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Sterilization and infection control practices to prevent transmision of COVID-19 in dental office: Systematic review article

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***Abstract*---**Aim: The review was to evaluate infection control measures and control of SARS – COV 2 infection in dental office. Objectives: To evaluate the infection control measures before and after the visit of patient, the awareness of dentists regarding SARS - COV 2, the knowledge, attitude and practices of dentists regarding infection control measures and control of SARS – COV 2 in dental office and their ability in identifying the source of infection and measures to curb it. Material and Methods: This review sought to assess the infection control measures in dental practice during covid-19 pandemic with a literature search covering the electronic databases: Cochrane library, PubMed, PubMed Central, Science Direct and Google scholar. Results: SARS-COV 2 infection occurs mainly through direct contact with micro droplets or core droplets and aerosol. Moreover, infected subjects, both with and without clinical signs of COVID-19, can transmit the virus. Virus enters human body mainly through mouth, nose, and eyes when they are touched by infected

hands. Thus, dental practice poses highest risk of transmission of SARS COV2 infection. Conclusion: Review focused on the methods, protocols, and recent reports regarding the SARS CoV2 infection. Evidences does not show connection between dental care or surgery and COVID-19 transfer, there is obviously the chance of transmission. There are a limited and heterogeneous number of primary sources directly related to the repercussions of SARS-CoV-2 on the dental discipline in the literature due to the current emergency. In future, more research will be required.

***Keywords*---**Dental office, Prevention, SARS COV 2.

Introduction

The WHO declared COVID-19 a pandemic after months of devastation across several nations and continents. However apart from frontline healthcare workers, people from other professions and socio-economic/cultural backgrounds have also been affected.[1] Dentistry requires dentists to work close to patients' oral cavity, increasing their risk of virus exposure, especially during open and invasive dental procedures. Dental plaque contains microorganisms that can cross-contaminate and cause systemic infections.[2] Despite this, patient-to-dental professional transmission of infectious microorganisms was rarely reported until recently. Few reasons for infection spread were unsafe injection practises, improperly sterilised dental hand pieces or instruments between patients, and inadequate autoclave monitoring.[3] The traditional classification of diseases is into bloodborne, airborne, and fomites. Understanding these diseases allows dentists to implement strict protocols and protective measures during dental procedures. This may help reduce infection spread in the clinical setting.[4] Noso-comial infections are acquired in a hospital or dental practise and include occupational infections spread among staff. Examples of nosocomial viruses include hepatitis B and C, herpes simplex, varicella-zoster, HIV, rotavirus, and enterovirus.[5] In December 2019, Wuhan, China, reported a viral pneumonia outbreak caused by an unknown coronavirus. An SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus) caused the disease and has become a major public health issue.[6] The World Health Organization (WHO) declared the disease a public health emergency of international concern on January 30, and named it coronavirus disease 2019 on February 11. (COVID-19).[7] Because SARS-CoV2 has been found in infected patients' saliva, dental professionals must follow strict infection control protocols and policies. They must also work diligently to prevent the disease from spreading among the population.[8] Thus, the current review assessed the role of infection control methods in preventing SARS-COV 2 infections in dentistry. The review assesses dentists' knowledge, attitudes, and behaviours in relation to infection control and the prevention of SARS – COVID 2 infection in dental offices, as well as their ability to identify the source of infection and take preventative measures.

History

An unusually high number of human infections by three novel coronaviruses (nCoV) prompted a public health emergency. Although the first SARS cases were reported in Guangdong province in China in November 2002, the disease's novel coronavirus (SARS-CoV) was discovered in February 2003.[9] Since then, 8096 cases and 774 deaths have been reported from SARS across 26 countries in Asia, Africa, Europe, and North America.[10] The WHO decided to contain the outbreak in July 2003, and SARS incidence has been almost zero globally since then. In June 2012, Saudi Arabia reported the first cases of a new disease called Middle East respiratory syndrome (MERS). MERS-CoV was the pathogen[11] since then, 27 countries have reported multiple outbreaks, with most cases coming from Saudi Arabia and outside the Middle East. Travellers were mostly infected before returning home.[12] Data confirms 2519 cases of MERS with 866 deaths as of January 2020 (37.1%).[13] On January 7, 2020, a novel virus was isolated from patients with pneumonia in Wuhan, China[14]. The International Committee on Taxonomy of Viruses originally named this novel corona virus, which was later renamed by WHO to "Severe Acute Respiratory Syndrome Coronavirus 2".[15] Infection from China then spread to neighbouring countries like Thailand, Japan, and South Korea[16] before eventually affecting the entire world.

