

Dentists and Oral Radiologists Awareness and Attitude regarding Preventive and Infection Control Measures During Dental Radiographic Examination in the COVID 19 Pandemic: A Cross-Sectional Study

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ABSTRACT

Background: A novel coronavirus SARS CoV 2 is one of the major outbreak affecting various countries worldwide since December 2019, and is a big challenge for health care professionals due to the high rate of contagious spread. Dentists are more prone to acquire infection due to face to face communication with the patient, touch with infected equipment, and exposure to saliva, blood and handling of sharp instruments. Hence, it is mandatory to adhere to preventive and infection control protocols to reduce the spread of infection while radiographic examinations.

Materials and Method: This study included 168 dentists including oral radiologists who gave consent to fill the online survey structured questionnaire comprising of 40 questions pertaining to demographic information, COVID 19 transmission, its clinical symptoms, infection control measures and radiological considerations during COVID 19 pandemic. Fifteen questionnaires were not adequately filled, and final 153 completed responses were subjected to statistical analysis.

Results: Results showed that 76(49.7 %) dentists reported incubation period of 2-14 days, they were well aware of modes of transmission and clinical symptoms, touch 124(81%), droplet 131 (85.6%), hand mouth contact 121(79.1%), saliva 107(69.9%), airborne 91(59.4%) were suggested as primary routes in the dental setting, when questioned regarding infection control majority of dentists reported limitation of radiology staff 115 (75.1%), hand hygiene 131(85.6%), Social distancing 134 (87.5%) and use of protective PPE 126 (82.3%) as effective preventive measures to curtail the spread. In relation to radiographic protocols, their awareness level was comparatively less, 132 (86.2%) dentists advised radiograph in emergencies dental problems, nearly 50% advised intraoral radiograph and extraoral radiograph for cellulitis and maxillofacial trauma.

Conclusion: Dentists including oral radiologists were well aware of general characteristic features, and infection control measures related to COVID 19 infection, however they had limited comprehension about the radiographic protocols, therefore dentists should be made aware about various national and international

Received: July. 5, 2020: Accepted: Aug. 21, 2020

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guidelines designed for the crisis, and should keep themselves updated or join online course to prevent cross infections in radiology room in dental clinic or hospital.

Keywords: COVID 19, SARS –CoV 2, dental, extraoral imaging, infection control.

INTRODUCTION

COVID -19 is a new viral infection caused by a novel coronavirus, SARS-CoV-2 that has been declared by the World Health Organization (WHO), as major pandemic affecting millions of people across the globe. Since its origin in Wuhan, China in December 2019, COVID -19 has become challenging public health emergency of international concern.¹ India reported its first case in Thrissur district of Kerala in January 2020 and currently total confirmed cases in India has surpassed 90,000 with the highest spike reported in states of Maharashtra, Tamil Nadu, Gujarat and New Delhi. Although recovery rate has been reported to be 3.1% in India in comparison to 7.0% globally, still crisis is progressive, and on May 31 India saw the highest single-day spike with 8,360 new active cases. As on May 31, 2020 reports by Union Health Ministry total cases in India jumped to 1,82,143 with 86,984 recovered cases and 5,164 fatalities.² Based on the epidemiological research, COVID -19 outbreak started with an animal (bats) to human transmission followed by a sustained human to human transmission, in dental settings airborne transmission, and contact with an infected patient / contaminated surfaces or equipment are major modes of transmission.³ It has been documented in the literature that viral infections such as Human Immunodeficiency Virus (HIV), Hepatitis C virus, etc. spread through saliva, and blood, in consideration to this these routes are yet to be explored for COVID -19.²

