

Oral Health & Its Effect on COVID 19: Systematic Review & Meta Analysis

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Abstract

Introduction: The world has faced the pandemic of COVID-19 in the march of 2020 and still it continues to effect in 2021. Hence in the present study we aim to evaluate the Oral Health & its effect on COVID 19 as a Systematic Review & Meta Analysis.

Material and Methods: Online data was collected from the search engines of EBSCO, Pubmed, Google Scholar, Scopus. The searched terms were COVID 19, CORONA, SARS-CoV-2, clinical features, Wuhan, etc. The study articles were collected that from Jan 2020 to Feb 2021. Based on the PRISMA guidelines the meta analysis was performed.

Results: The final systematic review included 13 studies. Infection control is a theme that was discussed extensively in the literature and remains the main theme of many of the Covid-19 articles on dentistry. Telephone triage using questionnaire to evaluate potential risk of SARS-Cov-2 and type of dental care was implement in the following studies. Three studies recommended that patients coming for elective treatments with temperature > 100.4 F or 38 C should be postponed, if possible or performed in an Airborne Infection Isolation Rooms (AIIRs) or negative pressure rooms. The guidelines to establish real need of emergency dental treatment was recommended in the following studies. Importance of hand hygiene, limiting number of

patients in the waiting room/operatory, removal of shared objects, proper ventilation and social distancing was highly recommended.

Conclusion: The biggest concern will remain the aerosol generating nature of dental work. More research is required on aerosol's specific risk assessment and measures that can protect the dental work force and patients from aerosol and droplet infection. The economic and psychological aspect of Covid-19 pandemic also need special attention as the pandemic is taking a toll on the mental health of large segments of the population in these unprecedented and stressful times.

Keywords: COVID 19, Oral health, Systemic Review and Meta Analysis.

Introduction

The world went into a state of stand still after the declaration of the pandemic COVID-19.¹ There has been no specific therapy and treatment for the COVID-19 disease. Only recently the vaccine has been given in some countries.² However till date there has been no specific data on the clinical course and the prognosis of the disease.³⁻⁸ In all the available studies there were only reports of the cases observed that were admitted into the hospital, or in the centers of the specific region care centers.¹⁻⁹ There has been a surge of the articles about the COVID19 that are available online and in print.¹⁻⁸ The chief motive of all these encouragements was the gain of the knowledge and the COVID19 proof of the evidence. The meta analysis is tool that helps to generate good quality evidence based practice. Dental practitioners are facing uncertainty and are being forced to rely on general information on Covid-19 transmission routes and other guidelines being followed by general frontline health staff to protect themselves and their patients 22 . Dental practice serves as a contagion point and a vector for Covid-19 outbreaks in the population if appropriate protocols are not followed. With its outbreak, Covid-19 has raised the bar for delivering high-quality dental care around the globe. This scoping review is an effort to review all the relevant literature published so far on dental aspects of Covid-19 in order to serve as point of synthesis for future recommendations and guidelines for dental practices in these troubling times.

Materials and methods

We conducted the search for the data from the online sources like the "EMBASE", "Pubmed", "Scopus" and other sources. The study was conducted by two reviewers independently. The PRISMA ScR guidelines were followed.¹² The articles were collected from January 2020 to February 2021. The search words are META ANALYSIS, COVID, COVID19, SARS, CoV2, PANDEMIC. The disputes between the reviewers were cleared by consent.

The articles were screened for the abstract and the title for the initial screening. Later the entire text was studied by one reviewer and then was cross checked by the other reviewer. The present study was organized according to the PICOS. The inclusion criteria was COVID19, meta analysis of the epidemiological studies, case reports, other type of the studies like the systemic reviews that were with the meta analysis, comparison of the COVID19 with other respiratory type of diseases.

The following article types were excluded: incomplete information, meta analysis done before December 2019, meta analysis other than corona, research design that didn't fit the meta analysis protocol.

