Overview of Trans-National Recommendations for COVID-19 Transmission Control in Dental Care Settings

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Title: Overview of trans-national recommendations for COVID-19 transmission control in dental care settings

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Abstract: On March 11th 2020, the World Health Organization (WHO) declared the coronavirus disease (COVID-19) caused by severe acute respiratory syndrome coronavirus (SARS-CoV2) as a pandemic. Until an effective treatment or a vaccine is developed, the current recommendations are to contain the disease, and control its transmission. It is now clear that the primary mode of SARS-CoV2 transmission is aerosol/droplet spread, and by contacting virus contaminated surfaces acting as fomites (inanimate vectors). Furthermore, recent data indicate that the live virus particles are present in saliva, and, more alarmingly, asymptomatic individuals may transmit the infection. By virtue of the nature of the practice of dentistry where intrinsically, a high volume of aerosols are produced, as well as the close proximity of dentists and patients during treatment, dentists and allied dental staff are considered the highest risk health professional group for acquiring SARS-CoV2 during patient management. Therefore, several organizations and specialty associations have proposed guidelines and recommendations for limiting the transmission of SARS-COV2 from carriers to dentists and *vice versa*. This paper aims to provide a review of these guidelines, and concludes with a brief look at how the practice of dentistry may be impacted by COVID-19, in the post-pandemic era.

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1. Background

In December 2019 a cluster of patients with respiratory illness and viral pneumonia caused by an unknown pathogen were reported in Wuhan, Hubei province, China and its origin was linked specifically to a seafood market in the region. The causative agent was later determined to a new coronavirus and was provisionally named 2019 novel coronavirus (2019 nCoV)("[The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) in China]," 2020; Phelan, Katz, & Gostin, 2020; Z. Wu & McGoogan, 2020). Within a one month period, the number of infected cases increased exponentially in mainland China and several cases were reported worldwide with a total of 7818 infected individuals (World Health Organization, 2020d). On February 11th, 2020, the WHO named the disease caused by this virus the coronavirus disease 2019 (COVID-19) (World Health Organization, 2020c) and the International Committee on Taxonomy of Viruses renamed the virus as severe acute respiratory syndrome coronavirus (SARS-CoV2)(Gorbalenya, Baker, Baric, de Groot, Drosten, Gulyaeva, Haagmans, Lauber, Leontovich, Neuman, Penzar, Perlman, Poon, Samborskiy, Sidorov, Sola, & Ziebuhr, 2020; Gorbalenya, Baker, Baric, de Groot, Drosten, Gulyaeva, Haagmans, Lauber, Leontovich, Neuman, Penzar, Perlman, Poon, Samborskiy, Sidorov, Sola, Ziebuhr, et al., 2020). On March 11th 2020, the WHO declared COVID-19 as a pandemic and emphasized the critical importance of containing the virus and preventing community transmission (World Health Organization, 2020e). Despite all preventive methods applied by numerous countries, the total number of infected individuals have surged to more than one million with more than fifty thousand deaths as of April 3rd, 2020. This exponential increase in infected individuals can be attributed to the high reproduction number of SARS-CoV2 (R0 range between 2 – 6.75), the relatively long

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prodromal period, and the possibility of asymptomatic carriers transmitting the infection (D. Wu, Wu, Liu, & Yang, 2020; Zhao et al., 2020).

One of the high-risk group susceptible to SARS-CoV2 infection is health care providers, specifically dentists, due to the nature of their work that entails aerosol production, and working at very close proximity to their patients. Indeed, in an analysis by the O*Net Bureau of Labour Statistics of the USA, dentists were considered the highest risk group of health care workers at risk for contracting COVID-19(Gamio, 2020).

Therefore, several protocols have been published to provide guidance on managing dental practices during the pandemic. This paper provides a brief overview of the disease and a review of the available transmission control guidelines.

2. Etiology and the mechanics of viral entry into cells.

COVID-19 is caused by SARS-CoV2 which belongs to the family of *Coronaviridae*. Coronaviruses can be divided into four genera; alpha, beta, gamma and delta coronaviruses. Alpha and beta genera mostly infects mammals, while the gamma and delta mostly infect birds. There are six different alpha and beta variants of coronaviruses that infect humans, four of them (alpha HCoV-229E and HCoV-NL63, and beta HCoV-HKU1 and HCoV-OC43) usually cause mild symptoms similar to common cold. While two of the beta coronaviruses can cause severe respiratory illnesses that can be fatal, such as the severe acute respiratory syndrome coronavirus (SARS-CoV1) and the Middle East respiratory syndrome coronavirus (MERS-CoV) (Ashour, Elkhatib, Rahman, & Elshabrawy, 2020; Guo et al., 2020). Indeed, recent genome sequencing and phylogenetic analyses of SARS-CoV2 have shown its close

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resemblance to SARS-CoV1 (about 79%) and MERS-CoV (about 50%) (R. Lu et al., 2020; Zhou et al., 2020). Furthermore, Zhou et al have demonstrated the high degree of similarity in receptor-binding domain (RBD) of SARS-CoV1 and SARS-CoV2 and both appear to target angiotensin-converting enzyme 2 (ACE2) of human cells (Zhou et al., 2020). SARS-CoV2 uses ACE2 as a portal of entry into host cells, thus, all cells expressing ACE2 are susceptible to SARS-CoV2 infection(Hoffmann et al., 2020; Zhou et al., 2020). Therefore, several authors suggest that knowing the expression pattern of ACE2 in different organs and tissues is very important to determine the routes of entry of SARS-CoV2, and also to understand the pathogenesis and the expected clinical manifestations of the disease (Hoffmann et al., 2020; Wan, Shang, Graham, Baric, & Li, 2020; Zhang, Penninger, Li, Zhong, & Slutsky, 2020). There are several organs and tissues that express ACE2, such as the lung, heart, kidney, small and large intestine, arterial and venous endothelium, oral mucosa and salivary glands (Cano et al., 2019; Hamming et al., 2004; L. Liu et al., 2011; Xu et al., 2020; Zhang et al., 2020). Interestingly, a recent study indicates high degree of expression of ACE2 in oral tissues, such as epithelial cells of the tongue and oral mucosa, suggesting that the oral cavity as a possible route of entry for SARS-CoV2 (Xu et al., 2020).