Although Government agencies and medical health care professionals are doing collaborated efforts to fight this infection, dental professionals are facing major challenges in providing oral health care to the patients due to risk of cross-infection and dissemination by aerosol production. In concern to this, Centre of Disease Control and Prevention (CDC),⁴ American Dental Association (ADA),⁵ and state dental organizations have issued guidelines to defer routine dental procedures until pandemic is under control, telephone triage patients in need of urgent dental care and prescribe them appropriate antibiotics and analgesics followed by regular follow up by telephonic communication or video

conferencing. Radiographic examination and treatment of dental emergencies such as uncontrolled bleeding, maxillofacial trauma, and severe odontogenic infection should be performed by proper donning of a protective mouth mask.^{4,5} Suspected/Confirmed COVID-19 patients are not supposed to undergo dental examination, dentists are recommended to provide telephonic consultations, still if an emergency situation arises, the dentist should examine them in a separate isolation room with proper use of personal protective equipment (PPE) that includes wearing of N 95 masks or higher respirator, goggles or face shields, head caps, gloves and full-length surgical gown /or medical apron.³⁻⁵ Besides this, asymptomatic COVID 19 patients in the incubation period, which has been reported to range from 2 to 14 days on an average of 5.1 days, are not often aware of being infected or try to hide their symptoms on a dental visit and are a major threat for the professionals due to high risk of contagious spread.⁶

Various recommendations have been made such as detailed patient evaluation in triage or waiting area, the practice of hand hygiene for at least 20 seconds after each patient, use of PPE, disinfection of equipment and work area after each patient, radiography or treatment of COVID 19 suspected patient in the isolation area, etc., still few dentists are not aware of preventive and infection control measures especially from a radiological perspective.^{5,7} Therefore it is mandatory to encourage dentists including oral radiologists to adhere to infection control and preventive measures in their dental hospital/or clinics for control of corona infection spread which is the need of the hour. In consideration to above, this study was undertaken to assess the level of awareness, and attitude of dentists/oral radiologists working in private or Government hospitals or clinics in different states of India regarding radiographic considerations and infection control measures during COVID -19 pandemic

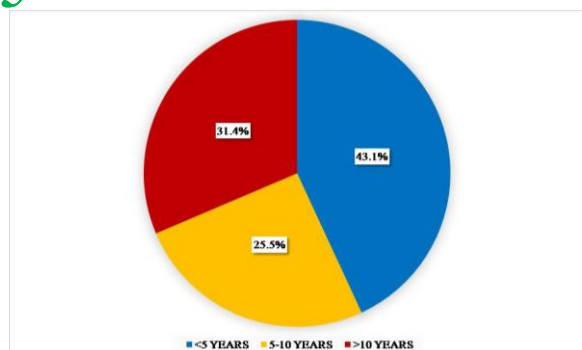


Fig 1: Distribution of study subjects based on years of clinical experience.

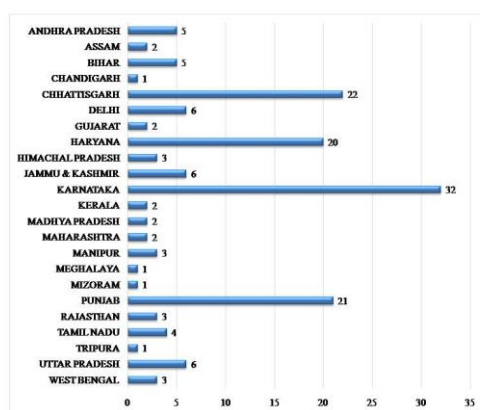


Fig 2: State wise distribution of study subjects.

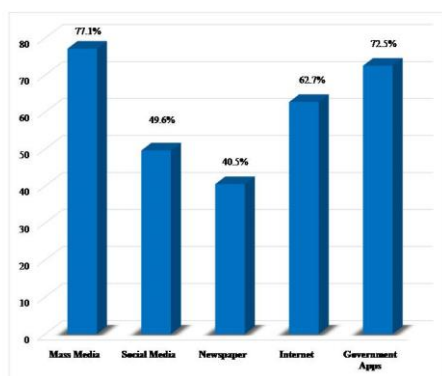


Fig 3: Distribution of study subjects based on source of information about COVID 19 pandemic.