The study design that were considered in the present review were organized according to the title, author, country, date of publishing, the number of the articles in the study, the number of the patients included, the search engine used, the registration of the study, the protocol followed. Also the quality of the studies that were included for the present scoping review was analyzed by AMSTAR 2.0.¹¹ After the trail assessment, to check the quality of the articles in the meta analysis, the authors performed the data extraction and the stratification of the studies were done.

Results

A summary of characteristics of the studies is presented in Table 1. The exhaustive process of literature searches and screening of articles (last electronic search done on 22 nd April) is presented in the Prisma chart (Prisma ow chart Fig 1) 23 . Data base and manual search yielded 5,353 articles in total. 4913 Articles remained after elimination of duplicate records. Furthermore 4786 articles were removed after examining abstracts, following which 127 remained for full text assessment. The final systematic review included 13 studies after excluding 114 articles due to lack of relevance in outcome to our stated research question, letter to editor and articles in languages other than English were also eliminated. 6 original articles and 7 review articles were selected for the nal review. Four of the studies were cross sectional in nature 28, 33, 36, 37 . One study was a research article on practical recommendations for dentists during the Covid-19 pandemic 33 . Furthermore, there was one article from China based on outpatient department (OPD) records of 48 tertiary care hospitals in China 29 . Four of the studies were related to ndings in China. One each was conducted in Austria 30 , USA 31 , Jordan 33 and Italy 34 . Infection control is a theme that was discussed extensively in the literature and remains the main theme of many of the Covid-19 articles on dentistry 25, 26, 27, 30, 31, 34 . Telephone triage using questionnaire to evaluate potential risk of SARS-Cov-2 and type of dental care was implement in the following studies 25, 27, 31, 32, 34 . Three studies recommended that patients coming for elective treatments with temperature > 100.4 F or 38 C should be postponed, if possible or performed in an Airborne Infection Isolation Rooms (AIIRs) or negative pressure rooms 27, 31, 32 . The guidelines to establish real need of emergency dental treatment was recommended in the following studies 28, 30, 33 . Importance of hand hygiene, limiting number of patients in the waiting room/operatory, removal of shared objects, proper ventilation and social distancing was highly recommended 29, 31, 34 . The weighed Kappa for intra-observer reproducibility exceeded the 0.70 cut off, with a mean of 0.86, indicating almost perfect reproducibility; while the mean weighted Kappa (κ_w) for inter-observer reproducibility was 0.80, showing substantial reproducibility. The other key recurrent themes discussed in the reviewed articles were pre-procedural mouth rinses with 1% hydrogen peroxide or 0.2 % povidone iodine to reduce viral load of aerosols 25, 31, 34, 42 use of rubber dam and high-volume evacuation/suction (HVE) during aerosol generating restorative procedures was repeatedly advised to reduce airborne and surface contamination 25, 27, 31, 32, 34 . The theme of protective masks was recurrent in the literature and differing views were observed, some authors suggested wearing FFP1/standard surgical mask for non-aerosol generating procedures and FFP2/N95 or higher for aerosol generating procedures 25, 27 while several others suggested using FFP2/N95 for all procedures for both clinical and non-clinical staff 31, 34, 35 . Waste

management and psychological impact of Covid-19 on dental work force was another theme explored extensively in the literature 25, 28, 33, 34, 35, 36 .