3. Signs and Symptoms

The clinical manifestations of COVID-19 range from early, prodromal asymptomatic cases to severe pneumonia with multiple organ failure. The most common symptoms are fever, cough, sore throat, fatigue, myalgia, headache, shortness of breath and in some cases diarrhoea. Chest computed tomographic (CT) scans might show patchy shadows and ground glass opacity in the lung("[The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) in China]," 2020; Guan et al., 2020; D. Wang et al., 2020; Zhu

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et al., 2020). Authors from the Chinese Center For Disease Control and Prevention published a detailed clinical report of 72,314 of patient with COVID-19 in mainland China and they classified the cases into mild, severe and critical (Table 1)("[The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) in China]," 2020; Z. Wu & McGoogan, 2020). Most of the observed cases presented were mild (80.9%), while only 4.7% were considered critical. They reported 2.3% mortality rate that affected mostly elderly patients (>70 years) and patients with pre-existing conditions such as cardiovascular diseases, hypertension, diabetes, chronic respiratory disease and cancer. Furthermore, no fatality was reported in mild and severe cases ("[The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) in China]," 2020). It can be concluded from the Chinese CDC report and other published studies, that elderly patients and those with pre-existing conditions are at a higher risk of developing severe symptoms than other groups ("[The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) in China]," 2020; Guan et al., 2020; D. Wang et al., 2020; Z. Wu & McGoogan, 2020; Zhu et al., 2020). This initial observation is now confirmed by data from multiple countries where the disease is currently prevalent.

4. Routes of Transmission

The most commonly reported routes of transmission for SARS-CoV2 are by inhalation of respiratory droplets or aerosols from the infected individuals, that may frequently occur within one meter radius of the index case, or through direct inoculation of virus-infested particles by touching surfaces contaminated with infected respiratory droplets (fomite transmission that occur through an inanimate vector)(Guan et al., 2020; Li et al., 2020; J. Liu et al., 2020; Yu, Zhu, Zhang, Han, & Huang, 2020). For instance, it has been reported that

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SARS-CoV2 can stay viable up to 24 hours on cardboard, and up to 72 hours on plastic or stainless steel surfaces (van Doremalen et al., 2020).

Opinions vary as to the degree and extent of the airborne mode of SARS-CoV2 transmission. There is direct and indirect evidence to indicate that aerosols with a particle size of < 5 µm can be entrained in air and carried over distances of up to 1 m (Samarahayake, 2018). One recent study has reported the survival of SARS-CoV2 up to 3 hours in aerosol particles, supporting the possibility of airborne transmission(van Doremalen et al., 2020). However, another study reported the absence of SARS-CoV2 in air samples collected from an actual clinical environment where symptomatic patients were admitted(Ong et al., 2020). Therefore, more studies are required to provide confirmatory evidence of airborne transmission of SARS-CoV2 in both clinical as well as non-clinical settings (World Health Organization, 2020b). Nevertheless, in clinical settings, as in dental clinics, where large volume of aerosol is produced, air borne infection transmission is likely, and hence dentists and allied dental staff might consider extra airborne and droplet precautions during the pandemic(World Health Organization, 2020b).

Furthermore, SARS-CoV2 has been detected in saliva of infected individuals(K. K.-W. To et al., 2020; K. K. To et al., 2020). As explained earlier, this can be attributed to the expression of ACE2 in salivary glands(Cano et al., 2019; Hamming et al., 2004; L. Liu et al., 2011). This is another significant point to be considered in dental practice, as aerosols generated during dental procedures is highly likely to be mixed with patients' virus-contaminated saliva(Peng et al., 2020). It also represents an opportunity to explore a non-invasive mode of sample

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collection for SARS-CoV2 testing, as an alternative to the commonly used nasopharyngeal swab(Sabino-Silva, Jardim, & Siqueira, 2020; K. K.-W. To et al., 2020).

Moreover, it has been reported that stool of infected individuals are also contaminated with SARS-CoV2(Xiao et al., 2020). These findings, together with the fact that ACE2 is expressed in the gastrointestinal track(Hamming et al., 2004) and reports of infected individuals presenting with diarrhea("[The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) in China]," 2020; Guan et al., 2020), tends to imply that faecal-oral transmission route of SARS-CoV2 is plausible.

5. Transmission Control:

As mentioned earlier, there is a high likelihood of SARS-CoV2 transmission in the dental practice setting due to the dual risk of high aerosol generating procedures in dentistry, plus the saliva-borne SARS-CoV2 in both symptomatic or asymptomatic infected individuals. With regards to this, several dental associations have provided guidelines to control transmission of SARS-CoV2 in dental practice. These guidelines include postponing elective dental treatment, developing screening protocols, assessment through telecommunication and recommending special additional precautions, as discussed below (Table 2).

5.1 Tele/online communication and Evaluation of patients:

Due to the alarming surge in the number of infected individuals, the American Dental Association (ADA) recommended (on March 16th 2020) to address only dental emergencies and to postpone all elective dental procedures(American Dental Association, 2020a). In

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addition, ADA and other dental societies have also published road maps for identifying dental emergencies in each of the dental specialties(American Dental Association, 2020b; New Zealand Dental Asscociation, 2020c; Scotish Dental Clinical Effectiveness Programme, 2020).

