

Review Article

The Impact of Covid-19 on Dentistry: A Sistematic Review

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12, 2020; **Published:** December 19, 2020**Abstract**

Purpose of this study was to revise, qualify and summarize the existing of evidence on the associations and risk factors for COVID-19 during dental treatment and dentists' knowledge of these risks. The systematic review was conducted according to the PRISMA guidelines (www.prisma-statement.org). Independent searches were conducted in the following eletronic databases: Lilacs/BBO, Medline, PubMed, the Cochrane Library, Open Grey, BVS, SciELO and Science Direct from December 2019 to August 2020. Specific journals in the field were also consulted. The search strategy was suited to each database. The following descriptors were used to search for articles: "COVID-19 OR SARS-CoV-2 AND dentists OR oral health professionals OR dental practice management OR oral health practitioner OR oral health provider" with one or more keywords. Six articles were included in this literature review because they met all defined inclusion criteria. Endodontic urgencies and emergencies, with symptomatic irreversible pulpitis being are the most common, consisting of a much higher proportion of dental emergencies during COVID-19 epidemic, compared with dental trauma and no-urgent care. Although dentists are aware of the symptoms, mode of transmission, infection controls and measures in dental clinics, they do not feel confident about the correct measures to be taken to prevent COVID-19 for their staff and patients.

Keywords: Dental practice management; Viral infection; Coronavirus.**Introduction**

At the end of 2019, a cluster of pneumonia patients with an unidentified cause emerged in Wuhan, Hubei Province, China. The International Committee on Taxonomy of Viruses (ICTV) named this novel coronavirus as SARS-CoV-2, disease COVID-19 which has been declared a pandemic by the World Health Organization (WHO) on March 11, 2020 [1]. The main clinical symptoms of COVID-19 patients were fever, cough, myalgia or fatigue, expectoration and dyspnea. Minor symptoms include headache or dizziness, diarrhea, nausea and vomiting [2].

Based on epidemiologic research, it appears that the COVID-19 outbreak started with a single animal-to-human transmission, followed by sustained human-to-human spread. Its interpersonal transmission occurs mainly *via* respiratory through direct or indirect contact, or through coarse or small droplets, and 2019-nCoV can also be transmitted directly or indirectly through saliva [3]. There may be risk of fecal-oral transmission and has been observed by spread through aerosols or vertical transmission (from mothers to their newborns) [4,5]. Conjunctivitis has been found in some patients, suggesting that eye exposure may provide an effective way for the virus to enter the body [6]. However, both symptomatic and asymptomatic patients are passive of transmissibility [7].

Dentists are particularly vulnerable to transmissible diseases by way of droplet transmission both due to the area of work and the type of instrumentation. The long and unpredictable incubation periods (0-27 days, mean 6.4 days) of the virus in COVID-19 patients expose us to the risk of treating asymptomatic patients. Worse still,

many patients who are harboring the virus may conceal their flu like symptoms or might be convalescing from the disease [7].

Most patients who will seek dental treatment for urgent and emergency care in this quarantine period will be asymptomatic, those in the incubation period or symptomatic in the home treatment period or in the recovering phase. Inpatients will not give priority to dental treatment because they are in a serious situation, in the inflammatory phase of COVID-19 (with tachycardia, increased respiratory rate, dyspnea, low oxygen saturation and hypotension). However, regardless of the patient's health situation, the dental team must use all preventive means during care to avoid contagion, which will be mentioned in this article [6-8]. Due to the characteristics of dental settings, the risk of cross infection may be high between dental practitioners and patients. For dental practices and hospitals in countries/regions that are potentially affected with COVID-19, strict and effective infection control protocols are urgently needed. The justification for this research is because we wanted to investigate whether there are clinical studies that correlate COVID-19 with dental procedures. This systematic review aimed to revise, qualify and summarize the existing of evidence on the associations and risk factors for COVID-19 during dental treatment and dentists' knowledge of these risks.

