

Coronavirus Pandemic

Dental care during the Covid-19 pandemic – To treat or not to treat?

Stefan Danilo Dacic¹, Milan Nebojsa Miljkovic², Milica Caslav Jovanovic³

¹ Department of Restorative Dentistry, Faculty of Medicine, University of Nis, Nis, Serbia

² Research Center for Biomedicine, Faculty of Medicine, University of Nis, Nis, Serbia

³ Department of Dentistry, Faculty of Medical Sciences, University of Kragujevac, Kragujevac, Serbia

Abstract

The recent spread of COVID-19 presents a huge public health concern. Clinical presentations of COVID-19 range from asymptomatic cases to severe pneumonia that can lead to death. Drastic measures were necessary to prevent the disease from spreading and protect the most vulnerable groups in the general population. The rapid reorganization of the healthcare system and great efforts made by medical staff were needed to admit to hospitals and then treat a progressively growing number of patients. The predominant route of virus transmission is through direct contact with an infected individual or respiratory droplets, therefore, all dental procedures with aerosol-formation pose an extremely high risk for the spread of infection. The aim of this article is to provide an overview of the current epidemiological situation, routes of transmission, and specific recommendations for dental practices including patient screening and triage, infection control, and treatment protocols. In this situation, it is essential that all dental healthcare workers make wise clinical decisions and educate themselves and their patients on how to prevent the spread of infection.

Key words: COVID-19; pandemic; dental care; infection control; cross-contamination.

J Infect Dev Ctries 2020; 14(10):1111-1116. doi:10.3855/jidc.13147

(Received 25 May 2020 – Accepted 09 September 2020)

Copyright © 2020 Dacic *et al.* This is an open-access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Introduction

SARS-CoV-2 is a newly discovered member of the Coronavirus family, first identified in the area of Wuhan, China, from where it rapidly spread to almost every part of the world [1]. The global spread of SARS-CoV-2 and its associated disease (COVID-19) has greatly affected the healthcare systems of all countries worldwide and still poses a huge challenge for all healthcare workers. This novel Coronavirus has similarities with the Coronavirus species found in bats which confirms the zoonotic nature of the disease [2]. It is a contagious viral infection that can be spread through inhalation or ingestion of viral droplets as a result of coughing, sneezing, and touching infected surfaces. The disease symptoms include fever, sore throat, dry cough, difficulty breathing, runny nose, headache, loss of appetite, myalgia, or fatigue [3]. Olfactory and gustatory dysfunctions have also been reported as symptoms in the clinical presentation of the European COVID-19 infection. In a study conducted on 417 COVID-19 patients, 85.6% and 88.0% of patients reported olfactory and gustatory dysfunctions, respectively [4]. Early diagnosis is very important for prevention and infection control but clinical

characteristics cannot alone define the diagnosis of COVID-19. Real-time PCR is considered the ‘gold standard’ for the detection of SARS-CoV-2 due to its high sensitivity and specificity [5]. A rapidly increasing number of patients with severe respiratory symptoms and life-threatening complications represents a huge burden and pressure on the healthcare system. According to the WHO situation report (24 June 2020), there have been more than 9 million reported cases of infection and 470 thousand deaths worldwide, and these numbers continue to increase [6]. As the virus mutates over time, its transmissibility and mortality rate may change. The last known estimate by the WHO (from March 2020) suggests transmissibility of 1,5-2,5 and overall mortality rate of 3,4% [7]. Different countries around the world have had different responses to the emergence of SARS-CoV-2 according to the organization and capacity of their healthcare systems and financial capabilities. Although each country has had its own specific approach in preventing the spread of COVID-19 among the local population, starting with promoting social distancing and heightened hygiene, eventually it all came down to introducing police curfew and forced quarantine as the most effective

measures in containing the virus spread [8]. Alongside many other services, routine dental care was suspended in fear of spreading COVID-19 among patients and dentists. Having in mind the modes of transmission, which include droplets, surface contact, and aerosolization during procedures, it is evident why dentistry presents an extremely high risk of spreading infectious diseases [9]. However, COVID-19 infected patients with urgent dental conditions, such as pain, swelling, and infections, still need to be treated and taken care of, so the real question is not “*To treat or not to treat?*”, but rather “*How to treat?*”. Clinical guidelines for emergency dental care were provided, highlighting strict personal protection. But these guidelines are sometimes inconsistent and are constantly changing, which is understandable given that our knowledge and understanding of this new kind of virus are also changing and that new scientific data is being analyzed and updated on a daily basis. General recommendations are designed for all healthcare workers [10], however, the dentist sometimes needs to make modifications to tailor these recommendations to meet the needs of a specific situation [11]. The aim of this paper is to reflect the existing evidence-based clinical guidelines for infection control and dental treatment of suspected or confirmed COVID-19 patients, based on the latest contemporary literature available. These guidelines can help dental staff in proper risk assessment, usage and disposal of personal protective equipment, environmental hygiene, and dental triage.

