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REVIEW ARTICLE

Mode of transmission of COVID-19, Oral Manifestations, Precautionary Measures/Clinical Strategies and Treatment Considerations in dentistry

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ABSTRACT

Background: So far more than 253 million cases & more than 5 million casualties worldwide, while more than 1 million cases and more than 28 thousand casualties have been reported in Pakistan due to pandemic of Novel Corona Virus (COVID19). At the end of December 2019, a pneumonia outbreak began in Wuhan China, which then quickly spread to entire world. The viral pneumonia was named "Corona Virus Disease (COVID19)" by WHO on 11th February 2020. On March 11, 2020; WHO declared this outbreak as "Pandemic". Its mode of transmission includes contact transmission through mucous membranes of nose, mouth & fomites, and direct transmission through sneeze, cough and inhalation of droplets. It can be transmitted indirectly or directly via saliva, aerosols formed throughout clinical procedures and via contact. Clinical symptoms included fever, muscle ache or pain, cough. Incubation period of 1–14 days. In this pandemic, dentists are rated as highly exposed health care professionals to this disease
Aims: To describe Coronaviruses and its modes of transmission and to discuss treatment considerations and precautionary measures or clinical strategies adopted by Oral health professionals to protect themselves and to prevent the spread of coronavirus in the dental setup
Methodology: Since it's a Literature review article, so no methodology was required as such
Results: It's a Literature review article
Conclusion Standard precautionary measures and highly responsible behavior of a dentist will prevent the spread of this disease especially from asymptomatic patients.
Keywords Aerosols generation, COVID-19, Dental procedures, Oral health professionals, Pandemic, Precautionary measures

INTRODUCTION

Until now, many diseases have been identified in human beings whose etiology is unknown. A viral source has been proposed for a large number of these sicknesses, highlighting the significance of constant research for new unknown viruses[1,2]. Most of the human developing infectious sicknesses over the previous decades, including avian flu, Acquired immunodeficiency syndrome (AIDS), and severe acute respiratory syndrome (SARS), have evolved as a result of the interspecies spread of zoonotic RNA infections[3,4]. The identification of those viruses which are closely related in hosts other than humans is essential for building up the biology of viral rise alongside a reconstruction of transformative pathways; however, complicated biological systems make this troublesome[5]. These facts will help a long way in controlling these maladies at their causes and for intercession in plausible epidemics[6].

It was January 30, 2020; when the World Health Organization announced a public health emergency of global concern over the worldwide pneumonia outbreak[7]. After genome sequencing the infectious agent responsible for this viral pneumonia outbreak was at last named as a novel coronavirus (2019-nCOV), the seventh fellow from the group of coronaviruses that contaminate humans[8]. The genome sequencing also indicates that the natural host of 2019-nCoV might well be the bat Rhinolophus affinis[9]. The novel viral pneumonia was named as "Corona Virus Disease (COVID19)" by WHO on 11th February 2020 while the international Committee on Taxonomy of Viruses (ICTV) proposed this new virus name as "SARSCoV-2" due to its taxonomic and phylogenetic analysis[10]. On 11th March 2020, WHO declared this Corona Virus outbreak as "Pandemic"[11]. The incubation period for patients of COVID19 has been stated as 1–14 days[12].

Coronaviruses, a genus of the Coronaviridae family, are enveloped viruses with a large plus-strand RNA genome. The genomic RNA is 27–32 kb in size, capped and polyadenylated[13]. Three serologically diverse classes of coronaviruses have been discussed. Inside each gathering, viruses are portrayed by their host range and genome succession. Coronaviruses have also been recognized in swine, rats, cats, mice, dogs, chickens, dogs, rabbits, cattle and human beings, and can be a reason for the diversity of serious sicknesses which includes respiratory tract ailments and also gastroenteritis[14].