Epidemiology of the Corona virus Pandemic

In the last week of December 2019, pneumonia cases of unknown etiology were recorded in Wuhan, the geographical heart of the People's Republic of China [17], with the Chinese competent authorities confirming 6000 cases of patients with SARS-CoV-2, by the second half of January. Eighty thousand cases were estimated by then though[18]. Unlike SARS-CoV-1, the greater and rapid human-to-human transmission characteristic of SARS-CoV-2, with an R0 varying between 1.4 and 6.5, and an incubation period ranging from 2 to 14 days (an average of 7 days)[19], alarmed the seriousness of situation and demanded a quick action. As on 31 January 2020, 213 deaths from 19 different countries were confirmed globally.[19]In mid-February, cases were also identified from African continent (in Egypt) [11] and South America (in Brazil) [19] by the WHO. Interestingly, there was a drop in the number of new cases from China, towards March 2020, thus shifting the epicentre of the epidemic to Europe. Largest outbreaks of cases came from Italy and then from Spain. On March 12, with the disease reported in more than 100 countries, COVID-19 was officially declared a pandemic.[12] During April, May and June, the epicenter of the epidemic shifted once again, to the USA, Brazil and Chile. The following months, even those countries that succeeded in bringing the epidemic under control, became the victims of new foci or the second wave and there was a sharp rise in more than 100 countries.[12] this trend resulted in making COVID-19 the leading cause of death in some countries.[13] As of December 27, 2020, COVID-19 cases reached 79,231,893 across the globe, among which 1,754,574 resulted in death, corresponding to a case fatality rate of 2.2%. (CFR, in % - number of reported deaths/ numbers of reported cases).[20] But, slight variations in the CFR from different parts of the world have been observed: Africa- 2.2%; America- 2.4%; Eastern Mediterranean- 2.5%; Europe- 2.2%; South-East Asia- 1.5%; and Western Pacific- 1.8%.[21] Such differences seem to be related to a multitude of factors ranging from geographic and cultural differences of the

countries in those regions, the methods used for counting cases, the mean age of the population, the severity of the outbreak, to the type of containment measures adopted and the spontaneity with which they were adopted.[21] Infections in patients older than 65 years, have a higher risk of death.[19] To add to it, COVID-19 CFR has also been greater in individuals with a previous chronic disease, which correspond to more than half reaching 90% of the cases of infection.[17] Most COVID-19 confirmed cases have been identified in patients above 30 years, even of which more than 90% involved patients over 45 years old.[22] But on the whole, CFR is a poor indicator of the mortality risk because a large number of cases are either asymptomatic or present with mild symptoms and more so, testing has not been done on the entire population.[23] A rather better way to estimate the mortality risk is the infection fatality rate (IFR= number of deaths from COVID-19/total number of infected individuals). Published COVID-19 data revealed an overall IFR ranging from 0.2%–1.6% in the first months of the pandemic. [24] It is also important to note that the estimated age-specific IFR is very low for children and younger adults (e.g., 0.002% at age 10 and 0.01% at age 25) and increases progressively to 0.4% at age 55, 1.4% at age 65, 4.6% at age 75, and 15% at age 85. [25]

COVID-19 pandemic turned out to be one of the greatest public health challenges of this century because of its high infection rate and mortality. With the COVID-19 pandemic involving a significant geographic distribution across the globe, all countries have implemented strict measures aimed at reducing interpersonal COVID-19 transmission. Some additional measures to contain the possible transmission of the disease in the health sector- dentistry in particular- have been implemented.

Aim

To evaluate the role of infection control measures and control of SARS – COV 2 infection in dental office.

Objectives

1. To evaluate the infection control measures before and after the visit of patient.
2. To evaluate the awareness of dentists regarding SARS - COV 2
3. To evaluate the knowledge, attitude and practices of dentists regarding infection control measures and control of SARS – COV 2 infection in dental office.
4. To evaluate their ability in identifying the source of infection and measures to curb it.