Figure 1. Flow chart describing the selection of the articles

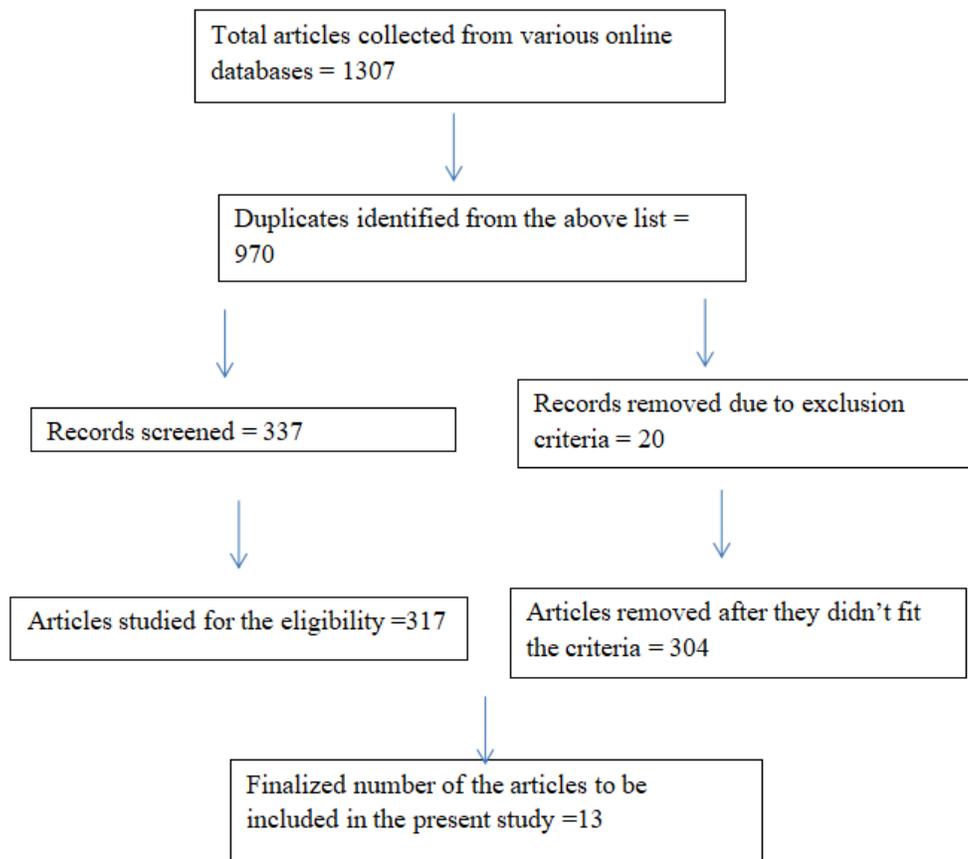


Table 1: Comparison of the included studies.

First author, date, reference	Type of article	Sample size/ Setting/ Population	Article key points	Recommendations/outcomes	Limitations
Peng X et al. (March 3, 2020) [24]	Review Article	Setup: Routes of 2019-nCoV transmission and control in dental practice. Context: China	Dental care environments typically bear the possibility of contamination with 2019-nCoV owing to the complexity of its practice, which requires face-to-face contact with patients. Patients and dentist can be exposed via inhalation of suspended airborne particles, indirect contact from contaminated surfaces, and direct contact with bodily fluids of infected individuals.	<ul style="list-style-type: none"> • Patient evaluation should be performed in the clinic using non-contact thermometer for fever and questionnaire to identify suspected case of Covid-19, and treatment should be deferred for 14 days if established. • A two-before-and-three-after hand hygiene guideline should be adopted. Dental practitioners should wash hands before examination, before procedure, after touching patient, after touching surrounding, and after touching contaminated equipment. • Primary/standard protection for staff in clinical setting including gloves, goggles, and white coat. Secondary/advanced protection for dental professionals including standard protection with extra layer of disposable surgical clothes and impermeable shoe cover. Tertiary protection with special protective outwear for unlikely contact with 2019-nCoV infected patient. • A pre-procedural mouth rinse with 1% hydrogen peroxide or 0.2% povidone to reduce salivary load of 2019-nCoV • Rubber dam and extra high-volume suction in addition to regular suction to reduce spatter and aerosol. Use of hand scaler for 	Lack of evidence for effectiveness of chlorhexidine mouth rinse against 2019-nCoV