At the end of 2019 December, a pneumonia outbreak began in Wuhan China, which then quickly spread to other cities and countries by Individual to-individual transmission of the pathogenic agent[15,16]. So far more than 253 million cases & more than 5 million casualties worldwide while more than 1 million cases and more than 28 thousand casualties have been reported in Pakistan[17]. In the past, Coronaviruses (CoVs) have been viewed as generally innocuous respiratory micro-organisms to people[18]. Only minor illnesses due to coronaviruses were reported in human beings before the outburst of severe acute respiratory syndrome coronavirus (SARS-CoV)[19]. After the pandemic of SARS in 2003, it seemed that coronaviruses are zoonotic i.e. transmitted from animals to human beings and can also cause severe illnesses in human beings. So, these coronaviruses caught the eyes of the scientists & demanded additional consideration[18]. The Global blowout of two formerly unfamiliar coronaviruses, the Middle East respiratory syndrome coronavirus (MERS-CoV) and the severe acute respiratory syndrome coronavirus (SARS-CoV) was seen in the 21st century [20].Studies conducted beforehand on wild life sampled from live animal markets in Guangdong, China, indicated that masked paguma larvata (palm civets) and two different species had already been contaminated by SARS-CoV[21].This resulted in an extensive culling of paguma larvata (palm civets) to avoid more SARS outbreaks[22]. Yet, consequent studies have exposed no extensive infection in farmed or wild civets[23].

Dentistry perpetually carry the danger of COVID19 because of its complex dental procedures, which includes a person to person communication and continuous exposure to blood, saliva, sharp instruments and contact with environmental surfaces as well as the contaminated apparatuses during or after treating the patients[24,25]. So it is necessary to adopt the recommended

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preventive measures against COVID 19 in dental setup. Management/treatment of patients is also necessary during this pandemic.

Doctors including dental health professionals are at extreme risk of accomplishing infections while handling the patients [26]. Personal protective equipment ought to be worn at whatever point there is potential for contact with splash[27]. The term "personal protective equipment (PPE) is used to key out all protective equipment that a Healthcare professional may utilize in their surgical practice"[28]. PPE includes gloves, masks, face shields, protective eyewear. PPE is intended to shelter the mucous membranes, respiratory epithelium and skin of Health service providers from introduction to a reservoir or source of microorganisms by indirect or direct communication [27]. Researches & Literature shows that if you do not properly follow recommended preventive measures in dental setup then you are more prone to get COVID 19[29].

The common mode of transmission includes contact transmission (contact through mucous membranes of nose, mouth, eye as well as fomites) and direct transmission (sneeze, cough and inhalation of the droplet)[30]. It can be transmitted indirectly or directly via saliva as well[31]. Studies have proposed that it might be transmitted via aerosols formed throughout clinical procedures[32]. Research shows that the eye exposure could give a viable route to the infection to go into the body[33]. It was also reported that the transmission of this virus might also occur via contact with those patients who are without symptoms[34]. Fecal–oral route of transmission bothered by the community need to be additionally examined and confirmed[35].

The Oral cavity offers a supportive atmosphere to several substantial organisms and dental care workers are in straight contact with patients[36]. Contaminated surfaces which are commonly contacted in health-related settings are a probable source for coronavirus transmission. In medical clinics and dental centers particularly during the flare-up of 2019-nCoV, Infections might be present via any of the above-mentioned sources[37].

If it spread, then it can even cause seriousness or mortality of the person i.e. it may prove fatal. According to the estimation by Ejaz et al, the total susceptible population in Pakistan would be 43.24 million while 760,000 deaths could occur in the near future[38].

To et al. via the viral culture technique reported that living viruses were available in the salivation of infected people[31]. As reported by many dental research papers that numerous dental procedures generate droplets and aerosols that are defiled with the viruses[28]. So, the most concerned and significant mode of transmission of COVID19in dental setup are the aerosols and droplets routes as it is difficult to stay away from these blood or salivation mixed droplets and aerosols throughout dental practice[29,39].

A lot of droplets and aerosols blended with the patient's blood or spit are produced while using dental devices especially high-speed handpieces in the oral cavity of the patient. These Particles remain airborne for an increased period before they settle-down on any environmental surface or go in the respiratory tract. So, the 2019-nCoV can spread via aerosols and droplets in the dental setup[37]. As it is a recent outbreak, still a lot of research regarding its transmission in dentistry is underway.

The aim of this literature review is to describe the coronavirus disease and its mode of transmission, along with the treatment strategies to cope up with this disease.