Methodology

Inclusion & Exclusion Criteria

The inclusion and exclusion criteria for the study were set following the PEO strategy as follows:

Factors	Inclusion Criteria	Exclusion Criteria
Language	The studies that are published in the English language will be included.	Papers written in a language other than English will be excluded.
Geographical context	Research papers from all over the world will be included in this review.	
Publication years	Research papers that have been peer reviewed and published after December 2019 were included.	Research papers that were published prior to December 2019 will be disqualified.
Design of the study	This study will include research with any type of study design that has proper evidence-based conclusions and is relevant to the topic under consideration.	Non-empirical research papers, such as public opinions, editorials, and any other studies that reach conclusions that cannot be independently verified, will be excluded.
Data collection process	The research process will include both primary and secondary data collection processes, and the results will be presented.	
Population	Dentist-related research will be taken into consideration as an inclusion criterion.	Any research conducted on any other health-care profession will be disqualified.

The aforementioned specific criteria covered all aspects of restricting the literature search in order to obtain desirable articles that addressed the review's queries.

Search Strategy

This review sought to answer a clearly focused questestion to assess the infection control measures in dental practice during covid 19 pandemic began with a literature search covering the electronic databases: Cochrane library, PubMed, PubMed Central, Science Direct and Google scholar. In order to search databases, strings of search terms, consisting of relevant key words and boolean links, were constructed. The string of English search term “covid 19” yielded 118179 articles and when the search was further refined using terms like “covid 19” AND “dentistry” and infection control” 217 articles were obtained. Reviewer studied them in detail for the above mentioned inclusion and exclusion criteria’s making a total of 11 articles were also included for review.

Data collection and analysis

Study selection

Three review authors independently carried out the selection of papers on the basis of the title, keywords and abstract, and the decisions about eligibility. The full text of every article considered for inclusion was obtained. (Figure 1: study strategy) Critical appraisals of the studies on this list were conducted using the NEW CASTLE OTTAWA SCALE instrument. Following a comprehensive assessment, the checklist was completed, noting alternative responses to each item. The checklist was completed at each stage until the final review of the literature search, and the quality of the search improved with each successive stage of the procedure.

Table 1: Quality Assessment using New Castle Ottawa Scale

S.No.	Author	Selection	Comparability	Outcome	Total	Risk
1.	Ayca SARIALIOGLU GUNGOR, Nazmiye DONMEZ, YesimSesen USLU	4	2	2	8	Low
2.	Alessandra Putrino , Mario Raso , CosimoMagazzino and Gabriella Galluccio	5	1.5	2	8.5	Low
3.	Shahin S Y et al.	3	2	2	7	Low
4.	Cagetti MG et al					
5.	Mista MT					
6.	Mustafa RM, Alshali RZ and Bukhary DM, 2020	4	1.5	2	7.5	Low
7.	Tarakji B et al, 2020	1	2	2	5	Moderate
8.	Baracco B et al	4	2	2	8	Low
9.	Estrich CD et al	2	2	2	6	Moderate
10.	OnöralO et al	3	1.5	2	6.5	Moderate
11.	Al-Khalifa KS et al	4	2	2	8	Low