<p>L Meng et al. (March 12, 2020) [25]</p>	<p>Review Article</p>	<p>Setup: Risk of Cross infection in dental settings. Context: China.</p>	<p>This report, based on expertise and related advice and study, offers critical information regarding COVID-19 and nosocomial infections in dental settings and presents appropriate management guidelines for dental practitioners and students in (potentially) infected areas.</p>	<ul style="list-style-type: none"> • Dentists should take stringent personal safety precautions and prevent or reduce the development of droplets or aerosols. • Dental clinics are advised to create pre-check triages to test and report the temperature of each workers and patient as a standard practice. • In the epidemic time, online lectures should be used to prevent excessive chance of infection. 	<p>None</p>
<p>Ge Z et al. (March 16, 2020) [26]</p>	<p>Review Article</p>	<p>Setup: Transmission and control of Covid-19 infection in dental setting via aerosol. Context: China</p>	<p>The article emphasizes on the importance of aerosol transmission of Covid-19 in dental settings and implementation of precautionary measures to limit its' spread.</p>	<ul style="list-style-type: none"> • Multidisciplinary consultation for management of dental emergencies in suspected or confirmed cases of Covid-19. Negative pressure rooms (minimum of 12 air changes per hour or 160L/s/patient) along with highest personal protective equipment for urgent 	<p>Distinguishing symptoms of fever and fatigue caused by dental infections from Covid-19 is merely dependent of practitioner's expertise. Effect of pre procedural mouth rinse against Sars-</p>

Kamate SK et al. (March 31 st 2020) [27]	KAP Study	Setup: 860 dental practitioners from different continents. Context: Global	The present research was conducted with the intention of evaluating the awareness, behaviours and activities (KAP) of dental practitioners in the light of the COVID-2019 pandemic.	<ul style="list-style-type: none"> • Dentists were found to have good knowledge and practice scores, which are significant in the battle against COVID-19. • All dentists accepted that they should help spread knowledge of the disease, and that hand hygiene and PPE were successful in avoiding COVID-19. 	A bias in social desirability. Owing to the cross-sectional aspect of the sample and the sampling method used, the effect of self-selection to the part of the respondents may have arisen. Questionnaire bias.
Yang Y et al. (Apr 3 rd 2020) [28]	Original Article	Setup: 48 public tertiary dental hospitals. Context: China	The state of non-emergency dental care, emergency dental facilities, Online consultation and regional spread of hospitals were evaluated during Covid-19.	<ul style="list-style-type: none"> • All 48 public tertiary dental hospitals discontinued regular non-emergency dental care and were offering emergency dental facilities only. • The penetration rate of teleconsultation in the eastern area was considerably higher than in the central and western regions. 	Within the limitation of this report, we observed significant changes in the health service provision of Chinese public tertiary hospitals during the COVID-19 epidemic. Nonetheless, more research should

<p>Zimmermann M et al. (Apr 4th 2020) [29]</p>	<p>Review Article</p>	<p>Setup: Risk of Covid 19 risk in Oral & Maxillofacial surgery Department. Context: Vienna</p>	<p>The purpose of the study is therefore to compile and address facets of the treatment of patients in oral and maxillofacial surgery during the COVID-19 pandemic.</p>	<ul style="list-style-type: none"> ▪ Correct usage of personal protection equipment should be made of. ▪ All patients should be considered to be contagious. ▪ Outpatient visits should be reduced to a minimum. ▪ All patients who are admitted to the inpatient unit should undergo a standard SARS-CoV-2 examination. 	<p>Necessary investments should be made for future dreadful situation.</p>
<p>Ather A et al. (April 6th, 2020) [30]</p>	<p>Review Article</p>	<p>Setup: Recommendations for clinical dental practice in Covid-19. Context: USA</p>	<p>The purpose of this article is to provide a brief summary of the epidemiology, symptoms and mechanisms of transmission of this novel infection. Implications for clinical dental practice in response to Covid-19 have been highlighted.</p>	<ul style="list-style-type: none"> ▪ Every patient should be considered infectious with this virus, and all dental practices need to evaluate their infection management policies. Tele-screening and triaging for identification of suspected Covid-19 individuals. Elective dental care should be deferred for up to 2 	<p>Likelihood of treating an asymptomatic Covid-19 patient in a dental setting is high due to wide range of incubation period from 0 - 24 days and mild presentation of disease in some individuals.</p>