Clinical features and oral manifestations of Novel Coronavirus 2019: Clinical symptoms shown by patients affected by this new virus-related pneumonia were fever, muscle ache or pain, cough, radiographic examination showed abnormal chest[40]. While some patients also reported hemoptysis, headache, diarrhea and sputum production[41].

Oral dryness (xerostomia), aphthous like lesions, vesiculobullous lesions, anosmia, dysgeusia, geographic tongue, desquamative gingivitis, oral pain, loss of taste sensation, melanin hyperpigmentation, thrush, petechiae have also been reported[42,43].

DISCUSSION

In order to minimize the risk of spread of COVID-19 in dental setup, always follow the recommended guidelines and the treatment considerations during this pandemic.

Infection control and prevention in dentistry: At room temperature it was revealed that COVID-19 stays contagious from 2 hours to as long as 9 days and continues well at 50% correlating with the 30% relative humidity. So, the perseverance of 2019-COVID-19 could be decreased in the dental setup by maintaining a dry and clean environment. Effective contamination control approaches are required to avoid the spread of COVID-19 via these contact practices[43].

Precautionary measures for dental treatment: Dental professionals should be familiar with COVID-19 disease and should also know how to work in this pandemic disaster. Dentists should give more emphasis on prevention and prefer telemedicine in this pandemic situation rather than doing live patients[44].

Dental professionals should treat all the patients by adopting standard precautionary measures because the principle of cross infection control is that all the patients are considered as positive[45].

Precautionary measures before the commencement of dental treatment or when the patient arrives: Dentists should always remember and follow the adaptation of basic precautionary measures as the patient arrives at the clinic

- Your staff should receive patients wearing masks.
- Patients and attendants should be offered hand sanitizer.
- Masks must be offered to the patients and attendants as well
- Children are not allowed in the dental set up except those to be treated
- Patients should be seated in a separate room for initial evaluation.
- Waiting area seats should be distant apart and remove reading materials and toys from the room.
- Companions should be avoided by the patients. But if the patient insists then evaluation of the patient companion also be considered.
- Make sure that your staff has received the seasonal flu vaccine.
- Your staff should be checked twice a day for temperature changes and shortness of breath.
- If any staff member complains of flue, temperature or shortness of breath, he should be advised to stay at home [46, 47]

According to the Guideline for the Prevention and Control of Novel Corona virus Pneumonia in Medical Institutes there are seven important points keep in mind for a dentist to treat the patients during pandemic disease.

Patient's evaluation: COVD-19 patient who has an acute febrile illness is not recommended for dental treatment. If a patient is suspected of such symptoms then immediately quarantine the patient or report to the infection control authorities.

Patient body temperature should be measured at reception with contact free digital thermometer. The patient is asked seven questions:

1. Have you experienced any fever in the last two weeks?
2. Have you felt any breathing difficulty or any respiratory problem in last two weeks?
3. Have you traveled to the area where the pandemic outbreak of COVID-19 occurs in the last two weeks?
4. Have you met the person who had confirmed COVID-19 in the last two weeks?
5. Have you contacted the person who travelled to the area where pandemic outbreaks of COVID-19 occur in last two weeks?
6. Have you met the at least two patients who had a respiratory problem or breathing difficulties in last two weeks?
7. Have you experienced any gatherings or meetings in last two weeks?

If the patient answers yes to any question but the temperature is below 37.5c then advice the patient to quarantine for two weeks and defer the treatment till further two weeks. But in case the patient says no to all questions and the temperature is above 37.5c then refer the patient to a physician. The patient is considered for

dental treatment if the patient says no to all questions and his temperature is also below 37.5^0C[48].

Treatment Considerations: According to the Centers for Disease Control and Prevention (CDC) always avoid the elective procedures [49] and do only emergency procedures such as:

- A maxillary or mandibular fracture which is unstable
- Ludwig angina or canine space infection
- Uncontrolled bleeding from the oral cavity
- Dental pain which cannot be treated without tooth extraction
- Vital tooth fracture causing severe pain which can be managed without the generation of aerosol.
- Dental avulsion and luxation injuries.
- Dry socket
- Repairing or removal of an orthodontic appliance which is fractured and causing troubleshoot.
- Periodontal abscess can be managed by without the generation of aerosol [50].