MATERIALS AND METHODS

This is a descriptive questionnaire based, cross sectional survey conducted on dentists and oral radiologists working in different states of India either in private or government clinics /hospitals. Ethical clearance was obtained from the

institutional ethical committee. The survey was carried out in May 2020 using a structured multiple-choice online questionnaire consisting of series of 40 questions pertaining to socio-demographic characteristics, knowledge and attitude of dentists regarding radiographic and infection control measures during COVID 19 pandemic in dental clinics and hospitals. Questions of the survey were designed in English after reviewing pertinent literature and CDC ⁴, and ADA⁵ guidelines. The questionnaire was anonymous to maintain privacy and confidentiality of the information collected from the participants. Survey content validated was verified by two experts (n=2) from the field, who were oral radiologists with ten-year experience. Initial screening was done by one expert who thoroughly checked if all the questions captured the topic of the study effectively after approval second expert reviewed the questionnaire for double, confused or misleading questions. As suggested by experts, irrelevant or unclear questions were deleted and our final questionnaire comprised of 40 series of questions.

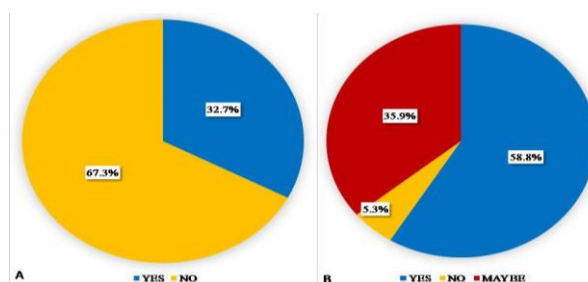


Fig 4: Study Subjects A) not joined or attended any online training course B) have plan to join online training course for COVID 19.

402 dentists, including oral radiologists, were approached to fill questionnaire via google form link (via WhatsApp groups/emails) and were also informed about the goal of the survey. One hundred sixty-eight dentists after entering the basic details about themselves, filled the questionnaire. Responses were made on a single Web page with one "submit" button that only allowed submissions through these unique links once. There was no option for participants to make more than one response to the questionnaire. Statistical analysis was done by using Statistical Package of social science (SPSS session 20, SPSS IN., Chicago, IL, USA), and frequency distributions of responses, i.e. % are presented in the form of bar and pie sector charts.

Table 1: Dentists awareness of the pathology of COVID 19 infection.

VARIABLES		N	%
Incubation period	2-14 Days	76	49.7
	2-7 Days	4	2.6
	7-14 Days	55	35.9
	7-21 Days	18	11.8
Mode of transmission	Airborne	91	59.4
	Fomites	45	29.4
	Blood	20	13.1
	Hand Mouth	121	79.1
	Faeco Oral	29	18.9
	Droplet	131	85.6
	Saliva	107	69.9
	Perinatal	14	9.1
	Touch	124	81
Symptoms	Fever	150	98
	Skin rash	31	20.7
	Cough	143	93.5
	Joint pain	61	39.9
	Breathlessness	138	90.2
	Red eyes	22	14.4
	Diarrhoea	59	38.6
	Sore throat	125	81.7
Onset	Abrupt	51	33.3
	Gradual	102	66.7
Oral manifestations	Xerostomia	30	19.6
	Taste alterations	69	45.1
	Ulcer	60	39.2
	Caries	3	1.9
	Depapillation	8	5.2
	Burning Sensation	19	12.4
	Candidiasis	6	3.9
	Nil	45	29.4
High risk patients	HCW	139	90.8
	Children	88	57.5
	HT	99	64.7
	DM	125	81.7
	Lung	148	96.7
	CVS	116	75.8
	Old	144	94.1
Complications	Acidosis	21	13.7
	ARDS	137	89.5
	Septic Shock	33	21.5
	Multi-organ Failure	64	41.8
	Severe Pneumonia	123	80.4
	Death	131	85.6

ARDS Acute Respiratory Distress Syndrome, **HCW** Health Care Workers, **CVS** Cardiovascular Disease, **DM** Diabetes Mellitus, **HT** Hypertension

Table 2: Practice of hand hygiene by the dentists during covid-19 pandemic.

