulted in individuals fleeing from quarantine and isolation facilities.

Only (25.8%) of DHPs are satisfied by the behavior of individuals during quarantine. The corona virus pandemic has imposed a harsh reality of bereavement, illness and unemployment. At a community level fear and anger can descends into acts of scapegoating, stigmatization and discrimination. Positive health behaviors are essential to achieve individual well-being such as eating healthy, sleeping well, exercise, regularly spend time in nature.

From our study mean score of 21.6 ($p < 0.001$) was obtained indicating DHPs with higher qualification (post graduates) reported better and significant knowledge as compared to under graduates. Various authors have documented similar findings during ZIKA Virus and Ebola hemorrhagic fever pandemic.[12]It may be because post graduate studies involve performing researches and updating the knowledge on recent advancements and evidence-based studies.

In the present study the mean score of 22.3 ($p < 0.001$) was obtained indicating that the DHPs who are working in government sector have more knowledge than the DHPs who are practicing in private sector. This can be attributed to disparities in practicing dentistry, aimed more at the mass distribution of dental services, larger roster of patients and further education and training through continuing professional education and journal clubs particularly on symptoms and transmission which is essential in improving the knowledge of government DHPs about COVID-19 than private DHPs.

In the present study mean score of 22.4 for years into practice and 23.1for age indicates that knowledge about COVID-19 increases as the years into practice increases with age ($p < 0.001$) indicating that a young DHPs may be more updated about latest advancement and technologies, but does not have experience of an old one, older ones may have skill and knowledge that can only be gained by experience and can improve quality of care by following continuing dental education programs throughout entire career as a Dentist regardless of age and experience.

Despite the findings introduced here, the study has some limitations one of them being the social desirability bias. In order to eliminate it we did not ask for any personal information and assured the participants as to the confidentiality of their data. Secondly, the relatively low response rate, which resulted in a smaller than expected sample size, however, this is considered a moderate sample size. This could have been caused by the short period of data collection and data presented here are only representative of practitioners residing in Lucknow city (U.P) and knowledge among dental health care professionals can vary geographically.

Conclusion

India has seen a disruptive and sudden outbreak of COVID-19 in the last few months, requiring strict measures to limit the contagion (spread of virus). In this extremely difficult moment of pandemic, we are facing an unexpected and totally new situation. Our health authorities like WHO, ADA and IDA have given the guidelines for clinical recommendation of Dental practice. Being a Dentist, we must have knowledge to thoroughly evaluate each patient in terms of current health status and infected people to avoid cross contamination.

Despite having high standards of knowledge and practices, DHPs around the world are in a state of anxiety and fear while working in their respective fields due to COVID-19 impact on humanity. DHPs practicing in Lucknow city are aware of COVID-19 symptoms, transmission, infection control and measures to be taken in Dental clinics. However, the DHPs had limited comprehension of the extra precautionary measures that protect the Dental staff and other patients from COVID-19. It is advised that DHPs should regularly attend the continuing dental education programs and internet should be used to read journal articles related to such outbreaks tom constantly update their knowledge and safeguarding the interest of the people.

DHPs are giving more priority to dental procedures which are declared as emergencies by WHO and all other dental treatment are deferred until a time when the outbreak goes into recession. Guidelines released by reputable institutions should be sent by regional and national Dental associations to all the registered Dentist during crisis of COVID-19 outbreak, to make sure that dentist are well informed about the recommended disease management approaches.

Declarations

Conflict of interest All the authors declared no conflicts of interest in this research work for the publication.

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