If you can delay the dental treatment, then you should advise home care instructions as well as appropriate medications to the patients.

1. Avoid appointing several patients at identical time[51].
2. If the procedures, generating aerosol, are unavoidable then dental professionals should perform such procedures at the end of the working day[46].
3. High-volume suction and rubber dam isolation should be utilized regularly as it is a basic way to minimize the production of aerosols generating throughout dental procedures. By using the elastic dam we can essentially decrease airborne particles up to a diameter of approximately~3-foot in the operational field by 70%[52].
4. Whenever possible use manual devices, so that the production of aerosols should be avoided or at-least minimized. Randomized control trials showed that manual and ultrasonic scaling is equally effective. In restorative procedures, Atraumatic Restorative Technique (ART) should be preferred. The patient should be in a supine position while performing extraction procedures [53].
5. Always prefer extraoral radiographs rather than intraoral radiographs to decrease the exposure of salivation [50].
6. In this pandemic situation, you should organize some workshops and drills to educate and train your staff to deal with susceptible COVID-19 patients [54].
7. Always Perform hand hygiene before and after utilizing PPE. Always use an N-95 mask or FFP3 respirator[55]. The COVID-19 are about 120 nm (0.12 µm) in size and aerosol particles are about 3–100 nm in size. FFP3 respirator filtration rate is reported as 99% for 0.6 µm sized particles [56].
8. Keep gloved hands far from eyes, face.
9. Avoid touching any surfaces or items. Always get rid of PPE before leaving your work area[57].
10. Single-use, disposable instruments ought to be utilized whenever possible to lessen the risks of cross- infection
11. Dental units should be cleaned as well as disinfected properly between every patient to avoid risks of cross-contamination[58].
12. Non-critical medical and dental equipment like a torch, B.P. apparatus, handles and dental unit control must be disinfected with 60-90% (v/v) isopropyl alcohol[58].
13. Housekeeping surfaces like floor, doorknob, window handles, table and chairs should be disinfected with 0.1% sodium hypochlorite or 0.5% hydrogen peroxide[59].
14. To decrease the viral burden in the patient's spit, ask the patient to rinse with 0.23% concentrated povidone-iodine or 1.5% hydrogen peroxide mouthwash for minimum of 15 seconds before the commencement of any procedure. Furthermore, Mouthwashes having anti-viral activity have been effective against numerous respiratory viruses[59].
15. The treatment must be as nominally invasive as possible[60].
16. Always try to avoid Ibuprofen in confirmed as well as suspected COVID-19 cases [60].

Dental education in pandemic disease of COVID-19: During pandemic disease interactive lectures and awareness programs/ seminars are not possible so the following strategies should be followed:

1. The use of electronic devices and software applications to teach dental students help a lot to overcome the deficiency of interactive lecture
2. Students should be advised to use online data regarding dentistry to make fruitful assignments which will help a lot to increase the knowledge of students.
3. Pressure and fear of pandemic disease can disturb the dental health experts and students emotionally, socially, and psychologically. So, they should be provided with psychological supportive care whoever needs [61].

CONCLUSION

In this pandemic disease (COVID-19), dentists are rated as highly exposed health care professionals. Standard precautionary measures and highly responsible behavior of a dentist will prevent the spread of this disease especially from asymptomatic patients. Oral healthcare workers and patients should be protected against this pandemic disease by practicing standard precautions in dental clinics. All working dentists should take responsibility to contribute in preventing spread of this pandemic disease.