VARIABLES		N	%
Frequency of cleaning hands	Always	124	81.1
	Sometimes	2	1.3
	often	17	11.1
	never	0	0
	After Each Patient	80	52.3
Materials used for hand hygiene	WW/Soap	74	48.3
	CW/Soap	42	27.4
	Eth 80%	67	43.7
	Iso Alc 75%	90	58.8
	Iso Alc 40%	8	5.2
	Iso Alc 60%	22	14.3
Duration of hand washing (in seconds)	10	4	2.6
	20	127	83
	30	21	13.7

RESULTS

Out of 402 dentists, 168 responded to fill the survey questionnaire, forming a response rate of 41.2% (168 participated out of 402). Their age ranged from 22 to 58 years with a mean age of 34.7 ± 9.2 years. All the responses were evaluated by our experts, 15 questionnaires were not completely filled, and they were excluded from the study, and 153 completely filled questionnaires were included consisting of 96 (62.7%) responses by females and 57(37.3%) responses by males. 135 (88.2%) participants worked in private clinics/hospitals, and 18 (11.8%) were employed in the Government sector. 66(43.1%) had < 5 years of clinical practice , 39(25.5%) 5-10 years , and 48(31.4%) practitioners had > 10 years of clinical practice (Figure 1). Most of the participants were from states of Karnataka (n=32) followed by Chhattisgarh (n=22), Haryana (n=20), Punjab (n=21) and remaining 58 were from other states as shown in Figure 2. Total of 110 (71.9%) possessed academic qualification of Master of Dental Surgery (MDS), 96 were MDS oral physician and radiologists, 38 (24.8%) had completed Bachelor of Dental Surgery (BDS) and 5 (3.3%) were PhD or had additional qualification such as Diploma, certified course, etc. Majority of practitioners used to update their knowledge regarding COVID -19 pandemic via mass media 118(77.1%) such as television, radio, etc., followed by Government Apps 111(72.5%) such as Arogya Setu App, internet 96

(62.7%), social media 76(49.6%) such as youtube, Whatsapp, Facebook, etc., and 62 (40.5%) used newspaper as a source of information [Figure 3]. The analysis of results is divided into five sections:

A) Dentists awareness about COVID-19 Pandemic

Table1 shows the percentage of dentists well aware of characteristic features of COVID 19 infection. Regarding incubation period, 76(49.7 %) reported 2-14 days, 55(39.5%) reported 7-14 days, 18(11.8%) reported 7-21 days and 4(2.6%) reported an incubation period of 2-7 days. Majority of participants reported correctly about main modes of transmission in the dental setting, touch 124(81%), droplet 131 (85.6%), hand mouth contact 121(79.1%), saliva 107(69.9%), airborne 91(59.4%) and remaining suggested other modes such as fomites, faecal-oral, blood, perinatal as shown in Table 1. Most of them reported fever 150 (98%), cough 143 (93.5%), , breathlessness 138(90.2%), and sore throat 125 (81.7%) as major symptoms of SARS CoV-2 infection [**Table 1**]. According to 102 (66.7%), participants onset of symptoms was gradual, and 51 (33.3%) agreed that too abrupt onset. When they were questioned about oral manifestations of COVID 19 infection majority of participants suggested taste alterations 69 (45.1%), oral ulcerations 60 (39.2%) and remaining 111 (72.5%) respondents reported burning sensation, candidiasis, depopulation, xerostomia, and dental caries as manifestations, out of 111, 45 (29.4%) suggested that SARS CoV 2 they haven't come across any oral manifestation of this virus. On the aspect of a high-risk group, 144 (94.1%) mentioned elderly population, medical comorbidities lung disease 148(96.7%), diabetes 125(81.7%), cardiovascular disease 116(75.8%), hypertension 99(64.7%) and 139 (90.8%), 88 (57.5%) mentioned health care workers (HCW) and children respectively. Majority of dentists reported acute respiratory distress syndrome (ARDS) 137(89.5%), severe pneumonia 123(80.4%), and ultimately death 131(85.6%) as major complications of COVID 19 infection.

B) The practise of hand hygiene by the dentists during COVID 19 pandemic

Majority of dentists reported that they cleaned their hands always 106 (69.2%) and after each patient

101 (66%) by using warm water and soap 74 (48.3%) and alcohol-based hand rub at various concentrations for 20 seconds 127(83%). Most respondents used isopropyl alcohol at 75% concentration 90 (58.8%), and 67 (43.7%) used ethanol 80% to scrub their hands. **Table 2** shows the practice of hand hygiene as a preventive measure by the dentists.