A list of common dental emergencies encountered in a dental clinic setting that demands the patient to visit the dental clinic in spite of the ongoing outbreak of COVID-19 is provided in Table 3. Virtual/telecommunication technologies are currently available to aid dental professionals to perform initial screening of patients, and identify emergencies. Such technology, in addition to taking a dental history, photographs and videos, will assist the clinician to reach a preliminary diagnosis. In regard to dental emergencies, initial management can be commenced over tele-communication using locally available analgesics and antimicrobials; whenever appropriate. However, in the event of severe, acute signs or symptoms where the initial palliative medication therapy does not show improvement, urgent on-site dental care has to be provided. Prior to scheduling such an appointment, a screening protocol has to be followed to determine potential exposure to COVID-19. The New Zealand Dental Association (NZDA) along with other dental societies proposed a list of probing questions that allows the dental staff to gauge the patient's potential exposure to COVID-19. Firstly, patients should be asked if they are positive for COVID-19 or show signs of respiratory illness including cough, shortness of breath or sore throat. In addition, the patient should be questioned on his/her recent travel history or any close contact with infected individuals(new Zealand Dental Asscociation, 2020a). These questions should be mandatory, henceforth, for all patients when they present at the dental practice. Furthermore, body temperature should be taken using contact-free forehead thermometer (world Health Organization, 2020a) If the patient does not respond affirmatively to the foregoing questions, and requires emergency

dental care, it must be provided in compliance with the infection protocol policies as described in the published guidelines, as briefly discussed below.

However, if the patient says “yes” to any of the aforementioned questions, and requires emergency dental treatment, the American Center for Disease Control and Preventions (CDC) has recommended immediate patient referral to a facility properly equipped to manage potentially exposed or confirmed COVID-19 patients(American Centers Of Disease Control and Prevention, 2020). This is critical as most of the dental practices are not designed or equipped to provide the necessary droplet transmission control environment, such as an isolation room with negative pressure, and High Efficiency Particulate Air (HEPA) filter systems (American Centers Of Disease Control and Prevention, 2020). Further details are discussed below.

5.2 Precautions for managing emergencies of non-COVID19 patients

5.2.1. Precautions in waiting areas:

Waiting areas in a dental practices are common areas where a higher likelihood of cross-infection or increased exposure between patients and accompanying persons or dental team personnel is a pertinent threat. First of all, it is important to regulate the number of people present in or around the waiting areas, and socially distancing them, by informing the patients to either arrive for the dental appointments unaccompanied or wait outside in a car only to arrive at the dental clinic when the dental staff is ready to accommodate the patient’s needs. Secondly, as discussed previously, due to the ability of SARS-CoV2 to survive on different surfaces for few hours special changes to the design and setup of waiting area are required to limit cross-contamination(van Doremalen et al., 2020). Such as removal of all unnecessary

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items from the waiting rooms including magazines and toys that can harbour virus particles on their respective surfaces. The concept of “Social distancing” by ensuring that the sitting spaces are 2 meters apart in the waiting area. Further guidance includes frequent cleansing of “high-touch” surfaces (reception counter, toilet doors, door knobs and handles etc.) using a neutral pH detergent(Ge, Yang, Xia, Fu, & Zhang, 2020). Moreover, patient related infographic images demonstrating optimum hand hygiene techniques, managing a cough etiquette, concept of “social distancing” that are easy to read and understand should be exhibited in the common areas (New Zealand Dental Asscociation, 2020b).

5.2.2. Personal protective equipment:

As discussed above, inhalation of virus-laden aerosols is a major and potent mode of SARS-CoV2 infection(Bentley, Burkhart, & Crawford, 1994; Nejatidanesh, Khosravi, Goroohi, Badrian, & Savabi, 2013). Additionally, transmission of the virus has also been attributed to infectious droplets contaminating the conjunctival epithelium of the eyes (Lu, Liu, & Jia, 2020). Hence, Personal protective equipment (PPE) must be worn, to provide an effective and efficient barrier against the foregoing aerosol generated hazards from the operative site can. These include protective eyewear, a face mask and a shield, a disposable working cap, appropriate gloves, gowns and impermeable shoe covers(C. W. Lu et al., 2020). If, for unavoidable reasons the dentist is performing aerosol generating procedures, then a particulate respirator that is at least as protective as a National Institute for Occupational Safety and Health (NIOSH)-certified N95, European Standard Filtering Face Piece 2 (EU FFP2), or equivalent has to be used(Kohn et al., 2003).

5.2.3 Radiographs

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As intraoral radiographs might induce gag reflex, increase saliva secretion and coughing in patients, published guidelines recommend avoiding intraoral radiographs. Extraoral radiographic techniques such as Panoramic and cone beam computed tomography can be used alternatively during COVID-19 pandemic (American Association of Endodontics, 2020; Indian Endodontic Society, International Federation Of Endodontic Associations, & Indian Dental Association, 2020; Meng, Hua, & Bian). Furthermore, if intraoral radiograph is necessary, additional precautions are recommended such as use of double barriers to prevent cross-contamination through perforations(American Association of Endodontics, 2020; Hokett, Honey, Ruiz, Baisden, & Hoen, 2000).

5.2.4 Pre-operative mouth rinse

It has been reported that the use of pre-operative antimicrobial mouth rinse reduce the microbial count in the oral cavity and aerosols generated during the procedure (Eggers, Koburger-Janssen, Eickmann, & Zorn, 2018; Kariwa, Fujii, & Takashima, 2004; Mani, Srikanthan, Selvaraj, Menaka, & Parangimalai Diwakar, 2020; Meng et al.; Peng et al., 2020). Therefore, several associations have recommended the use of pre-procedural mouth rinse as measure to reduce the potential risk of infection transmission during dental treatment. The NZDA recommends 1% hydrogen peroxide, 0.2% chlorhexidine (CHX), 2% povidine-iodine or 2% Listerine for 30 seconds prior to procedures(New Zealand Dental Asscociation, 2020b). If a pre procedural mouth rinse is not possible, a swab soaked in hydrogen peroxide 1% or CHX 1% can be used alternatively (New Zealand Dental Asscociation, 2020b). In contrast, both the Indian Endodontic Society (IES) and National Health Commission of the People's Republic of China have highlighted the ineffectiveness of 0.2% CHX against SARS-COV2 and have recommended the use of 1% hydrogen peroxide or 0.2% povidone-iodine as pre-procedural

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moth rinse(Indian Endodontic Society et al., 2020; National Health Commission of the People's Republic of China, 2020). American Association of Endodontics recommends using preprocedural mouth rinse with 0.2% povidone-iodine(American Assiciation of Endodontics, 2020). It can be concluded that the hydrogen peroxide or iodine are the most recommended mouth rinses.