<p>Khader Y et al. (April 9th, 2020) [32]</p>	<p>Cross sectional study</p>	<p>Setup: 368 Jordanian dentists from private clinics, hospitals, and health centers. Context: Jordan</p>	<p>The study assessed the degree of understanding, interpretation and attitude of coronavirus disease (COVID-19) and infection management among Jordanian dentists.</p>	<ul style="list-style-type: none"> ▪ However, most dentists were conscious of COVID-19 symptoms, transmission routes, and standard infection control protocols but had limited understanding of additional safety measures to prevent spread of Covid-19 infection between patients and staff. 	<p>Low response rate, Selection bias, and sampling error limits generalizability of the findings</p>
<p>Izzeti R et al. (April 17th, 2020) [33]</p>	<p>Review Article</p>	<p>Setup: Risk of transmission of Covid-19 in dental practice and preventive measures. Context: Italy</p>	<p>There is substantial risk of direct and indirect transmission of covid-19 among dental practitioners and between patients when performing dental procedures with hand piece under irrigation due to generation of aerosol and surface/environmental contamination.</p>	<ul style="list-style-type: none"> • Double-phase triage telephonic followed by in-clinic to identify high risk patients; pre and post-operative handwashing for 60 seconds followed by application for 60% hydro alcoholic solution; pre and post-operative mouth rinse for the patient with oxidative agents for 1 minute; level 2/3 	<p>There is lack of systemic data on use of chlorhexidine against Sars-cov-2. Lack of evidence, data, and unpredictable nature of this disease is affecting adequate delivery of clinical dental care.</p>
<p>Shacham M et al. (Apr 22nd, 2020) [36]</p>	<p>Cross sectional study</p>	<p>Setup: 338 Israeli dentists. Context: Israel.</p>	<p>The analysis examined the correlation of COVID-19 variables and psychological factors with psychological distress in dental workers during the outbreak of the COVID-19 pandemic.</p>	<ul style="list-style-type: none"> • As far as self-efficacy is concerned, our findings indicate that dental workers with a higher score for self-efficacy have shown lower psychological suffering. • With respect to observational evidence, our studies 	<p>Cross-section model, which precludes causal inferences. Low response rate. Selection bias and sampling error.</p>

Xu R et al. (April 17 th , 2020) [34]	Review Article	Setup: Role of Saliva in transmission and diagnostic tool for 2019-nCoV. Context: China	The article discusses saliva being a potential non-invasive diagnostic tool for 2019-nCoV detection and a potential transient medium for spread of infection via short distance droplets or sustained airborne aerosols.	<ul style="list-style-type: none"> Wearing masks, disinfecting indoor air, and maintaining social distance can prevent dissemination of infectious salivary droplets. 	None
Ahmed M A et al. (Apr 19 th , 2020) [35]	Cross sectional Study	Setup: 669 dentists from 30 different countries. Context: Global	The present research measured distress and fear of infection among dentists operating during the current viral epidemic. In addition, the dentist's information on various practice modifications in the battle against a novel coronavirus disease (COVID-19) epidemic has been analyzed.	<ul style="list-style-type: none"> More than two-thirds of general dental practitioners (78%) from 30 countries were nervous and frightened by the disastrous consequences of COVID-19. A significant majority of dentists (90 per cent) were conscious of recent improvements to care protocols. 	Information gathered over a concise span of time, keeping in mind the sudden effect this epidemic had on the mind set and profession of dental health practitioner. Responses from all countries impacted by the outbreak