C) Awareness and practice of infection control and preventive measures by the dentists during COVID 19 pandemic

Results[**Table 3**] showed that all the respondents followed infection control protocols in their dental clinic/hospitals. Majority of respondents suggested limitation of dental/radiology staff 115 (75.1%), hand hygiene 131(85.6%), Social distancing 134 (87.5%) and use of protective PPE 126 (82.3%) are effective preventive measures to curtail the spread. They well-practised donning of PPE, 141 (92.1%) used face shields, 124 (81%) protective goggles, 141(92.1%) N95 respirator, 137 (89.5%) head cap and 143 (93.4%) gloves. They used to wear protective medical apron /gown, 92(60.1%) preferred full-length disposable gown, 79(51.6%) full-length surgical gown, 38 (24.8%) disposable plastic apron and 78(50.9%) preferred both disposable full-length gown and a plastic apron. Most of the respondents used to clean and disinfect PPE always 76(49.6%) and after each patient, 81(52.9%). According to them, PPE should be worn by both staff 112 (73.2%) and radio technician 144(94.1%). 106 (69.2%) reported that cleaning of radiological equipment should always be done and after each patient, 101 (66%) used sodium hypochlorite solution 98 (64%) or 99(64.7%) used isopropyl alcohol. Screening of patients before entry into the clinic was done by dentists always, and 121 (79.1%) used to screen patients at the waiting area. Screening methods used by dentists are shown in Table 3, dentists preferred recording patient history 152 (99. 3%) (travel history in last 14 days, history of recent exposure to COVID 19 symptomatic /suspected patient, any medical issues) as a primary screening method, and 122 (79.7%) recorded body temperature of the patients.

D) Awareness and practice of radiological considerations by the dentists during COVID 19 pandemic

Table 4 enlists awareness and practice of radiographic protocols followed by dentists in their dental clinics or hospitals. 107 (69.9%) dentists suggested that they avoid taking radiograph if suspected COVID 19 patient reports, and preferred to refer the patient to a nearby quarantine centre. On the other hand, few 28 (18.3%) preferred taking radiograph in a separate isolation room. On questioning of dental problems, 132 (86.2%) dentists advised radiograph for only emergencies dental problems such as maxillofacial trauma with trauma 112 (73.2%), dental trauma 104(67.9%), severe odontogenic pain 85 (55.5%), maxillofacial trauma with controlled bleeding 87 (56.8%) and other conditions dry socket pain, pericoronitis /third molar pain, neuropathic pain [Table 4]. Majority of dentists advised intraoral radiograph in case of severe dental pain 90(58.8%) and tooth fracture with avulsion/luxation 79(51.6%), they recommended extraoral radiograph for maxillofacial trauma 133 (86.9%) and cellulitis/space infection 103(67.3%), and if COVID 19 patient arrives for radiographic examination, majority of dentists preferred to take radiograph in isolation room 78(50.9%) and 58 (37.9%) did not advise radiograph. When questioned about choice of radiograph/imaging modality for localized dental pathology most of the dentists exposed intraoral periapical radiograph with mounted X-ray machine 68(44.4%), and 47(30.7%) used radiovisiography, and for generalized dental pathology mostly full mouth panoramic radiograph 115(75.1%) was imaging modality of choice. 45 (29.4%) captured the pathology with cone-beam computed tomography (CBCT). 62 (40.5%) dentists agreed, 40 (26.1%) were neutral, 29 (18.9%) disagreed, 15(9.8%) strongly disagreed, and 7(4.5%) strongly agreed that digital sensors offer better infection control than conventional films.

Regarding infection control measures followed during radiographic examinations, for COVID 19 patient with an emergency situation, 71 (46.4%) mentioned that imaging should be done in a well-ventilated room, 59(38.5%) temporarily closed room with air exchange filters, 18 (11.7%) temporarily closed room, and 5(3.2%)closed poorly ventilated room. For panoramic radiograph majority of dentists used only chin rest 74(48.3%), and barrier enveloped bite block 56(36.6%), 120 (78.4%) advised patients to wear N 95 mask and

20(13%) surgical mask Asymptomatic patient was made to wear the surgical mask by 50(32.6%) of dentists, and N95 mask by 45(29.4%) dentists. After finishing off the radiographic procedure, dentists 149 (97.3%) practised hand hygiene always and disinfected used equipment always and after each patient, 76(49.6%). 63 (41.1%) processed radiograph in the automatic processor, 38 (24.8%) used manual no-touch technique, 36 (23.5%) only manual method and 16 (10.4%) used self-developing films.