Risk assessment

The most important factors which determine the level of risk include aerosol-formation during dental procedures, the proximity of the dental therapist to the patient's oropharyngeal region, exposure time, and use of personal protective equipment (PPE) [12]. When all these factors are taken into account, risk exposure can be divided into four levels:

- very high risk exposure - performing aerosol-generating procedures for a prolonged/short period, without the use of PPE;
- high risk exposure – performing aerosol-generating procedures for a prolonged/short period, with the use of PPE;
- medium risk exposure – performing non-aerosol-generating procedures for a prolonged period, with the use of PPE;
- low risk exposure – performing urgent, non-aerosol-generating procedures for a short period, with the use of PPE.

The fact that the incubation period can range between 0 and 28 days may additionally complicate dentists' decision making and risk assessment since it has been confirmed that asymptomatic patients can also be infection transmitters [13-15]. In the dental office, there are several possible routes of transmission from patient to dentist, and vice versa: direct contact with blood and oral fluids, indirect contact with contaminated objects (instruments, equipment, and environmental surfaces), and inhalation of aerosol particles containing infectious pathogens [16]. In case the dentist has unprotected contact with a suspected or confirmed Covid-19 patient or is experiencing any Covid-19-compatible symptoms, self-quarantine is strongly advised to rule out the possibility of COVID-19 infection and cross-transmission among dental staff. People of any age with severe underlying medical conditions, such as diabetes, heart or lung disease, have an increased risk of developing severe illness from COVID-19. In general, the risk of getting severely ill from COVID-19 increases with age, so special attention should be paid to protect the elderly with chronic diseases since they are the most vulnerable category [17].

Personal protective equipment (PPE)

Upon the emergence of SARS-CoV-2, each country issued recommendations to the general public to increase hand hygiene, avoid social contacts, group gatherings in small spaces, and wear protective equipment including face masks and gloves to prevent spreading of the infection among the local population [18]. This was mandatory especially for individuals experiencing respiratory symptoms such as coughing, fever, and difficult breathing [19]. Previous research has shown that a surgical mask on the source of infection is far more effective than on the recipient, in terms of protection and transmission prevention [20]. However, these measures soon caused a shortage of medical protective equipment which is far more necessary to healthcare workers than to the general public given their greater exposure to the virus on a daily basis. Unfortunately, this resulted in an increased number of infected medical staff.

Healthcare workers should always use PPE when they are in contact with suspected or confirmed COVID-19 patients. The use of respirators, gloves, goggles, and gowns is mandatory [21]. When performing procedures with aerosol, the use of conventional surgical masks is not adequate, and a particulate respirator with HEPA (high-efficiency particulate air) filter, of at least N95 – American

standard or FFP3 – European standard, should be used whenever possible [22]. Ordinary surgical masks have pores of about 2-10 microns, while the N95/FFP3 mask has pores of about 0.3 microns. The coronavirus is about 0.12 microns in diameter, but the droplets are larger, about 3-50 microns, so the use of N95/FFP3 respirator can provide a filtration rate of 95-99.9% of all particles measuring up to 0.6 μM [23]. All dental staff should go through the fit testing and training for the chosen model and size of the respirator mask at least once a year. Respirators have to be retested whenever there is a change in the physical condition, such as significant weight gain or loss, new dentures, facial surgery or scarring, so they seal properly to the face. Each time the mask is applied, a quick seal check to the face should always be performed. If the mask is properly seated, after taking a deep breath, no additional air is coming in from the outside and negative pressure inside the mask is pulling it closer to the face. Also, when exhaling, no air should come out between the mask and the face. If this occurs, the mask should be readjusted for a better fit. Facial hair, like a beard or mustache, can affect your respirator's ability to properly seal to the face [24]. The mask should be removed from the face immediately after each intervention (patient). The extended use or reuse of a face mask is not recommended due to an increased risk of self-inoculation after touching the surface of a contaminated mask. The sterilization of disposable masks is also not recommended, except in cases of significant shortage, because this process reduces their effectiveness in protecting the wearer [25]. Some dental procedures, including calculus and caries removal, root canal, oral surgery, tooth preparation for veneer, crown, or a bridge, can not be carried out without the use of aerosol-generating instruments, such as ultrasonic scalers and high-speed dental turbines and air-water syringes. In such cases, safety glasses and protective face shields are required to minimize aerosol effects. Additional protective measures, such as the use of rubber dam and high-volume suction, are also highly recommended since they have been proven to reduce the contamination arising from the operative site by more than 90%. A combination of multiple protective measures is much more effective in reducing the risk of infection than a single protective approach [26]. Personal protective equipment is of great use to healthcare workers but can also become a source of contagion if not properly removed and disposed of [27]. The safest way for dentists to do their job in these circumstances is to use disposable (single-use) items. To minimize handling of potentially contaminated PPE,