5.2.5 Rubber dam

Since the virus load in human saliva is very high, pre-operative mouth rinse can only reduce it but cannot eliminate, therefore, taking additional measures such as the use of dental rubber dam to reduce exposure to contaminated aerosols during treatment is important (Spagnuolo, De Vito, Rengo, & Tatullo, 2020). For instance, it has been reported that rubber dam isolation can significantly reduce airborne particles in 3-foot diameter of the operational field by 70%(Peng et al., 2020; Samaranayake, Reid, & Evans, 1989). Therefore, using rubber dam is recommended in several published guidelines, not only for endodontics procedures, but for almost all aerosol generating dental procedures when possible(American Assiciation of Endodontics, 2020; American Dental Association, 2020a; Indian Endodontic Society et al., 2020; New Zealand Dental Asscociation, 2020b). Moreover, IES recommended dental dam isolation as well as high volume saliva ejectors in aerosol generating procedures(Indian Endodontic Society et al., 2020; Samaranayake et al., 1989).. In general, it is highly advisable to use dental rubber dam, either high / low volume saliva ejectors, and four-handed dental assistance in the immediate post-pandemic era to eliminate SARS-CoV2 transmission risk posed by asymptomatic patients.

5.2.6 Type of instruments and material

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According to the American Center for Disease Control and Prevention, the practice of dentistry involves the use of rotary dental/surgical instruments, which create a high volume of aerosols that could contain mixture of water, saliva, blood, microorganisms and other debris(American Centers Of Disease Control and Prevention, 2020). Example of aerosol generating dental instruments/equipment includes triplex syringe (3:1 syringe), high and low speed handpieces, ultrasonic scalers, air abrasion devices and intra-oral sandblasters(American Centers Of Disease Control and Prevention, 2020). The NZDA along with other associations advised to avoid using aerosol generating equipment as much as possible, and stressed the use of hand instrumentation, as well as low speed handpieces without water spray. If the use of aerosol generating equipment can't be avoided, use of high volume saliva ejectors is recommended(American Assiciation of Endodontics, 2020; New Zealand Dental Asscociation, 2020b). Furthermore, the of use of a handpiece with anti-retraction valve or other anti-reflux design is recommended during the pandemic and post-pandemic period of COVID-19(Peng et al., 2020). The guidelines also emphasized on the use of disposable instruments whenever possible.

5.3 Precautions for managing emergencies of potentially exposed or confirmed COVID-19 patients

As discussed previously for potential exposed or confirmed COVID-19 patients, regular appointments and elective treatments should be postponed until complete recovery. It is unlikely for symptomatic COVID-19 patient to attend the dental clinic. However, if that is not the case, due to a dental emergency, it is recommended to refer the patient to a facility equipped with Airborne Infection Isolation Rooms (AIIRs). This extra precaution is due to the potential of airborne transmission through aerosols. AIIRs are single-patient rooms at

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negative pressure relative to the surrounding areas, and with a minimum of 6 air changes per hour. As mentioned above HEPA filter integrated into the air-conditioning system is also required to filter air directly before recirculation (American Centers Of Disease Control and Prevention, 2020). Further, furniture and equipment in the room should be minimal and those essential for the operating procedure should be present. Rooms should be always closed, and entry/exit should be minimized. Furthermore, in addition to previously discussed transmission control precautions, all dentists and allied staff should use N95 or higher-level respirators(Kohn et al., 2003; Peng et al., 2020).

Both the American CDC and ADA, advised that recovered COVID-19 patients can be seen in normal clinic setting for dental emergencies only. Recovery is defined as at least 3 days (72 hours) since resolution of fever without the use of fever-reducing medications and improvement in respiratory symptoms, e.g., cough, shortness of breath, and at least 7 days since symptoms first occurred. Or for individuals with laboratory-confirmed COVID-19 who have not had any symptoms, at least 7 days since the date of the first positive COVID-19 diagnostic test, and have had no subsequent illness.

6. Post-pandemic dental practice

There is little doubt that the practice of dentistry will be irrevocably affected by the COVID-19 pandemic, at least in the shorter term until a successful antiviral agent or a vaccine is found for the causative agent. Although at this stage it is difficult to extrapolate the `new reality' of post-pandemic dentistry, as the disease is still evolving in a majority of affected countries, there are some predictions that could be made, mainly because COVID-19 is not the first coronavirus infection the humans have encountered. Indeed, we have successfully curbed the

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epidemics of SARS-CoV1 infection that began in 2002, and the Middle East Respiratory Syndrome (MERS) Coronavirus infection, a decade later, and thankfully, they never developed into pandemics, and the regional epidemics burnt out fairly swiftly(Samaranayake & Peiris, 2004).

Only sporadic cases of MERS coronavirus is now seen, whilst it appears that the SARS-CoV1 infection has disappeared altogether. So what are the lessons we could learn from the past epidemics of these corona virus infections, that closely resembles COVID-19 in many respects?

In terms of post-pandemic infection control in the dental clinic environment, it is imperative to maintain a very high degree of suspicion by all dental personnel whilst strictly adopting the standard infection control precautions. Fortunately, the latter appears to be the norm in most, if not all, dental practices, and hence additional precautions appear to be unnecessary for routine patients. All dental personnel must maintain vigilance for any patient entering the clinical premises with symptoms of acute respiratory infections (e.g. cough, cold, sneezing etc). Further, it may be highly desirable to record the temperature of each patient immediately after entering the premises, and before the patient enters the patient waiting area. For instance, this could be performed by a trained receptionist using a non-contact thermometer gun. Additionally, the patient history questionnaire should include recent travel abroad, as the COVID-19 pandemic may be smouldering in some parts of the world for the foreseeable future. As diarrhoea is also a relatively common in COVID-19, a recent or current history of this symptom may also have to be included in the questionnaire(X. Wang et al., 2020).