E) Educational perspectives

For proper knowledge and implementation of preventive and infection control protocols 50(32.7%) have attended or joined online training course, 103 (67.3%) haven't joined or attended any course, and most of them 90 (58.8%) plan to join in future, 55 (35.9%) may be joining, and 8(5.3%) were not interested in joining a course in future [Figure 4].

DISCUSSION

COVID 19 outbreak is a major challenge that dental professionals, assistants and patients have to face ever since December 2019, although many clinical trials of drugs such as chloroquine, remdivisir, convalescent plasma therapy, and vaccines are in process, there is no clear evidence of accurate and safe therapeutic treatment available to curtail the rapid transmission of COVID 19 infection.⁸ SARS CoV 2 comprises of the single-stranded RNA genome and uses Spike or S protein on lipid bilayer envelope to bind to the angiotensin-converting enzyme 2(ACE 2) receptors present on the host cell membrane.^{1,2} Oral health care professionals are at higher risk of acquiring infection due to close face to face contact with patients and aerosol, and droplet/splatter produced during dental procedures such as tooth preparation, ultrasonic scaling, etc. as these require the use of high speed or air turbine handpieces, besides this intraoral periapical (IOPA) radiographs induce cough and gag reflex thereby producing droplets which become a source of cross-infection among dentists and subsequent patients especially if the patient is positive for COVID 19 infection. Moreover, coronavirus has been studied to persist on plastic, metal or glass surfaces for a maximum of nine days and survives well in a humid environment.^{9,10}

The only key measure to slow down spread the infection in the dental setting is to follow preventive and infection control protocols designed by ADA, CDC and respective state organizations. Based on the current scenario, the purpose of the present study was to assess the awareness of dentists and oral radiologists about COVID 19, its mode of transmission and clinical presentation. To our best knowledge, this is the first study to assess the level of awareness of the oral radiologists and dentists regarding radiological and infection control measures, if in emergency dental situation COVID 19 patient reports to their dental clinic or hospital for examination.

In the present survey, dentists gave variable response regarding incubation period (IP) of the SARS –CoV 2 infection, majority of dentists reported it to be 2-14 days and awareness about IP necessary as it determines safe period to treat suspected patients.¹ In a case study of 181 confirmed patients, average IP was estimated to be 5.5 days, for 97.5% infected patients, symptoms appeared at 11.5 days, and fewer than 2.5 % became symptomatic within 2.2 days. Their findings signify that if the person gives a history of recent exposure to the suspected patient, quarantine of 2-14 days is required a majority of patients if infected show symptoms within this time period.¹¹

In dental settings, droplet or splatter, aerosols, saliva and touch with a contaminated surface are major sources of infection. Aerosols are a suspension of solid or liquid particles in a gas, containing bacteria or viruses, are small-sized < 5 µ m and little bigger sized particles from the splatter or droplet. Aerosols due to their small size, travel far distances, remain suspended in the air for longer duration and then enter patients/ dentists respiratory tract or settle on the environmental surfaces such as x-ray machine, table covers, doorknobs, computers, mobiles etc.^{9,10} Dentists are at risk of acquiring infection by the touch of contaminated or an infected surface and then touching their mouth or nose, in addition, most of the dental procedures involve unavoidable patient close contact, if the asymptomatic carrier/ symptomatic patient sneezes or coughs risk becomes higher, therefore wearing of protective mouth mask is mandatory.¹⁰ Recently saliva has been found to be a potential source of spread, and each cough can produce 3000 saliva droplet nuclei,

each sneeze can produce 40,000 droplets of saliva and get suspended in air, due to this saliva has been established as a non-invasive diagnostic tool for Detection of COVID 19 in dental settings.¹² Other routes such as perinatal, i.e. from mother to newborn, faeco oral, and blood are yet to be explored.^{1,2} In the present study most of the practitioners were well aware of the major modes of spread and reported droplet 131(85.6%), hand mouth contact 121 (79.1%) and airborne 91 (59.4%) as primary routes, 45 (29.4%) reported fomites as possible route as infectious particles on fomites reside on surfaces for a brief period, our findings were similar to a hospital-based survey of Jin YH et al.¹³, in which 87.5% suggested hospital environment as the primary source of infection.