reuse of disposable items is not recommended, except in cases of significant shortage, when PPE can be reused after careful decontamination [28]. The volume of infectious waste during the COVID-19 outbreak is expected to increase, especially through the use of disposable PPE. All dental-care waste produced during patient treatment is considered to be infectious and should be collected safely in clearly marked containers [29]. During this period of growing concern, special attention should be paid to good hand hygiene, instrument sterilization, surface disinfection, and waste disposal. If necessary, dental staff should be provided with additional education and training on the proper use of PPE and hazardous waste disposal [30].

Environmental Hygiene

The dentist's personal and environmental hygiene is an absolute necessity, as patients become more aware of the potential danger to themselves from materials and instruments that are not properly disinfected or sterilized. To decrease the number of people present in the operating room, the only personnel allowed is the one necessary to perform the treatment, including the dental therapist, and possibly the dental assistant. All unnecessary dental staff should remain at the front desk or in the waiting room, providing instructions to escorts and other patients. Patient escorts should be asked to wait outside and called after patients are finished with their procedures. Before seating the patient, the dental chair should be covered with a plastic sheath, which is removed after each treatment. The only instruments and materials located within 2m of the seated patients are the ones to be used during the treatment. The area that becomes contaminated during dental procedures is far larger than it has previously been thought. All surfaces and objects within 2m of the patient should be considered contaminated and must be disinfected after each intervention to prevent cross-contamination [31]. When performing aerosol-generating interventions, optimal ventilation and air exchange in the operating room should be ensured to reduce exposure risks. The use of air purifiers with ultraviolet light units can help with aerosolized pathogens and act reassuringly, both to the patient and dental staff, that collective welfare is being appreciated, but may represent a significant financial burden as well [32]. Given the fact that the Coronavirus can survive on surfaces for more than 24 hours, it is important to keep all surfaces clean and sanitized [33]. Cleaning agents with declared virucidal effects, such as 0.1% sodium hypochlorite, 0.5% hydrogen peroxide, and 70% ethanol, should be used for surface disinfection. For surfaces that could be

damaged by the hypochlorite solution, 70% alcohol is recommended for disinfection. The cleaning process is performed from more to less contaminated areas. Although many details need to be addressed, good environmental hygiene is critical to ensure patient and dental staff safety [34].

Dental triage

Screening and triaging of dental patients is essential in these epidemic circumstances to identify and isolate potential COVID-19 infected patients. The process of initial screening and triage should begin via telephone when the patient calls to make an appointment. Random walk-in visits to the dentist should be strictly avoided. After assessing the urgency of the visit, all elective dental procedures should be deferred and rescheduled 30+ days down the road. Patients with urgent conditions such as pain, swelling, infection, or trauma, should be asked whether:

- they are experiencing any respiratory symptoms such as cough, fever, anosmia and heavily breathing;
- they have traveled to areas with a high incidence of COVID-19 in the past 30 days;
- they have been in contact with persons suspected or diagnosed with COVID-19 infection.

If the answer to any of these questions is affirmative, these patients should be discouraged to take dental procedures because of the risks to other patients and staff. Instead, they should be alternatively managed by pharmacological therapy in the form of antibiotics and analgesics and referred to their primary care physician for general health assessment [35]. In case the dental procedure can't be postponed and requires immediate treatment (such as progressive infection or dentoalveolar trauma), specific measures need to be taken to prevent the spread of infection [36]:

- the dentist should ensure the suspected or infected COVID-19 patient arrives at an empty waiting room;
- upon arrival, the dentist should measure the patient's body temperature using a non-contact forehead thermometer;
- if possible they should be seated in a dental chair separated from other patients, in a well-ventilated room. Ideally, infected patients should not be treated in routine dental offices, but only in AIIRs (Airborne Infection Isolation Rooms), specially designed to isolate airborne pathogens to a safe containment area by creating negative differential pressure;
- dental staff should always use the aforementioned disposable personal protective equipment and safe work practices;

- before starting the procedure, patients should rinse their mouth with 1% hydrogen-peroxide or 1% povidone-iodine, since these antiseptics have been proven to have virucidal activity and reduce the percentage of Coronavirus in saliva [34,37];

- the dentist should avoid using aerosol-generating instruments (ultrasonic scaler, high-speed drill) whenever possible;

- extraoral imaging should always be prioritized over intraoral imaging to avoid cough reflex;

- after the procedure, thoroughly disinfect and dry all of the contaminated surfaces to prevent cross-contamination.