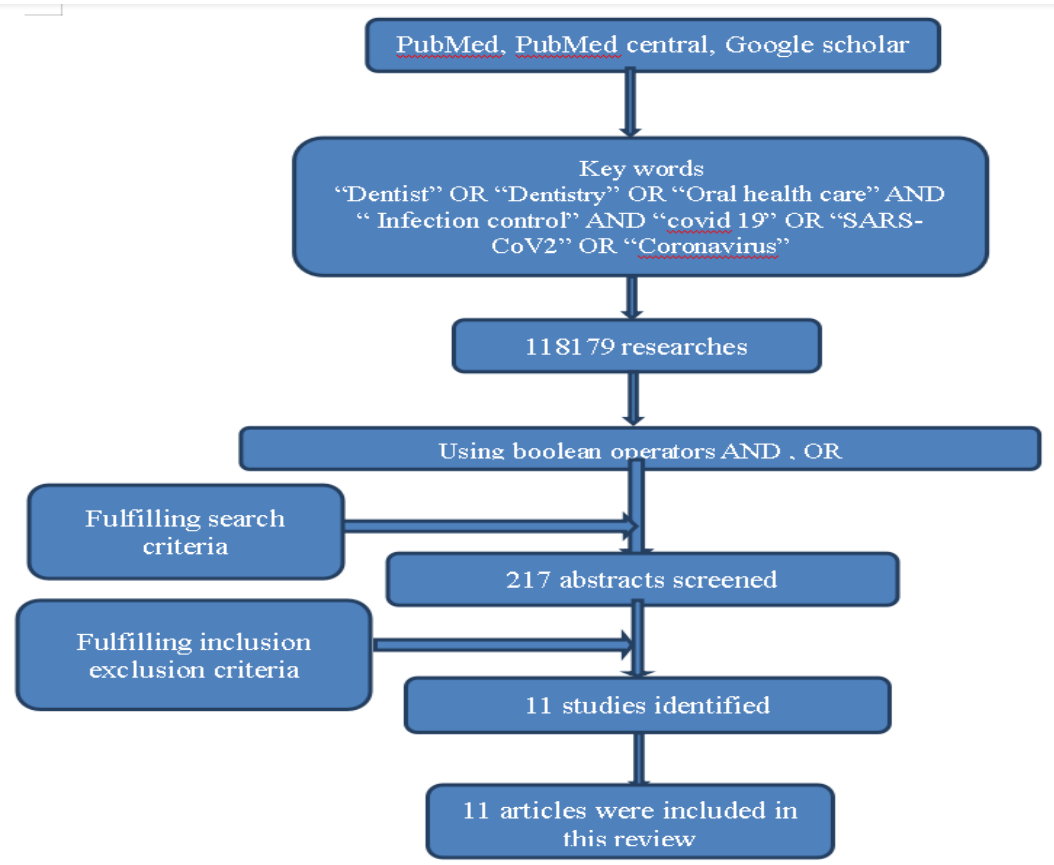

Figure 1: Study Strategy

Data Extraction

Data were extracted independently by three review authors. The data pertaining to the methodology, design, participants, settings, outcome and exposure variables and important results about the infection control was extracted from the relevant studies. The data whatever was available in the articles in the form of charts, figures was all identified and presented in the tables and description form in results.

Discussion

SARS Corona virus 2 (SARS-CoV-2) is a novel coronavirus that was discovered in Wuhan, China (COVID-19). Covid 19 has recently become a major pandemic, killing millions worldwide. HCVs cause diseases of the respiratory, gastrointestinal, and central nervous systems. [37] Aetiology, pathogenicity, characteristics, mechanisms of human-to-human transmission and potential therapies are still unknown. [38] SARS-COV 2 is spread by direct contact with micro- or core-droplets that remain suspended as aerosol for a long time. In

addition, infected people with or without COVID-19 symptoms can spread the virus. When infected hands touch the mouth, nose, or eyes, the SARS-COV 2 virus enters the body. [39] Dental practises are the most likely to spread SARS COV2 due to aerosol production and saliva contact. A specific protocol should be followed to reduce the risk of infection, along with measures to prevent the spread of infection from a patient to another person or medical equipment (cross-infection).[40] Dental care without proper infection control may result in the spread of SARS-COV2 via droplet infection. SARS-CoV-2 can be spread from person to person via droplets, contact, and saliva.[41] Thus, dentists are at high risk of SARS-COV2 infection. Contact of the conjunctival, nasal, or oral mucosa with droplets and microorganism-containing aerosols generated by an infected person and propelled by coughing or using high-pressure irrigation systems such as the hand piece or ultrasonic scalers; and indirect contact with contaminated instruments.[42] The WHO recommends only performing emergency/urgent procedures during a coronavirus outbreak. Since elective procedures like restoration and ultrasonic scaling produce large amounts of aerosols and droplets, they should be used only for dental emergencies, and aesthetic and chronic treatments should be postponed until the pandemic subsides. [43] One of the most widely accepted COVID-19 transmission scenarios involves droplet transmission and a distribution far greater than seasonal influenza.[43] The annualised probability for a DHP to acquire COVID-19 infection in a dental office, become symptomatic, and die from the infection is estimated at 1:13,000 (0.008 percent) by Ren et al. The risk estimate varies with age. When the local community has few asymptomatic cases, the risk to DHPs under 70 is minimal. [44] Only patients in urgent or emergency need dental treatment. Patients should be screened for COVID-19 and classified as (a) apparently healthy, (b) suspected for COVID-19, or (c) confirmed for COVID-19. To reduce the risk of disease transmission, each patient group should have its own waiting and operating rooms. PPE for dental clinicians and staff should be applied to all groups equally.[45] Personal protective equipment (PPE) for dental health care providers, environmental measures, adjunctive measures, and rapid point of care tests in dental offices are among the strategies reported by Keyhan SO et. al.[46]