This survey indicated that practitioners were adequately aware of the symptoms of COVID 19, and the majority of them suggested fever, cough, shortness of breath and sore throat as major symptoms. Recording of symptoms is utmost important as it helps in early detection of the infection and treatment decision, according to literature data, professionals in various countries consider patients history (travel history within last 14 days, any symptoms, history of recent exposure, medical comorbidities etc.) and recording of temperature by infra head thermometer as primary screening methods. In the present study, patient history as initial screening method was mentioned by 152(99.3%) dentists and recording of temperature by 122 (79.7%), similar results were reported by **Khader YS et al.**⁹, according to the author's patients with positive symptoms, or other findings of high fever, travel etc. should be treated in a well ventilated separate room with protective barrier equipment for emergency dental care, or they should be referred to nearby COVID 19 specialized centre. Our study results showed that small percentage of dentists 33(21.5%) were using pulse oximeters as it has been hypothesized that COVID 19 patients often have low blood oxygen saturation levels or have "silent hypoxia" and a pulse oximeter is one of the non-invasive devices that measure both blood oxygen saturation levels and pulse rate, oxygenated blood cells are displayed as bright red and non deoxygenated as dark red.¹⁴ According to literature search, Real-time Polymerase Chain Reaction (RT –PCR) performed on rectal or respiratory specimens is the most

reliable diagnostic method, that detects genome sequences with reduced errors.^{1,2}

Limited research studies have been conducted on oral manifestations of this virus, **Chen et al.**¹⁵ reported that ACE 2 receptors which are the main target of virus, are found in salivary gland ducts, in later stages high viral loads could be detected in the saliva of infected patients and virus has potential to destroy salivary gland tissue that eventually results in xerostomia and taste alterations. In this study, majority of dentists reported taste alterations (45.1%), oral ulcerations (45.1%) and xerostomia (19.6%) as main oral manifestations but future demands more studies in this domain.

When questioned regarding high-risk groups, most of them agreed that health care workers, patient with medical comorbidities such as chronic lung, renal, cardiovascular disease, hypertensive and diabetic patients, elderly patients are at higher risk due to inadequate immune response to fight the virus. Studies have reported that patients with severe pneumonia and acute respiratory distress syndrome, find difficult to recover due to severe damage of lungs by the virus, they present with poor prognosis, even if they survive its long way for complete recovery and such patients should be closely monitored for at least two weeks.¹⁶ In India many patients have recovered by joint efforts of medical physicians and government authorities of posing restrictions on the outward movement of people, quarantine of COVID 19 diagnosed patients, social distancing of 6 feet, wearing of protective mouth mask or face cloth covering while going out, the etc Mortality rate in India has been recorded to be lowest 3.1 % in comparison to 7.0% globally , and recovery rate has been reported to be 47.5%.²

We, as oral physicians are fore frontiers in performing a thorough clinical examination of the patient. Therefore it is necessary to follow preventive, and infection control protocols, thorough clinical evaluation or screening, is required at the hospital waiting area and at radiology front desk to avoid dissemination. The dental clinic should be divided into sections i) triage or waiting area; ii) Radiology or treatment room, and iii) isolation room. It has been recommended that all the dental equipment and PPE should always be disinfected, after each patient. Dentists should practice hand hygiene with solutions

containing 60 to 80% alcohol for at least 20 seconds after each patient and on touching infected surfaces, if the hands are deeply soiled initial washing with warm water and soap should be done.^{4,5,10} Related to this, our survey found that practitioners maintained hand hygiene, majority of them used warm water and soap 48.3% followed by isopropyl alcohol 75%(58.8%) and ethanol-based sanitizer 43.7%. To maintain infection control in their clinic, most of them cleaned used equipment after each patient, and 87.5% practised social distancing, 75.1% limited the radiology staff and 82.3%, conducted radiographic examinations by donning of PPE consisting of face shields, protective goggles, N95 mask, head cap, gloves and 51.6%, preferred to wear a disposable full-length gown, our results were consistent with the study by **Khader et al.**⁹