Discussion

The aim of this scoping review was to capture, document, and demonstrate all the relevant literature published so far on dental aspects of Covid-19 in order to serve as point for future recommendations and evidence-based guidelines for dental practices in this challenging time. Considering that dental professionals are at higher risk of exposure to Covid-19, infection control has been discussed intensively in the literature 25, 26, 27, 30, 31, and 34 . Ge Z et al argued that aerosol-generating dental procedures for suspected/confirmed Covid-19 patients have a particularly higher risk of infection transmission 27. To achieve optimal infection control, a better understanding of the chain of infection is crucial for the control and prevention of any infectious disease. The chain of infection requires a pathogen (virus or bacteria), natural reservoir (human or animal) to reside and multiply, which then leaves host through portal of exit, and enters into a susceptible host through portal of entry using some mode of transmission. Interrupting chain of infection anywhere along the chain will stop the spread of infection.

The standard infection control provisions in dentistry can potentially serve as first line of defence for many dental professionals. However, considering highly contagious nature of SARS-Cov-2, extra protective measures should be adopted to prevent the transmission of Covid-19 disease 25. We have identified 4 crucial phases which can be adopted to break the chain of transmission: (i) protocols for patient triage before treatment, (ii) patient evaluation upon arrival, (iii) during treatment, and (iv) after treatment. We found six out of the thirteen articles across different geographic locations (including China, USA, Italy) and practice settings, which implemented telephone triage using questionnaire to evaluate potential risk of SARS-Cov-2 transmission and type of dental care needed 25, 26, 27, 31, 32, 34 . When the patient arrives at the clinic, the same questionnaire should be repeated and body temperature should be documented using non-contact

thermometer 25, 31, 34 . Patients with temperature > 100.4 F or 38 oC should be postponed if possible or performed in an Airborne Infection Isolation Rooms (AIIRs) or negative pressure rooms 27, 31, 32 . AIIRs are highly recommended for aerosol generating procedures. These are single patient isolated room with minimum 6 air changes per hour 27, 39. AIIRs or negative pressure rooms have been recommended and utilized in the management of corpses with suspected/confirmed Covid-19 patient's.

Waste management and psychological impact of Covid-19 on dental work force was another theme explored extensively in the literature. Hand disinfection for patients, removal of shared objects (toys, drinks, magazines, etc.), 6 feet social distancing, limiting number of patients and use of mechanical or natural ventilation in the waiting area has been suggested to minimize risk of disease transmission to other patients and staff 27, 31, 34 . Ge Z et al suggested posting cough etiquette instructions at entrances and waiting area to promote respiratory hygiene 27 . When preparing patient for the treatment, it has been suggested that preprocedural mouth rinse with an oxidizing agent such as 1% hydrogen peroxide or 0.2% povidone iodine for 1 minute should reduce the viral load in aerosols 25, 31, 34.

A rubber dam should be used where possible, which can potentially eliminate all sources of aerosol contamination from blood or saliva by blocking the throat and soft tissue area, except the tooth/teeth undergoing treatment. An in-vitro trial found 70% reduction in aerosol with use of rubber dam during conservative pedodontic procedures . Peng et al recommends use of Carisolv, a minimally invasive chemo-mechanical removal of carious dentine and hand scaler for periodontal procedures where rubber dam is not feasible 25 . Finally, the effectiveness of rubber dam as an isolation barrier is merely dependent on the placement skills of the provider and its' technique sensitivity. Peng et al emphasized use of dental hand piece with anti-retraction/anti-reux valve to prevent aspiration of contaminated bodily fluids into the tubes of hand-piece or dental unit and subsequent cross-infection 25. There has been much debate about choice of filtering face-piece (FFP), level 1 vs level 2 vs level 3 for aerosol and non-aerosol generating dental procedures. Some authors suggest wearing FFP1/standard surgical mask for non-aerosol generating procedures and FFP2/N95 or higher for aerosol generating procedures 25, 27 while others suggest FFP2/N95 for all procedures for both clinical and non-clinical staff 31, 34 .