The foregoing is a provisional and a rather brief account of the plausible, key features of post-pandemic patient management. Definitive recommendations and guidelines on this subject

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should be developed by local and regional health authorities, and are beyond the remit of this article.

7. Drugs and vaccines for COVID-19

Many researchers and scientists, the world over are working on potential drugs, and vaccines to manage COVID-19. Repurposed drugs are being either experimentally used or planned for the management of the condition and these include the anti-retroviral drugs lopinavir and ritonavir successfully used to manage HIV disease, anti-malarial drug hydroxychloroquine, and the antibiotic azithromycin(Cao et al., 2020; Rosa & Santos, 2020). There is also a current Australian trial of the BCG (Bacille Calmette Guerin vaccine which contains attenuated *Mycobacterium bovis* bacilli[30]) for the condition(Miller et al., 2020).

Other possible products in the pipe-line include massive screening of millions of compounds using *in silico* research for their ability to destroy the SARS-CoV2. As these are all in the early experimental stages and human trials are still ongoing, conclusive data are yet unavailable. Although a promise of a quick cure for the disease using the above approaches appear to be waning, several vaccines are under various developmental stages in many countries and should be available within the next 18 months or so, after appropriate human trials. There are recent, promising reports of patients showing improvement when they are administered hyperimmune sera (containing antibodies to SARS-CoV2) from recovered COVID-19 patients (Cunningham, Goh, & Koh, 2020). This implies that the vaccination for preventing COVID-19 is the most promising approach to obviate a recurrence of the pandemic. If this were the case, then mass vaccination for COVID-19 could be the future, a situation akin to the annual vaccination required to prevent seasonal influenza amongst susceptible population cohorts, including dental care workers. Predictably then, one could foresee, the COVID-19 vaccine to

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be the next new addition to the armamentarium of recommended vaccinations for all dental health care workers.

8. Summary:

Since the announcement of COVID-19 as a pandemic and the reported transmission risk to dental professionals, several dental societies the world over have published guidelines for transmission control and management of dental emergencies during the current pandemic. In this review, we summarize and outline the common themes and principles that emerge from these recommendations. There is universal concurrence on directives such as postponing elective dental treatment, developing appropriate screening protocols through telecommunication, applying special additional, droplet precautions when treating patients with dental emergencies, and sequestrated treatment of infected or suspect patients in specially fitted suites with negative pressure We also discuss the recommended equipment and settings for clinics that can receive confirmed COVID-19 patients. Finally, we briefly outline the practice of dentistry in the post-pandemic era and potential antiviral drugs and vaccine that can be used to manage COVID-19. It should, however, be noted that due to the highly fluid, dynamic and the evolving nature of the pandemic, and the unfolding natural history of the disease process, the foregoing recommendations are likely to change and all dental personnel should constantly keep abreast of the new developments and pronouncements on infection control in dentistry, issued by the local and regional health authorities.

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References:

American Association of Endodontics. (2020). Coronavirus Disease 19 (COVID-19): Implications for Clinical Dental Care. Retrieved from https://www.aae.org/specialty/clinical-resources/coronavirus-disease-19-covid-19-implications-for-clinical-dental-care/

American Centers Of Disease Control and Prevention. (2020). Interim Infection Prevention and Control Guidance for Dental Settings During the COVID-19 Response. Retrieved from https://www.cdc.gov/coronavirus/2019-ncov/hcp/dental-settings.html

American Dental Association. (2020a). ADA adds frequently asked questions from dentists to coronavirus resources. Retrieved from https://www.ada.org/en/publications/ada-news/2020-archive/march/ada-adds-frequently-asked-questions-from-dentists-to-coronavirus-resources.

American Dental Association. (2020b). What Constitutes a Dental Emergency? Retrieved from https://success.ada.org/~/media/CPS/Files/Open%20Files/ADA_COVID19_Dental_Emergency_DDS.pdf

Ashour, H. M., Elkhatib, W. F., Rahman, M. M., & Elshabrawy, H. A. (2020). Insights into the Recent 2019 Novel Coronavirus (SARS-CoV-2) in Light of Past Human Coronavirus Outbreaks. *Pathogens, 9*(3). doi:10.3390/pathogens9030186

Bentley, C. D., Burkhart, N. W., & Crawford, J. J. (1994). Evaluating spatter and aerosol contamination during dental procedures. *J Am Dent Assoc, 125*(5), 579-584. doi:10.14219/jada.archive.1994.0093

Cano, I. P., Dionisio, T. J., Cestari, T. M., Calvo, A. M., Colombini-Ishikiriama, B. L., Faria, F. A. C., . . . Santos, C. F. (2019). Losartan and isoproterenol promote alterations in the local renin-angiotensin system of rat salivary glands. *PLoS One, 14*(5), e0217030. doi:10.1371/journal.pone.0217030

Cao, B., Wang, Y., Wen, D., Liu, W., Wang, J., Fan, G., . . . Wang, C. (2020). A Trial of Lopinavir-Ritonavir in Adults Hospitalized with Severe Covid-19. *N Engl J Med*. doi:10.1056/NEJMoa2001282

Cunningham, A. C., Goh, H. P., & Koh, D. (2020). Treatment of COVID-19: old tricks for new challenges. *Critical care (London, England), 24*(1), 91. Retrieved from https://doi.org/10.1186/s13054-020-2818-6

Eggers, M., Koburger-Janssen, T., Eickmann, M., & Zorn, J. (2018). In Vitro Bactericidal and Virucidal Efficacy of Povidone-Iodine Gargle/Mouthwash Against Respiratory and Oral Tract Pathogens. *Infect Dis Ther, 7*(2), 249-259. doi:10.1007/s40121-018-0200-7

[The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) in China]. (2020). *Zhonghua liu xing bing xue za zhi = Zhonghua liuxingbingxue zazhi, 41*(2), 145-151.