Conclusions

Having in mind the prolonged incubation period of Coronavirus and the fact that most patients only develop mild symptoms or can even be asymptomatic, it is important to emphasize that even with all these precautions, an infected patient might still slip through. This is why, in our opinion, every patient should be considered potentially infected, and infection control protocols should always be carried out rigorously. It is still unknown how this pandemic will unfold in the upcoming period, but there are certain opinions in the scientific community that COVID-19 might persist in our population as a less virulent infection, so we may need to get used to working in this kind of circumstances. While we keep our distance to stop the spread of COVID-19, exercise and proper rest are vital for both our physical and mental health. Recommendations given in this article represent a summary of all available and useful information in the scientific literature at this point, but they are still prone to changes according to the course of this pandemic, so all healthcare workers are advised to continuously educate themselves to provide the best care to their patients in the safest possible manner.

References

1. Boopathi S, Poma AB, Kolandaivel P (2020) Novel 2019 coronavirus structure, mechanism of action, antiviral drug promises and rule out against its treatment. *J Biomol Struct Dyn* 1-10.
2. Zhou P, Yang XL, Wang XG, Hu B, Zhang L, Zhang W, Si HR, Zhu Y, Li B, Huang CL, Chen HD, Chen J, Luo Y, Guo H, Jiang RD, Liu MQ, Chen Y, Shen XR, Wang X, Zheng XS, Zhao K, Chen QJ, Deng F, Liu LL, Yan B, Zhan FX, Wang YY, Xiao GF, Shi ZL (2020) A pneumonia outbreak associated with a new coronavirus of probable bat origin *Nature* 579: 270–273.
3. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, Zhang L, Fan G, Xu J, Gu X, Cheng Z, Yu T, Xia J, Wei Y, Wu W, Xie X,