Therefore, considering highly infectious nature of Sars-Cov-2 compared to influenza, we recommend use of FFP2/N95 for both clinical and dental assistants and all dental procedures. Every patient should be considered potentially contagious. Hand hygiene has been extensively emphasized as key factor in preventing cross-contamination, a two-before-and-three-after hand hygiene guideline recommended by CDC and WHO has been suggested 25, 27, 28, 31, and 34 . Alharbi et al recommends use of extra-oral radiographs such as orthopantomogram, and cone beam computer tomography over intraoral to prevent gag and excessive salivation 32 . Overall, a layering approach including head covers, long-sleeved water-resistant gowns, shoe cover, level 2 FFP, and eye protection has been proposed for both clinical and dental assistant's staff to significantly break the chain of infection 25, 27, 31, 34. After the procedure is complete, disinfection of the treatment room and waiting area including doorknobs, chairs, desks, restrooms, and elevators between patients has been suggested to break the chain of transmission 27, 31, 34 . It is important to clean/mop floor between patients especially after aerosol generating procedures and wearing shoe covers, to effectively disinfect treatment and waiting area 25,34.

Dental providers need to consider best practices approach to create clean and safe environment for their staff and patients and to minimize risk of disease transmission. Notable consideration should be given to staff training, education, revision & reinforcement of infection control protocols. A temporary storage area should be assigned in the clinic for storage of medical waste 25 . Reusable instruments should be adequately pre-treated using oxidizing disinfectant, cleaned, sterilized, and stored in accordance with the local health authorities' protocol 25 . Double-layered packing, appropriate labeling, and gooseneck ligation has been suggested for medical waste generated from suspected/confirmed cases of Covid-19 25 . The contaminated disposable PPE including gloves, gowns, head covers should be safely disposed-off in a bag, within clinical area before entering non-clinical area. FFP level 2/3 mask should be worn by all staff members at all times. This is especially important as emotional instability due to fear and anxiety can foster irrational behaviour and inadequate infection control practices. We identified four articles examining awareness, perception, attitudes, and behaviour among dental professionals regarding Covid-19 pandemic 28, 33. Khader et al conducted a cross-sectional study among 368 Jordanian dentists from different clinical settings to assess awareness, perception, and attitude regarding covid-19 and infection control practices 33. Jordanian dentists were found to have limited knowledge about right incubation period, social distancing and mask for patients in the waiting area, hand hygiene practices, protective clothing for clinical and non-clinical staff, and over 80% reported to avoid treatment for suspected/confirmed covid-19 cases amid to fear of contracting disease 33 . Another study conducted by Ahmed et al surveying 669 dentists from 30 different countries reported almost 80% feared contracting covid-19 and would avoid treating suspected cases. This is further backed by scientific evidence available from previous research showing unwillingness of dental providers to treat patients with infectious diseases such as SARS, HIV, tuberculosis, and MERS. The role of local authorities in providing procedural guidelines in the face of pandemic is vital to help healthcare providers in making informed decisions. Adequate knowledge of incubation period is essential to determine safe period in treating suspected Covid-19 patients 33. Use of rubber dam, protective clothing, and preprocedural mouth rinse play a significant role to prevent cross-contamination 33.

Conclusion

The biggest concern will remain the aerosol generating nature of dental work. More research is required on aerosol's specific risk assessment and measures that can protect the dental work force and patients from aerosol and droplet infection. The economic and psychological aspect of Covid-19 pandemic also need special attention as the pandemic is taking a toll on mental health of large segments of the population in these unprecedented and stressful times. It is important to fill in the gaps in knowledge regarding the complex nature of Covid-19's impact on dentistry, there are still blind spots regarding transmission and possible precautions which need to be removed with more research and a concentrated and united effort by Governments, regulating authorities and health care researchers. The goal is to make the practice of dentistry secure in the era of Covid-19.

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