Material and Methods

This systematic review was registered in PROSPERO with number: CRD42020212155 and conducted according to the PRISMA guidelines (www.prisma-statement.org) [9]. Independent searches were conducted in the following eletronic databases: Lilacs/BBO,

Medline, PubMed, the Cochrane Library, Open Grey, BVS, SciELO and Science Direct from December 2019 to August 2020. Specific journals in the field were also consulted. The search strategy was suited to each database. The following descriptors were used to search for articles: "COVID-19 OR SARS-CoV-2 AND dentists OR oral health professionals OR dental practice management OR oral health practitioner OR oral health provider" with one or more keywords. The search strategy was adapted for use in each database. National and international scientific reports including published material that focuses on the direct or indirect relationships of COVID-19 to Dentistry, focusing on dentists' knowledge of COVID-19 risk factors during dental procedures, as compared with other exposed health professionals was included to determine the association between these risk factors and COVID-19. Editorials or personal opinions, literature reviews, critical reviews, letters to the editor, and clinical and case reports were excluded. Manual searches on the references of the included articles and search in the Google Scholar were also carried out to assess partially the grey literature. There was no restriction of language for inclusion.

Focal question

The present systematic review was conducted in order to answer the following clinical question: During the period of Covid-19 patients have sought dental care in the emergency room and do dentists know the symptoms and mode of transmission of the disease and do they feel qualified to attend them?

Eligibility criteria of the articles

The inclusion criteria that were adopted for selection of national and international scientific productions included published productions that focused on the direct or indirect relation of COVID-19 to Dentistry, focusing on dentists' knowledge (P) of COVID-19 risk factors (E) during dental procedures, as compared with other exposed health professionals (C), to determine the association between these risk factors and COVID-19 (O) to investigate the direct or indirect relationship of COVID-19 to Dentistry. The exclusion criteria were editorial or personal opinions, literature reviews, critical reviews, letters to editor clinical and case reports. The selection of articles was performed by two investigators based on critical analyzes of inclusion and exclusion criteria and the level of agreement according to the Kappa scores was 0.86 intra-examiner and 0.85 inter-examiner. If there were discrepancies found between the two researchers, a new researcher would be added to evaluate the articles. When there was a consensus among reviewers for articles that met the inclusion criteria, the article would eventually be included in the systematic review.

Data extraction

The selection of articles was performed by two investigators based on critical analyses of the inclusion and exclusion criteria, and the level of agreement according to Kappa scores. For any discrepancies between the two researchers, a new researcher was included to evaluate the articles. The initial analysis were excluded articles with titles and abstracts not related to the issue studied, and that included at least one of the exclusion criteria. The next step was involved a detailed analysis of the selected articles to identify those which meet all the inclusion criteria, or the exclusion criteria. If the information in the title or abstract was insufficient, the full article was read and then a decision made regarding inclusion or exclusion. Articles

without an abstract were read in their entirety to define eligibility. Once consensus had been reached among the reviewers regarding articles that met the inclusion criteria, they were included in the systematic review. Once the results of the bibliographic searches had been reduced to the relevant articles only, a separate sheet was used to extract the data necessary from each eligible article. This was done independently by the two reviewers, and the data sheet will be a personalized version of the Cochrane model of data extraction for reviews. Details of each study (author names, year of publication, country, data of search), study methods (database search, risk factor(s) evaluated, methodological quality assessment tool(s) used), results (number of studies included, risk of bias results) and study conclusions were extracted by the investigators. After data collection, the information of the studies was organized in tables that showed the participants, interventions, controls, results, and study designs to enable analysis of the data. The initial analysis excluded articles with titles and abstracts that were not related to the issue studied and that presented at least one of the exclusion criteria. The next step was a detailed analysis of the selected articles to examine those who met all the inclusion criteria or presented exclusion criteria. When the information in the title or abstract was insufficient to decide on inclusion or exclusion, the full article was read and then decided about its inclusion or exclusion. Articles without abstract have been read entirely to define their eligibility.