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REFERENCES

1. Stohlman SA, Hinton DR. Viral induced demyelination. Brain pathology. 2001 Jan; 11:92-106. DOI: https://doi.org/10.1111/j.1750-3639.2001.tb00384.x
2. Jubelt, B. & Berger, J.R. Does viral disease underlie ALS? Lessons from the AIDS pandemic. Neurology. 2001; 57: 945–946. DOI: https://doi.org/10.1212/WNL.57.6.945
3. Chua et al. Nipah virus: a recently emergent deadly paramyxovirus. Science 2000; 288:1432–1435. DOI: 10.1126/science.288.5470.1432
4. Subbarao et al. Characterization of an avian influenza A (H5N1) virus isolated from a child with a fatal respiratory illness. Science 1998; 279:393–396. DOI: 10.1126/science.279.5349.393
5. Vijgen et al. Evolutionary history of the closely related group 2 coronaviruses: porcine hemagglutinating encephalomyelitis virus, bovine coronavirus, and human coronavirus OC43. J. Virol. 2006; 80:7270–7274. DOI: 10.1128/JVI.02675-05
6. Vijaykrishna D, Smith GJ, Zhang JX, Peiris JS, Chen H, Guan Y. Evolutionary insights into the ecology of coronaviruses. Journal of virology. 2007 Apr 15; 81:4012-20. DOI: 10.1128/JVI.02605-06
7. Huang C. et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. The Lancet. 2020 Feb 15;395(10223):497-506. https://doi.org/10.1016/S0140-6736(20)30183-5
8. Wu, F. et al. A new coronavirus associated with human respiratory disease in China. Nature. 2020 Apr 2:1-. https://doi.org/10.1038/s41586-020-2008-3.
9. Zhou, P. et al. A pneumonia outbreak associated with a new coronavirus of probable bat origin. Nature https://doi.org/10.1038/s41586-020-2012-7 (2020).
10. Gorbalenya AE. Severe acute respiratory syndrome-related coronavirus–The species and its viruses, a statement of the Coronavirus Study Group. BioRxiv. 2020 Jan 1. https://doi.org/10.1101/2020.02.07.937862
11. WHO, 2020a. WHO Virtual press conference on COVID-19 [WWW Document]. World Heal. Organ. https://www.who.int/docs/default-source/coronaviruse/transcripts/who-audio-emergencies-coronavirus-press-conference-full-and-final-11mar2020.pdf (accessed 3.29.20).
12. Backer JA, Klinkenberg D, Wallinga J. Incubation period of 2019 novel coronavirus (2019-nCoV) infections among travellers from Wuhan, China, 20–28 January 2020. Euro surveillance. 2020 Feb 6; 25:2000062. https://doi.org/10.2807/1560-7917.ES.2020.25.5.2000062
13. van der Hoek L et al. Identification of a new human coronavirus. Nature medicine. 2004 Apr;10 :368-73. https://doi.org/10.1038/nm1024
14. Guy JS, Breslin JJ, Breuhaus B, Vivrette S, Smith LG. Characterization of a coronavirus isolated from a diarrheic foal. Journal of clinical microbiology. 2000 Dec 1; 38:4523-6. https://doi.org/10.1128/jcm.38.12.4523-4526.2000
15. Zhu N et al. China Novel Coronavirus Investigating and Research Team. A novel coronavirus from patients with pneumonia in China, 2019. N Engl J Med. 2020 Feb 20; 382 :727-33. DOI: 10.1056/NEJMoa2001017
16. Wang C, Horby PW, Hayden FG, Gao GF. A novel coronavirus outbreak of global health concern. The Lancet. 2020 Feb 15; 395:470-3. https://doi.org/10.1016/S0140-6736(20)30185-9
17. WHO, 2021a. WHO statistics on COVID-19 [WWW Document]. World Heal. Organ https://www.who.int/docs/defaultsource/coronaviruse/transcripts/whocoronavirus - 16 Nov 2021 https://covid19.who.int/?
18. Song Z. et al. From SARS to MERS, thrusting coronaviruses into the spotlight. Viruses. 2019 Jan;11 :59. https://doi.org/10.3390/v11010059