Gamio, L. (2020, 15 March). The Workers Who Face the Greatest Coronavirus Risk. *The New York Times*. Retrieved from https://www.nytimes.com/interactive/2020/03/15/business/economy/coronavirus-worker-risk.html

Ge, Z.-y., Yang, L.-m., Xia, J.-j., Fu, X.-h., & Zhang, Y.-z. (2020). Possible aerosol transmission of COVID-19 and special precautions in dentistry. *Journal of Zhejiang University-SCIENCE B*. doi:10.1631/jzus.B2010010

Gorbalenya, A. E., Baker, S. C., Baric, R. S., de Groot, R. J., Drosten, C., Gulyaeva, A. A., . . . Ziebuhr, J. (2020). Severe acute respiratory syndrome-related coronavirus: The species and its viruses – a statement of the Coronavirus Study Group. *bioRxiv*, 2020.2002.2007.937862. doi:10.1101/2020.02.07.937862

Gorbalenya, A. E., Baker, S. C., Baric, R. S., de Groot, R. J., Drosten, C., Gulyaeva, A. A., . . . Coronaviridae Study Group of the International Committee on Taxonomy of, V. (2020). The species Severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2. *Nat Microbiol, 5*(4), 536-544. doi:10.1038/s41564-020-0695-z

Guan, W.-j., Ni, Z.-y., Hu, Y., Liang, W.-h., Ou, C.-q., He, J.-x., . . . Zhong, N.-s. (2020). Clinical Characteristics of Coronavirus Disease 2019 in China. *New England Journal of Medicine*. doi:10.1056/NEJMoa2002032

Guo, Y. R., Cao, Q. D., Hong, Z. S., Tan, Y. Y., Chen, S. D., Jin, H. J., . . . Yan, Y. (2020). The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak - an update on the status. *Mil Med Res, 7*(1), 11. doi:10.1186/s40779-020-00240-0

Hamming, I., Timens, W., Bulthuis, M. L., Lely, A. T., Navis, G., & van Goor, H. (2004). Tissue distribution of ACE2 protein, the functional receptor for SARS coronavirus. A first step in understanding SARS pathogenesis. *J Pathol, 203*(2), 631-637. doi:10.1002/path.1570

Hoffmann, M., Kleine-Weber, H., Schroeder, S., Krüger, N., Herrler, T., Erichsen, S., . . . Pöhlmann, S. (2020). SARS-CoV-2 Cell Entry Depends on ACE2 and TMPRSS2 and Is Blocked by a Clinically Proven Protease Inhibitor. *Cell*. doi:10.1016/j.cell.2020.02.052

Hokett, S. D., Honey, J. R., Ruiz, F., Baisden, M. K., & Hoen, M. M. (2000). Assessing the effectiveness of direct digital radiography barrier sheaths and finger cots. *J Am Dent Assoc, 131*(4), 463-467. doi:10.14219/jada.archive.2000.0202

Indian Endodontic Society, International Federation Of Endodontic Associations, & Indian Dental Association. (2020). *Joint position statement on dental practice during COVID-19*. Retrieved from https://www.ies.org.in/

Kariwa, H., Fujii, N., & Takashima, I. (2004). Inactivation of SARS coronavirus by means of povidone-iodine, physical conditions, and chemical reagents. *Jpn J Vet Res, 52*(3), 105-112.

Kohn, W. G., Collins, A. S., Cleveland, J. L., Harte, J. A., Eklund, K. J., & Malvitz, D. M. (2003). Guidelines for infection control in dental health-care settings--2003. *MMWR Recomm Rep, 52*(Rr-17), 1-61.

Li, Q., Guan, X., Wu, P., Wang, X., Zhou, L., Tong, Y., . . . Feng, Z. (2020). Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus–Infected Pneumonia. *New England Journal of Medicine, 382*(13), 1199-1207. doi:10.1056/NEJMoa2001316

Liu, J., Liao, X., Qian, S., Yuan, J., Wang, F., Liu, Y., . . . Zhang, Z. (2020). Community Transmission of Severe Acute Respiratory Syndrome Coronavirus 2, Shenzhen, China, 2020. *Emerg Infect Dis, 26*(6). doi:10.3201/eid2606.200239

Liu, L., Wei, Q., Alvarez, X., Wang, H., Du, Y., Zhu, H., . . . Chen, Z. (2011). Epithelial cells lining salivary gland ducts are early target cells of severe acute respiratory syndrome coronavirus infection in the upper respiratory tracts of rhesus macaques. *J Virol, 85*(8), 4025-4030. doi:10.1128/jvi.02292-10

Lu, C. W., Liu, X. F., & Jia, Z. F. (2020). 2019-nCoV transmission through the ocular surface must not be ignored. *Lancet, 395*(10224), e39. doi:10.1016/s0140-6736(20)30313-5

Lu, R., Zhao, X., Li, J., Niu, P., Yang, B., Wu, H., . . . Tan, W. (2020). Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. *Lancet, 395*(10224), 565-574. doi:10.1016/s0140-6736(20)30251-8

Mani, S., Srikanthan, S., Selvaraj, B., Menaka, V., & Parangimalai Diwakar, M. (2020). Effectiveness of 0.2% chlorhex plus and 0.1% turmix as preprocedural mouthrinses on aerosol contamination produced by ultrasonic scalers: An interventional study. *Journal of Dental Research and Review, 7*(1), 5-9. doi:10.4103/jdrr.jdrr_7_20

Meng, L., Hua, F., & Bian, Z. Coronavirus Disease 2019 (COVID-19): Emerging and Future Challenges for Dental and Oral Medicine. *Journal of Dental Research, 0*(0), 0022034520914246. doi:10.1177/0022034520914246

Miller, A., Reandelar, M. J., Fasciglione, K., Roumenova, V., Li, Y., & Otazu, G. H. (2020). Correlation between universal BCG vaccination policy and reduced morbidity and mortality for COVID-19: an epidemiological study. *medRxiv*, 2020.2003.2024.20042937. doi:10.1101/2020.03.24.20042937

National Health Commission of the People's Republic of China. (2020). *Guideline for the Diagnosis and Treatment of Novel Coronavirus Pneumonia (5th Edition)*. Retrieved from

Nejatidanesh, F., Khosravi, Z., Goroohi, H., Badrian, H., & Savabi, O. (2013). Risk of Contamination of Different Areas of Dentist's Face During Dental Practices. *Int J Prev Med, 4*(5), 611-615.