Quality and risk of bias assessment

Once the results of the bibliographic research were reduced to the relevant articles, a separate sheet was used to extract the data necessary for each eligible article. This was done independently by the 2 reviewers. The data sheet was a personalized version of the Cochrane model of data extraction for reviews [10]. After data collection, the information of each study was organized in tables that showed the participants, interventions, controls, results, and study designs to enable analysis of the data. The risk of bias for each article was independently evaluated by the 2 authors. Misunderstandings were discussed until a resolution was achieved. The risk of bias was evaluated in accordance with the guidelines of the Cochrane Risk of Bias Assessment Tool [11] and Cochrane Study Quality Guide [12].

Strategy for data synthesis

Descriptive data were collected. Meta-analysis was not done. The articles were analyzed according to the 12 items on the MINORS scale and were classified with 0 (not reported), 1 (reported inadequately), 2 (reported properly). The maximum score was 16 for non-comparative studies and 24 for comparative studies. The quality of the study was defined as poor (less than or equal to 5 points), reliable (6-10) or good (greater than or equal to 11 points). The data were analyzed with descriptive statistics. The Qui-square test was applied to compare dentists regarding knowledge and ability with others health professionals to care for patients with Covid-19. The following key items were extracted from the articles: author, publication year, country, date of search, study design, aim, sample calculation, sample characteristics, loss of follow up not exceeding 5%, inclusion criteria, control group or comparison between groups (dentists and health professionals, or patients for different dental care), age, details of the intervention and results, end point appropriate for the study aim, risk factor(s) evaluated, unbiased evaluation of end points, based on the variables (knowledge and dentists' attitudes about preventing

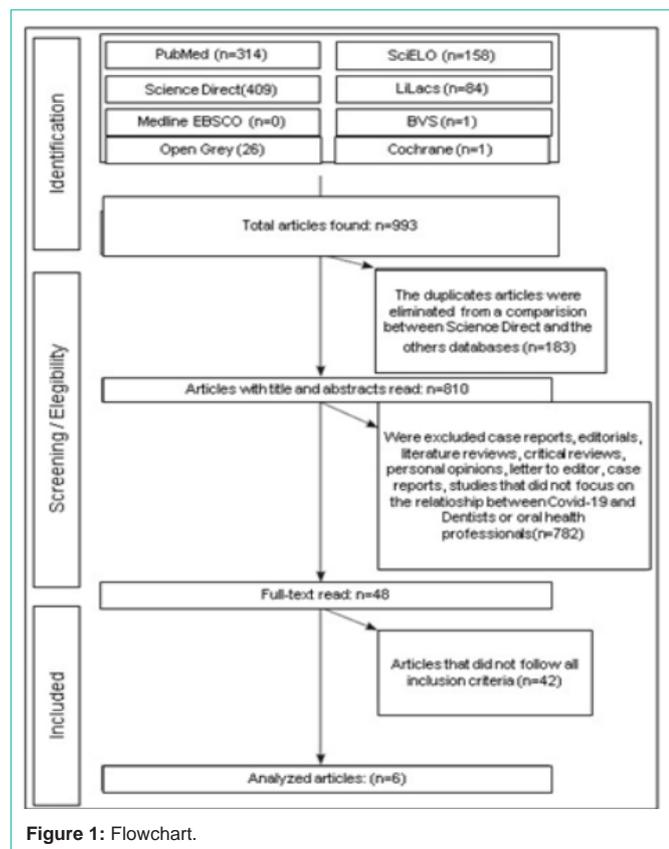


Figure 1: Flowchart.

Covid-19 during consultations, when compared with others exposed health professionals, patient demand based on low, medium and high risk of contagion), detailed intervention to assess the aforementioned variables, statistical analyses adapted to the study design and conclusion based on aim.

Results

During the first step of the selection and evaluation process, 810 of the 993 papers were eligible for research in their titles and abstracts. For the removal of the repeated articles, the result of the PubMed search database was compared with the other study participants. As a result, 48 articles were retrieved and read completely. Those who did not meet the inclusion criteria were excluded from the survey. Finally, only 6 articles [8,13-17] were included in this systematic review (Figure 1).