Various guidelines have been proposed for treatment, and radiographic examination of patients during COVID 19 outbreak, WHO has suggested dentists should defer routine or elective dental procedures and should prefer telephonic consultation for routine cases and for urgent dental problems such as severe dental pain, pericoronitis or third molar pain, dental trauma with avulsion, orthodontic pain, they should manage these conditions by prescription of appropriate antibiotics or analgesics .¹⁰ Radiographs for only emergency conditions should be taken such as uncontrolled bleeding, maxillofacial trauma with bleeding or controlled bleeding, and cellulitis or severe swelling compromising airway.⁹ The present survey revealed that 86.2% of dentists were well aware of above protocols, and preferred attending emergency cases, 58.8% of dentists advised intraoral radiographs in cases of severe dental pain, 79 % in tooth fracture with avulsion, 74 % in localized abscess and 44 % in third molar pain. Only 17 % considered need for radiograph in case of orthodontic pain. Majority of dentists advised extra-oral radiograph if the patient reports with cellulitis or maxillofacial trauma.

According to the literature review, intraoral radiographs should not be advised in COVID 19 scenario, as they result in discomfort, gag reflex and cough that increases chances of cross-infection, for localized pathology mobile handheld intraoral x-ray machine should be preferred as it is portable and becomes easy for the radiologist to shoot radiograph in the separate isolation room or in a

hospitalized patient with a dental emergency, sectional panoramic radiographs, extraoral periapical radiography (EOPA) or occlusal radiographs with increased angulation serve as a better option to capture periapical region. For generalized dental pathology, full mouth panoramic radiographs, cone-beam computed tomography (CBCT) and lateral oblique radiographs should be considered.¹⁷ Our findings showed that awareness of dentists in this prospective was above average, 44.4% of dentists used intraoral mounted radiographic machine, 17.6% advised sectional panoramic radiograph, and 40.5% agreed that digital offers with envelopes better infection control than conventional films as suggested by Mc Donald et al.¹⁸ Moreover, Digital radiography has advantages of less exposure, reduced retakes and elimination of processing procedures in comparison to conventional radiography.

Dentists are not suggested to take radiograph in suspected or confirmed COVID 19 patient, if an emergency situation arises they should be exposed in separate well ventilated or temporarily closed rooms with high-efficiency particulate air (HEPA) filters with proper wearing of N95 mask or higher respirator. In the present study, 37.9% dentists agreed that radiograph should be avoided for COVID 19 patient and 50.9% preferred to take radiograph in an isolation room, and the majority of them used HEPA filters for air exchange.¹⁹ For panoramic radiograph, only chin rest should be used, and this was reported by 48.3 % of dentists, and 36.6% preferred barrier enveloped bite block. After radiographic examination, 97.3% dentists practised hand hygiene, 84.9% cleaned and disinfected used equipment, 41.1% used to process films in automatic process and 23.5% preferred manual no-touch method. Despite the findings introduced, the limitation of the survey was the low response rate, that resulted than smaller than expected sample size, which may be due to our short period of data collection, this signifies the interest of dentists who were aware, updated themselves and actively participated in filling the questionnaire.

CONCLUSION

Our results indicate that dentists were well aware of the mode of transmission, symptoms and infection control measures in a dental setting, but they were

less aware of radiographic procedures or protocols. Therefore radiology staff and assistants should keep themselves updated about the various guidelines of infection control, although they vary based on the local epidemic situation. Limited researches have been conducted in the radiological domain, this necessitates the dentists to join online courses, 50 % of dentists wanted to join online training course and 35.9% were in a dilemma to join by our questionnaire survey. In future, more studies should be encouraged in this domain to enhance safe working environment in the radiology department for dentists and radiologists.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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