19. Yin, Y.; Wunderink, R.G. MERS, SARS and other coronaviruses as causes of pneumonia. Respirology 2018, 23, 130–137. [CrossRef] [PubMed] https://doi.org/10.1111/resp.13196
20. Rota, P.A. Characterization of a Novel Coronavirus Associated with Severe Acute Respiratory Syndrome. Science 2003, 300, 1394–1399. [CrossRef] [PubMed]
21. Guan Y. et al. Guan YJ, Butt KM. Isolation and characterization of viruses related to the SARS coronavirus from animals in southern China. Science. 2003 Oct 10; 302:276-8. https://doi.org/10.1126/science.1087139
22. Tu C et al Antibodies to SARS coronavirus in civets. Emerging infectious diseases. 2004 Dec;10 :2244. https://doi.org/10.3201/eid1012.040520
23. Li W et al. Bats are natural reservoirs of SARS-like coronaviruses. Science. 2005 Oct 28; 310:676-9.
24. Liu L et al. 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. Journal of virology. 2011 Apr 15;85: 4025-30. https://doi.org/10.1128/jvi.02292-10
25. Kampf, G., Todt, D., Pfaender, S. & Steinmann, E. Persistence of coronaviruses on inanimate surfaces and its inactivation with biocidal agents. J. Hosp. Infect.2020 Mar;104:246-251. https://doi.org/10.1016/j.jhin.2020.06.001
26. Javaid M, Jamil M, Sajid M. Status of vaccination against hepatitis B among dental assistants of Multan. J Pak Dent Assoc 2020; 29:42-45. https://doi.org/10.25301/JPDA.291.42
27. Centers for Disease Control and Prevention. Summary of infection Prevention Practices in Dental Settings. basic expectations for Safe Care. Atlanta: US Department of Health and Human Services, Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion, Division of Oral Health. 2016.
28. Javaid M, Kumar R, Abbasi MMJ, Kiyani S, Kavita, Basharat S. Knowledge, Attitude & Practice regarding use of Personal Protective Equipment (PPE) among Dental Assistants Working at Tertiary Care Hospitals of Multan, Pakistan. J Liaquat Uni Med Health Sci. 2019;18(3): doi: 10.22442/jlumhs.191830000.
29. Cleveland, J. L. et al. Transmission of blood-borne pathogens in US dental health care settings: 2016 update. J. Am. Dent. Assoc 2016 Sep 1; 147:729-38.
30. Lu CW, Liu XF, Jia ZF. 2019-nCoV transmission through the ocular surface must not be ignored. Lancet (London, England). 2020 Feb 22; 395(10224):e39.
31. To, K. K.-W. et al. Consistent detection of 2019 novel coronavirus in saliva. Clinical Infectious Diseases. 2020 Feb 12. https://doi.org/10.1093/cid/ciaa149
32. Belser JA, Rota PA, Tumpey TM. Ocular tropism of respiratory viruses. Microbiol. Mol. Biol. Rev. 2013 Mar 1; 77:144-56. . https://doi.org/10.1128/mmbr.00058-12
33. Wax RS, Christian MD. Practical recommendations for critical care and anesthesiology teams caring for novel coronavirus (2019-nCoV) patients. Canadian Journal of Anesthesia/Journal canadiend'anesthésie. 2020 Feb 12:1-9. https://doi.org/10.1007/s12630-020-01591-x
34. Rodríguez-Morales AJ, MacGregor K, Kanagarajah S, Patel D, Schlagenhauf P. Going global–Travel and the 2019 novel coronavirus. Travel medicine and infectious disease. 2020 Jan;33: 101578. doi: 10.1016/j.tmaid.2020.101578
35. Rothe, C. et al. Transmission of 2019-nCoV infection from an asymptomatic contact in germany. N. Engl. J. Med. https://doi.org/10.1056/NEJMc2001468 (2020)
36. .Javaid M, Jamil M, Saadullah M, Haider E, Sajid M & Mahmood A. Knowledge, Attitude & Practice Regarding Use of Personal Protective Equipment Among Dental Assistants. PJMHS 2019; 13(3): 623-26
37. Peng X, Xu X, Li Y, Cheng L, Zhou X, Ren B. Transmission routes of 2019-nCoV and controls in dental practice. International Journal of Oral Science. 2020 Mar 3;12:1-6. https://doi.org//10.1038/s41368-020-0075-9
38. Khan EA, Umar M, Khalid M. COVID 19: An SEIR model predicting disease progression and healthcare outcomes for Pakistan. medRxiv. 2020 Jan 1. https://doi.org/10.1101/2020.05.29.20116517
39. Wei, J. & Li, Y. Airborne spread of infectious agents in the indoor environment. Am. J. Infect. Control 2016 Sep 2; 44: S102-8. https://doi.org/10.1016/j.ajic.2016.06.003