Table 1 shows the data extracted from the articles: author, year, age, sample size and characteristics, method, results and p value. The studies [8,13,16,17] were cross-sectional with application of questionnaires. The first one [8] found that one patient admitted had a confirmed COVID-19 history and 3 were exposed to contagion. Most sought care for endodontic diagnosis. The second study [13] concluded that dentists were aware of COVID-19 symptoms, mode of transmission, and infection controls and measures in dental clinics. However, dentists had limited comprehension of the extra precautionary measures that protect the dental staff and other patients from COVID-19. The fifth study [16] observed that the COVID-19 emergency is having a highly negative impact on the activity of dentists practicing. All respondents reported practice closure or

strong activity reduction. The perception of this negative impact was accompanied by feelings of concern, anxiety and fear. The last one [17] found that Brazilian endodontists are knowledgeable about the signs and symptoms of COVID-19. They practice social distancing and treat only dental emergencies and patients who require urgent care. A majority of the participating endodontists believed that conventional Personal Protective Equipment (PPE) cannot prevent COVID-19 transmission. The third study [14] was retrospective with analysis of dental records of patients and it concluded that the number of emergency dental visitors reduces, the proportion of dental and oral infection increases and those of dental trauma and nonurgency decrease at the beginning of COVID-19 epidemic. The fourth study [15] was a retrospectively review the impact of the outbreak of coronavirus disease 2019 (COVID-19) on services in the oral emergency room whose conclusion was that the number of visits to the oral emergency room and the proportions of the patients who were children, adolescents and elderly people were reduced, meanwhile the percentage of emergency cases, except trauma, and conservative treatments increased during the outbreak of COVID-19.

Risk of Bias

Four cross-sectional studies [8,13,16,17] had an adequate approach. In the first study 8, a questionnaire was applied to patients about COVID-19 and pain, body temperature measured and endodontic diagnosis. Blinding of the participants (performance bias) could not be implanted because the questionnaire was applied directly to patients when they sought emergency dental care the dates studied were compared to past statistics corresponding to these same dates in 2018 and 2019, with application of statistical tests Poisson regression, T-test, ANOVA. In the second study [13] 700 dentists were randomly selected to participate in the study by their Facebook. Each participant who was randomly selected was contacted individually to make sure that they were a dentist and worked in Jordan. The questionnaires were anonymous to maintain the privacy and confidentiality of all information collected in the study. However, there was no blinding of the results (detection bias) and statistical analysis was only descriptive. In the fifth study [16] dentists were also randomly selected to participate in the study from 2 April to 20 April 2020, with application of statistical Test ANOVA. The survey with 40 questions was created using the free-access Google Forms application and the link to the online survey was sent through an anonymous mailing list to all dentists registered in the Dental Board Commission (CAO). Participants provided their informed consent before completing the survey. In the last one [17] 2135 Brazilian endodontists were randomly selected to participate in the study by their Facebook, WhatsApp and Instagram to answer 15 questions using the free-access Google Forms application. The sampling methodology was based on the capillarity of the social media and the endodontics network. Responses were accepted from March 28 to April 3, 2020 and the chi-square test, t-test, and one-way analysis of variance were conducted.

Discussion

Since COVID-19 has recently appeared, there are still no case-control, RCT studies related to dentistry. There are case reports, editorials, reviews, personal opinions and guidelines. In the researched databases, only 3 cross-sectional studies were found, one

Table 1: Description of included studies.