New Zealand Dental Asscociation. (2020a). COVID-19 Response Interim Advice for Oral Health Practitioners. Retreived from https://www.dcnz.org.nz/assets/Uploads/COVID/NZDA-COVID-19-Response-Interim-advise-for-oral-health-practitioners-20Mar20.pdf

New Zealand Dental Asscociation. (2020b). COVID-19 Safety Standards. Retreived from https://www.nzda.org.nz/assets/files/Standards__Guidelines/COVID-19_Safety_Standards.pdf

New Zealand Dental Asscociation. (2020c). Medical Management of Acute Dental Pain. Retreived from https://www.nzda.org.nz/assets/files/Standards__Guidelines/Medical_Management_of_Acute_Dental_Pain.pdf

Ong, S. W. X., Tan, Y. K., Chia, P. Y., Lee, T. H., Ng, O. T., Wong, M. S. Y., & Marimuthu, K. (2020). Air, Surface Environmental, and Personal Protective Equipment Contamination by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) From a Symptomatic Patient. *Jama*. doi:10.1001/jama.2020.3227

Peng, X., Xu, X., Li, Y., Cheng, L., Zhou, X., & Ren, B. (2020). Transmission routes of 2019-nCoV and controls in dental practice. *International Journal of Oral Science, 12*(1), 9. doi:10.1038/s41368-020-0075-9

Phelan, A. L., Katz, R., & Gostin, L. O. (2020). The Novel Coronavirus Originating in Wuhan, China: Challenges for Global Health Governance. *JAMA, 323*(8), 709-710. doi:10.1001/jama.2020.1097

Rosa, S. G. V., & Santos, W. C. (2020). Clinical trials on drug repositioning for COVID-19 treatment. *Rev Panam Salud Publica, 44*, e40. doi:10.26633/rpsp.2020.40

Sabino-Silva, R., Jardim, A. C. G., & Siqueira, W. L. (2020). Coronavirus COVID-19 impacts to dentistry and potential salivary diagnosis. *Clinical Oral Investigations, 24*(4), 1619-1621. doi:10.1007/s00784-020-03248-x

Samarahayake, L. P. (2018). *Essential microbiology for dentistry*. UK: Elsevier Health Sciences.

Samaranayake, L. P., & Peiris, M. (2004). Severe acute respiratory syndrome and dentistry: a retrospective view. *J Am Dent Assoc, 135*(9), 1292-1302. doi:10.14219/jada.archive.2004.0405

Samaranayake, L. P., Reid, J., & Evans, D. (1989). The efficacy of rubber dam isolation in reducing atmospheric bacterial contamination. *ASDC J Dent Child, 56*(6), 442-444.

Scotish Dental Clinical Effectiveness Programme. (2020). Management of acute dental prolems during COVID-19 pandemic. Retrieved from http://www.sdcep.org.uk/published-guidance/acute-dental-problems-covid-19/

Spagnuolo, G., De Vito, D., Rengo, S., & Tatullo, M. (2020). COVID-19 Outbreak: An Overview on Dentistry. *International journal of environmental research and public health, 17*, 2094. doi:10.3390/ijerph17062094

To, K. K.-W., Tsang, O. T.-Y., Leung, W.-S., Tam, A. R., Wu, T.-C., Lung, D. C., . . . Yuen, K.-Y. (2020). Temporal profiles of viral load in posterior oropharyngeal saliva samples and serum antibody responses during infection by SARS-CoV-2: an observational cohort study. *The Lancet. Infectious Diseases*. doi:10.1016/s1473-3099(20)30196-1

To, K. K., Tsang, O. T., Chik-Yan Yip, C., Chan, K. H., Wu, T. C., Chan, J. M. C., . . . Yuen, K. Y. (2020). Consistent detection of 2019 novel coronavirus in saliva. *Clin Infect Dis*. doi:10.1093/cid/ciaa149

van Doremalen, N., Bushmaker, T., Morris, D. H., Holbrook, M. G., Gamble, A., Williamson, B. N., . . . Munster, V. J. (2020). Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. *New England Journal of Medicine*. doi:10.1056/NEJMc2004973

Wan, Y., Shang, J., Graham, R., Baric, R. S., & Li, F. (2020). Receptor Recognition by the Novel Coronavirus from Wuhan: an Analysis Based on Decade-Long Structural Studies of SARS Coronavirus. *J Virol, 94*(7). doi:10.1128/jvi.00127-20

Wang, D., Hu, B., Hu, C., Zhu, F., Liu, X., Zhang, J., . . . Peng, Z. (2020). Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. *Jama*. doi:10.1001/jama.2020.1585

Wang, X., Fang, J., Zhu, Y., Chen, L., Ding, F., Zhou, R., . . . Zhao, Q. (2020). Clinical characteristics of non-critically ill patients with novel coronavirus infection (COVID-19) in a Fangcang Hospital. *Clin Microbiol Infect*. doi:10.1016/j.cmi.2020.03.032

World Health Organization. (2020a). Clinical management of severe acute respiratory infection (SARI) when COVID-19 disease is suspected.