40. Guan, W.-j. et al. Clinical characteristics of 2019 novel coronavirus infection in China. Preprint at https://www.medrxiv.org/content/10.1101/2020.02.06.20020974v1 (2020). DOI: https://doi.org/10.1101/2020.02.06.20020974
41. Wang, D. et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. JAMA https://doi.org/10.1001/ jama.2020.1585 (2020)
42. Diaz Rodriguez M, Jimenez Romera A, Villarroel M. Oral manifestations associated with COVID-19. Oral diseases.2020 Aug 17
43. Dos Santos JA, Normando AG, da Silva RL, De Paula RM, Cembranel AC, Santos-Silva AR, Guerra EN. Oral mucosal lesions in a COVID-19 patient: new signs or secondary manifestations? International Journal of Infectious Diseases. 2020 Jun 9. https://doi.org/10.1016/j.ijid.2020.06.012
44. What can dentists do during covid-19 lockdown– Dental News Pakistan [Internet]. [cited 2020 April 25]. Available from: https://www.dentalnewspk.com/ What can dentists do during covid-19 lockdown .2020;4: 16,24
45. Interim infection prevention and control guidelines for the management of COVID-19 in healthcare settings Version 1.12 11 May 2020
46. ADA Interim Guidance for Minimizing Risk of COVID-19 Transmission. Available from ADA.org/ InterimGuidance
47. Preparing for COVID-19: Everything a dentist should know– Dental News Pakistan [Internet]. [cited 2020 April 25]. Available from: https://www.dentalnewspk.com/ Preparing for COVID-19: Everything a dentist should know.2020;4: 20
48. Terézhalmy GT. Clinical Practice Guideline for an Infection Control/Exposure Control Program in the Oral Healthcare Setting. Available at dentalcare. com. 2012.
49. CDC Guidance for Providing Dental Care During COVID-19. Available from: https://www.odh.ohio.gov
50. Alharbi, A. et al. Guidelines for dental care provision during the COVID-19 pandemic. Saudi Dental Journal (2020), https://doi. 1. org/10.1016/j.sdentj.2020.04.001
51. Guidelines for Providing Dental Care Services during COVID-19. Ministry of National Health Services, Regulations & Coordination Government of Pakistan. May 2020; 01:1-6
52. Samaranayake LP, Reid J, Evans D. The efficacy of rubber dam isolation in reducing atmospheric bacterial contamination. ASDC journal of dentistry for children. 1989; 56:442-4.
53. Ge ZY, Yang LM, Xia JJ, Fu XH, Zhang YZ. Possible aerosol transmission of COVID-19 and special precautions in dentistry. Journal of Zhejiang University-SCIENCE B. 2020 Mar 16:1-8. https://doi.org/10.1631/jzus.B2010010
54. Susan H. Davide. Coronavirus Transmission in the Dental Setting *Decisions in Dentistry.* April 2020;6:27–28,31–33
55. Guidelines for Wearing a Face Mask. Ministry of National Health Services, Regulations & Coordination Government of Pakistan. May 2020; 02:1-4
56. Health and Safety Executive. Evaluating the protection afforded by surgical masks against influenza bioaerosols: Gross protection of surgical masks compared to filtering facepiece respirators. 2008. Available at https://www.hse.gov.uk/research/rrpdf/rr619.pdf (accessed March 2020).
57. Cleaning & Disinfection of Environmental Surfaces in a Healthcare Facility. Ministry of National Health Services, Regulations & Coordination Government of Pakistan. March 2020; 02:1-5
58. 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.1. Dis. Ther. 7, 249–259. https://doi.org/10.1007/s40121-018-0200-7
59. Ahmed MA et al. Fear and Practice Modifications among Dentists to Combat Novel Coronavirus Disease (COVID-19) Outbreak. International Journal of Environmental Research and Public Health. 2020 Jan;17: 2821. https://doi.org/10. 3390/ijerph17082821
60. Day, M., 2020. Covid-19: ibuprofen should not be used for managing symptoms, say doctors and scientists. BMJ 368, m1086. https://doi. 1. org/10.1136/bmj.m1086.
61. Meng L, Hua F, Bian Z. Coronavirus disease 2019 (COVID-19): emerging and future challenges for dental and oral medicine. Journal of Dental Research. 2020 May; 99: 481-7.