Authors	Sample	Study	Method	Results	Statistic	P-value
Yu et al., [8]	96 patients (mean age of 42.24±18.32 years; 50 male and 46 female) with pain to endodontic emergencies;	cross-sectional study	Questionnaire about COVID-19 and pain, body temperature measured and endodontic diagnosis. The number of total patient visits and type of visits at the General and Emergency Department, WHUSS during the dates studied were compared to past statistics corresponding to these same dates in 2018 and 2019.	One admitted patient (1.04%, 1/96) had a confirmed COVID-19 history and was recovering at the time of treatment. Three admitted patients (3.13%, 3/96) had history of exposure to confirmed or suspected COVID-19 patients recently. No patient had fever (>37.2°C) but 97, 90% Diagnosis of endodontic first visit.	Poisson regression, T-test, ANOVA	<0.05
Khader et al., [13]	368 dentists aged 22-73 years (mean 32.9±10.6 years)	cross-sectional study	Questionnaire about dentists awareness of the incubation period, the symptoms of the disease, mode of transmission of COVID-19 and infection control measures for preventing COVID-19; and their attitude toward treating patients with COVID-19. 700 dentists were randomly selected to participate in the study by their Facebook. Each participant who was randomly selected was contacted individually to make sure that they were a dentist and worked in Jordan.	Dentists were aware of COVID-19 symptoms, mode of transmission, infection control and measures in dental clinics. However, dentists Had limited comprehension of the extra precautionary measures that protect the dental staff and other patients from COVID-19.	Descriptive	
Guo et al., [14]	1567 patients, 822 females and 745 males, with the mean of (37.5±19.3 years) during Pre-COVID-19. 970 patients, 420 females and 550 males, with the mean of (41.2±19.1 years) during COVID-19 epidemic.	A retrospective study	Analysis of dental records of COVID-19 retrieved patients seeking emergency dental services in a public tertiary stomatological hospital during Pre-COVID-19 and COVID-19 epidemic.	The proportion of dental and oral infection raised from 51.0% of pre-COVID-19 to 71.9% during COVID-19 and dental trauma decreased from 14.2% to 10.5%. The non-urgency cases reduced to three tenths of pre-COVID-19.	Descriptive	<0.001
Bai et al., [15]	742 males and 795 females, between 4 months and 95 years old, with median age 20 years.	A retrospective study	Analysis of dental records of patients seeking in emergency Department of Peking University Hospital of Stomatology during Covid-19 in 2020 compared with those in 2019 in Beijing.	The proportions of patients with acute toothache and infections were higher in 2020 than in 2019 and the proportions of patients with maxillofacial trauma and non-emergencies were lower in 2020 than in 2019. Drug treatment for acute pulpitis was used more often in 2020 than in 2019 and endodontic treatment and examination consultations were less common in 2020 than in 2019.	Pearson correlation	<0.001
Consolo et al., [16]	356 dentists between 35 and 55 years old. They had been working for 6-14 years, 30-40 h per week.	Cross-sectional study	Questionnaire about the practical and emotional consequences of COVID-19 emergence on daily clinical practice.	The COVID-19-related emergency condition is having a highly negative impact on dental practices. All respondents reported practice closure or strong activity reduction. The perception of this negative impact was accompanied by feelings of concern, anxiety and fear.	Anova	<0.001
Candeiro et al., [17]	2135 endodontists (women: 72.92%, men: 27.02%, transgender men: 0.06%). 77.05% had their own private practice.	cross-sectional study	Questionnaire about dentists' knowledge of COVID-19 symptoms and biosecurity measures during dental care and whether they performed elective and/or emergency procedures during the social distancing period	A total of 98.50% of the participants affirmed that COVID-19 can be transmitted during dental procedures and 76.53% of them reported that the use of conventional Personal Protective Equipment (PPE) is insufficient to prevent COVID-19 transmission. 91.7% of them reportedly suspended elective dental procedures and 25% knew someone who had COVID-19.	T-test, chi-square and analysis of variance.	<0.001

being retrospective.