Pre-appointment measures

Patients must be aware of the protection barriers implemented to ensure satisfactory, safe dental care. Bio-safety measures must be implemented before, during, and after dental procedures. Patients should wash their hands before entering the dental clinic. Patients must follow all bio-safety precautions set forth by international standards. Schedule appointments in advance. Postponing dental treatment for elderly or sick patients. [47]

Detecting the patient's body temperature

In most cases, patients' body temperatures must be taken before any dental procedure (92%). This infection control metric is mentioned elsewhere. For example, Consolo et al. reported that dentists in Italy would consider temperature monitoring to reduce the risk of COVID-19 transmission to dental staff or other patients. [48]

Measures adopted in the operating room

The oral cavity may be a potential COVID-19 transmission reservoir due to close contact with the patient, high aerosol production, and detection of SARS-CoV-2 in saliva. Preoperative mouthwash with 1 percent hydrogen peroxide, 0.12–0.2% chlorhexidine, and 0.2–1% povidine to reduce the number of microorganisms in aerosols and drops during oral procedures, iodine, alcohol, and essential oils are recommended.[49] Surface disinfection with 62-71 percent ethanol, 0.5 percent hydrogen peroxide, or 0.1 percent sodium hypochlorite inactivates SARS-COV2 for up to 9 days on inanimate surfaces like metal, glass, or plastic. Another option is to use benzalkonium chloride (0.05-0.2%) or chlorhexidinedigluconate (0.02%). Coronaviruses can survive on surfaces for up to nine days, according to Fiorillo et al. They recommend 1 minute of surface disinfection with 0.1 percent sodium hypochlorite or 62–71 percent ethanol.[50] The CDC recommends frequent hand washing with soap and water to prevent virus transmission. Hand washing effectively prevents COVID 19. [51]

Dentist Knowledge, attitude and practices towards infection control in dental office

Per Baracco et al., most dentists (76.40%) have changed their disinfection procedures since the COVID-19 outbreak, while 10% haven't. 7.45 improved surface protection in surgery, 7.22 increased disinfection timing and upgraded disinfection products (bleach). Also, 17.53 percent of respondents made all of the suggested changes. Another study found that 99.7% of dental offices use improved infection control and management procedures, and many use advanced PPE. Mask reuse or combination of surgical masks and respirators by dentists may indicate current CDC PPE optimization guidance due to supply issues. According to Al-Khalifa KS, most respondents (92%) agreed that patients should take their body temperature before any dental procedure. 47% patients said, use an antiseptic mouth rinse before dental work. 68% of those polled said a face mask was required in the waiting room. 77 percent of respondents said they used social distancing in the waiting room. [36]

Summary and Conclusion

This review focused on methods, protocols, and recent reports regarding nCoV-19 infection and transmission during routine dental and surgical procedures. While the current evidence does not show a clear link between dental or surgical care and COVID-19 transmission, it is possible. During dental treatment, contaminated fluids, saliva, or aerosols may be transferred between patients, or contaminated instruments or surfaces. Following COVID-19 protective protocols is critical in a dental context, according to existing literature. COVID-19 prevention strategies in dental practise include telephone and clinical triage, body temperature monitoring, oral rinses with 1 percent hydrogen peroxide, and appropriate PPEs. Anti-retraction dental handpieces, four-handed work, a rubber dam, and large-volume aspiration cannulas are all pragmatic and technical clinical recommendations. These respirators outperform surgical masks in terms of protection against viral respiratory infections. The best surface disinfectants contain 62-71 percent ethanol and 0.1-0.5 percent sodium hypochlorite. This

review has some limitations. Due to the current emergency, the literature contains a limited number of primary sources directly related to SARS-impact CoV-2's on dentistry. More research is required in the future.

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