World Health Organization. (2020b, 29 March). Modes of transmission of virus causing COVID-19:implications for IPC precaution recommendations. Retrieved from https://www.who.int/publications-detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations

World Health Organization. (2020c, 11 Feb). Naming the coronavirus disease (COVID-19) and the virus that causes it. Retrieved from https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-(covid-2019)-and-the-virus-that-causes-it

World Health Organization. (2020d, 30 Jan). Novel Coronavirus(2019-nCoV) Situation Report - 10. Retrieved from https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200130-sitrep-10-ncov.pdf?sfvrsn=d0b2e480_2

World Health Organization. (2020e, 11 March). WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020. Retrieved from https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020

Wu, D., Wu, T., Liu, Q., & Yang, Z. (2020). The SARS-CoV-2 outbreak: what we know. *Int J Infect Dis*. doi:10.1016/j.ijid.2020.03.004

Wu, Z., & McGoogan, J. M. (2020). Characteristics of and Important Lessons From the Coronavirus Disease 2019 (COVID-19) Outbreak in China: Summary of a Report of 72 314 Cases From the Chinese Center for Disease Control and Prevention. *JAMA*. doi:10.1001/jama.2020.2648

Xiao, F., Tang, M., Zheng, X., Liu, Y., Li, X., & Shan, H. (2020). Evidence for gastrointestinal infection of SARS-CoV-2. *Gastroenterology*. doi:10.1053/j.gastro.2020.02.055

Xu, H., Zhong, L., Deng, J., Peng, J., Dan, H., Zeng, X., . . . Chen, Q. (2020). High expression of ACE2 receptor of 2019-nCoV on the epithelial cells of oral mucosa. *International Journal of Oral Science, 12*(1), 8. doi:10.1038/s41368-020-0074-x

Yu, P., Zhu, J., Zhang, Z., Han, Y., & Huang, L. (2020). A familial cluster of infection associated with the 2019 novel coronavirus indicating potential person-to-person transmission during the incubation period. *J Infect Dis*. doi:10.1093/infdis/jiaa077

Zhang, H., Penninger, J. M., Li, Y., Zhong, N., & Slutsky, A. S. (2020). Angiotensin-converting enzyme 2 (ACE2) as a SARS-CoV-2 receptor: molecular mechanisms and potential therapeutic target. *Intensive Care Med, 46*(4), 586-590. doi:10.1007/s00134-020-05985-9

Zhao, S., Lin, Q., Ran, J., Musa, S. S., Yang, G., Wang, W., . . . Wang, M. H. (2020). Preliminary estimation of the basic reproduction number of novel coronavirus (2019-nCoV) in China, from 2019 to 2020: A data-driven analysis in the early phase of the outbreak. *Int J Infect Dis, 92*, 214-217. doi:10.1016/j.ijid.2020.01.050

Zhou, P., Yang, X. L., Wang, X. G., Hu, B., Zhang, L., Zhang, W., . . . Shi, Z. L. (2020). A pneumonia outbreak associated with a new coronavirus of probable bat origin. *Nature, 579*(7798), 270-273. doi:10.1038/s41586-020-2012-7

Zhu, N., Zhang, D., Wang, W., Li, X., Yang, B., Song, J., . . . Tan, W. (2020). A Novel Coronavirus from Patients with Pneumonia in China, 2019. *New England Journal of Medicine, 382*(8), 727-733. doi:10.1056/NEJMoa2001017

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Table 1

Classification of COVID-19 cases		Percentage of total observed cases
Mild	Non-pneumonia and mild pneumonia	80.9%
Severe	Dyspnea, respiratory frequency ≥30/min, blood oxygen saturation ≤93%, partial pressure of arterial oxygen to fraction of inspired oxygen ratio <300, and/or lung infiltrates >50% within 24 to 48 hours	13.8%
Critical	Respiratory failure, septic shock, and/or multiple organ dysfunction or failure	4.7%

Table 2

Recommended measures for dental treatment during COVID-19 pandemic		
	Management of dental care	• Postpone elective treatment. [1,2,3,4] • Provide urgent, emergency treatment only. [1,2,3,4]
	Primary care dental triage	• Recommend to screen patients using telecommunication technology [1,2,3,4] • Triage room for consultations [1,2,3,4]
	Personal protective equipment (PPE)	• N95 or equivalent (especially in aerosol generating procedures) [1,3,4] • Surgical mask [2] • Protective eyewear [1,2,3,4] • Disposable working cap [1,2,3,4] • Appropriate gloves [1,2,3,4] • Gowns [1,2,3,4] • Impermeable shoe covers [1,2,3,4]
	Radiographs	• Avoid taking intra-oral radiograph [1,2,3,4] • Double barrier for intra-oral sensor or films, if intra-oral radiograph is required. [5]
	Pre-operative mouth rinse	• 1% Hydrogen Peroxide [1,2,3,4] • 0.2% Povidone-Iodine [1,2,3,4] • 0.2% Chlorhexidine [3] • 2% Listerine [3]
	Rubber dam	• Used as appropriate, especially in aerosol generating procedures [1,2,3,4]
	Type of instruments and material	• Avoid the use of ultrasonic, and use hand instruments [1,2,3,4] • Avoid the use of three-way syringes if possible [1,2,3,4] • Avoid the use of high-speed handpiece if possible [1,2,3,4] • High volume suction [1,2,3,4]
	As per guidelines published by American Dental Association[1], Scottish Dental Clinical Effectiveness Programme[2], New Zealand Dental Association[3] and International federation of Endodontic Association - Indian Endodontic Society joint statement[4]. American Association of Endodontics[5]	

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Table 3

List of commonly encountered dental emergencies that require urgent dental care:	
	Acute apical abscess [1,2,3]
	Acute Periodontal abscess/ Endo-Perio lesion [2,3]
	Acute pericoronitis [2,3]
	Necrotising ulcerative gingivitis/ periodontitis [2,3]
	Reversible pulpitis [1,2,3]
	Irreversible pulpitis [1,2,3]
	Dentine hypersensitivity [2]
	Dry socket [1,2,3]
	Post-extraction hemorrhage [1,2]
	Oral ulcerations [2]
	Cracked, fractured, loose or displaced tooth fragments and restorations [1,2]
	Ill-fitting or loose dentures [1,2]
	Trauma from fractured or displaced orthodontic appliances [1,2]
	Dento-alveolar injuries [1,2]
	Avulsed, displaced or fractured teeth [1,2]
	temporary crown or bridge recementation [1]
	Biopsy of abnormal tissue [1]
	Removal of sutures [1]
As per guidelines published by American Dental Association [1], Scottish Dental Clinical Effectiveness Programme [2] and New Zealand Dental Association [3]	