Yu et al., [8] (Table 1), concluded that during COVID-19 outbreak endodontic emergencies are the most prevalent and the

treatment time should be the maximum in two sessions to reduce the risk of contamination. Rubber dam, personal protective equipment and patient screening are of great importance during the COVID-19

outbreak in protecting clinicians. In the questionnaire applied to dentists, Khader et al., [13] observed that they had basic knowledge about symptoms, mode of transmission and control of COVID-19. However, they were not prepared and safe as to the necessary protective measures to be adopted by the entire dental team to avoid contagion of both the team and patients during urgent and emergency dental care. The authors emphasized the importance of guidelines that give detailed guidance on all preventive measures to be performed. Guidelines released by reputable institutions should be sent by the regional and national dental associations to all registered dentists to make sure that dentists are well informed and aware of the best practices and recommended disease management approaches. Guo et al., [14] noted that the greatest demand for dental care occurred in the period before COVID-19 was considered an epidemic. However, during the outbreak there was an increase in endodontic emergencies and reduction of dental trauma and non-emergency care. This was expected due to the social isolation and awareness of the population to seek dental care in cases of urgency and emergency. Bai et al., [15] observed that the outbreak of COVID-19 affected the patient population and structure of disease types and oral services in the emergency room. The spread of the COVID-19 epidemic affected the patient population and structure of disease types and oral services. The number of visits to the oral emergency room and the proportions of patients who were children, adolescents and elderly people reduced, meanwhile the percentage of emergency cases, except trauma, and the conservative treatments increased during the outbreak of COVID-19. Besides, the decrease in the percentage of patients with acute pulpitis undergoing examinations and consultations from 2019 to 2020 may be related to the decrease in the number of outpatient registrations in public hospitals during the epidemic, the suspension of the operation of private clinics, and the narrowing of patient treatment options.

Consolo et al., [16] observed that emergency condition is having a highly negative impact on dental practices. All of the dentists that completed the survey reported practice closure or reduction, a high level of concern about the professional future and the hope of economic funding for all dental practitioners. The perception of this negative impact was accompanied by feelings of concern (70.2%), anxiety (46.4%) and fear (42.4%).

Candeiro et al. [17] found that Brazilian endodontists reported that dental procedures can transmit COVID-19, and who believed that personal protective equipment cannot prevent contamination were more knowledgeable about the symptoms of COVID-19. Besides they practice social distancing and treat only dental emergencies and patients who require urgent care. Dental patients and professionals have been exposed to pathogenic microorganisms, including viruses and bacteria that infect the oral cavity and respiratory tract. Dental care settings invariably carry the risk of 2019-nCoV infection due to the specificity of its procedures, which involves face-to-face communication with patients, and frequent exposure to saliva, blood, and other body fluids, and the handling of sharp instruments [18-22]. Both patients and dental workers can become infectors and transmitters of COVID-19 because dental treatment is characterized by relatively long operation times, which results in the persistent existence of aerosols within a large area of the clinical office and introduces a potential risk of spreading disease. The water mist generated by the air driven high-speed handpiece, air polisher, and

various other instruments mixes with the saliva and blood of patients, form aerosols and diffuse them into the surrounding air [23-27]. Regarding care during dental procedures, the 4-handed technique is beneficial for controlling infection. Rubber dams and high-volume saliva ejectors can help minimize aerosol or spatter in dental procedures. Furthermore, face shields and goggles are essential with use of high or low-speed drilling with water spray [28]. Dentists have been recommended to take several personal protection measures and avoid or minimize operations that can produce droplets or aerosols. Moreover, the use of saliva ejectors with a low volume or high volume can reduce the production of droplets and aerosols [29-30]. Dentistry is considered one of the professions greater risk of contamination. Droplets of saliva and aerosols that are generated in dental care, and even all the standard protection measures that have always been used, are not sufficient to prevent contagion by COVID-19. Prevention and control measures for this pandemic are being developed and improved. Dentists will have to adapt to the new preventive and control procedures for the spread of infections during dental care [26,28].

Conclusion

Endodontic urgencies and emergencies, with symptomatic irreversible pulpitis being are the most common, consisting of a much higher proportion of dental emergencies during COVID-19 epidemic, compared with dental trauma and no-urgent care. Although dentists are aware of the symptoms, mode of transmission, infection controls and measures in dental clinics, they do not feel confident about the correct measures to be taken to prevent COVID-19 for their staff and patients. It is essential to give clear and easy guidelines to manage dental patients and to make working dentists safe from any risk.

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