- Yin W, Li H, Liu M, Xiao Y, Gao H, Guo L, Xie J, Wang G, Jiang R, Gao Z, Jin Q, Wang J, Cao B (2020) Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China *Lancet* 395: 497-506.
4. Lechien JR, Chiesa-Estomba CM, De Siaty DR, Horoi M, Le Bon SD, Rodriguez A, Dequanter D, Blecic S, El Afia F, Distinguin L, Chekkoury-Idrissi Y, Hans S, Delgado IL, Calvo-Henriquez C, Lavigne P, Falanga C, Barillari MR, Cammaroto G, Khalife M, Leich P, Souchay C, Rossi C, Journe F, Hsieh J, Edjlali M, Carlier R, Ris L, Lovato A, De Filippis C, Coppee F, Fakhry N, Ayad T, Saussez S (2020) Olfactory and gustatory dysfunctions as a clinical presentation of mild-to-moderate forms of the coronavirus disease (COVID-19): a multicenter. European study *Eur Arch Otorhinolaryngol*; 277: 2251-2261.
 5. Tahamtan A, Ardebili A (2020) Real-time RT-PCR in COVID-19 detection: issues affecting the results. *Expert Rev Mol Diagn* 20: 453-454.
 6. World Health Organization (WHO) (2020). Coronavirus disease (COVID-19) Situation Report – 156. Available: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200624-covid-19-sitrep-156.pdf?sfvrsn=af42e480_2. Accessed 25 June 2020.
 7. World Health Organization (WHO) (2020) WHO Director-General's opening remarks at the media briefing on COVID-19 - 3 March 2020 Available: <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---3-march-2020>. Accessed 25 June 2020.
 8. Institute of Medicine (US) Forum on Microbial Threats. Strategies for Disease Containment. In: Ethical and Legal Considerations in Mitigating Pandemic Disease: Workshop Summary. Washington (DC): National Academies Press (US); 2007.
 9. Peng X, Xu X, Li Y, Cheng L, Zhou X, Ren B (2020) Transmission routes of 2019-nCoV and controls in dental practice. *Int J Oral Sci* 12: 9.
 10. Wax RS, Christian MD (2020) Practical recommendations for critical care and anesthesiology teams caring for novel coronavirus (2019-nCoV) patients. *Can J Anaesth* 67: 568-576.
 11. Centers of Disease Control and Prevention (CDC) (2020) Guidance for Providing Dental Care During COVID-19. Available: <https://www.cms.gov/files/document/cms-non-emergent-elective-medical-recommendations.pdf>. Accessed 17 May 2020.
 12. Faculty of General Dental Practice (UK) (FGDP). Implications of COVID-19 for the safe management of general dental practice: A practical guide. Available: <https://www.fgdp.org.uk/sites/fgdp.org.uk/files/editors/Implications%20of%20COVID-19%20for%20the%20safe%20management%20of%20general%20dental%20practice%20A-%20a%20practical%20guide.pdf>. Accessed 25 June 2020.
 13. Rothe C, Schunk M, Sothmann P, Bretzel G, Froeschl G, Wallrauch C, Zimmer T, Thiel V, Janke C, Guggemos W, Seilmaier M, Drosten C, Vollmar P, Zwirgmaier K, Zange S, Wölfel R, Hoelscher M (2020) Transmission of 2019-nCoV infection from asymptomatic contact in Germany. *N Engl J Med* 382: 970–971.
 14. Pan X, Chen D, Xia Y, Wu X, Li T, Ou X, Zhou L, Liu J (2020) Asymptomatic cases in a family cluster with SARS-CoV-2 infection. *Lancet Infect Dis* 20: 410-411.
 15. Han Y, Yang H (2020) The transmission and diagnosis of 2019 novel coronavirus infection disease (COVID-19): A Chinese perspective. *J Med Virol* 92: 639-644.
 16. Upendran A, Geiger Z (2020) Dental Infection Control Treasure Island (FL): StatPearls Publishing. Available: <https://www.ncbi.nlm.nih.gov/books/NBK470356/>. Accessed 23 May 2020.
 17. Centers for Disease Control and Prevention (CDC) (2020) People who need extra precautions – Older adults Available: <https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/older-adults.html> Accessed 26 June 2020.
 18. European Centre for Disease Prevention and Control (ECDC) (2020) Guidelines for the use of non-pharmaceutical measures to delay and mitigate the impact of 2019-nCoV. Available: https://www.ecdc.europa.eu/sites/default/files/documents/novel-coronavirus-guidelines-non-pharmaceutical-measures_0.pdf Accessed 13 May 2020.
 19. MacIntyre CR, Chughtai AA (2015) Facemasks for the prevention of infection in healthcare and community settings. *BMJ* 350: h694.
 20. Diaz KT, Smaldone GC (2010) Quantifying exposure risk: Surgical masks and respirators. *Am J Infect Control* 38: 501-508.
 21. European Centre for Disease Prevention and Control (ECDC) (2020) Guidance for wearing and removing personal protective equipment in healthcare settings for the care of patients with suspected or confirmed COVID-19. Available: <https://www.ecdc.europa.eu/sites/default/files/documents/COVID-19-guidance-wearing-and-removing-personal-protective-equipment-healthcare-settings-updated.pdf>. Accessed 15 May 2020.
 22. Centers of Disease Control and Prevention (CDC) (2020) Recommended Guidance for Extended Use and Limited Reuse of N95 Filtering Facepiece Respirators in Healthcare Settings. Available: <https://www.cdc.gov/niosh/topics/hcwcontrols/recommended-guidanceextuse.html>. Accessed 16 May 2020.
 23. Abd-Elsayed A, Karri J (2020) Utility of Substandard Face Mask Options for Health Care Workers During the COVID-19 Pandemic. *Anesth Analg* 131: 4-6.
 24. United States Department of Labor (2020) Occupational Safety and Health Administration (OSHA). Respirator Fit Testing. Available: https://www.osha.gov/video/respiratory_protection/fittesting_transcript.html. Accessed 26 June 2020.
 25. Centers of Disease Control and Prevention (CDC) (2020) Recommended Guidance for Extended Use and Limited Reuse of N95 Filtering Facepiece Respirators in Healthcare Settings. Available: <https://www.cdc.gov/niosh/topics/hcwcontrols/recommended-guidanceextuse.html>. Accessed 27 June 2020.
 26. Harrel SK, Molinari J (2004) Aerosols and splatter in dentistry: a brief review of the literature and infection control implications. *J Am Dent Assoc* 135: 429-437.
 27. Centers of Disease Control and Prevention (CDC) (2020) Using Personal Protective Equipment (PPE) Available: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/using-ppe.html>. Accessed 17 May 2020.
 28. World Health Organization (WHO) (2020) Personal protective equipment for use in a filovirus disease outbreak. Available: <https://apps.who.int/iris/bitstream/handle/10665/251426/9789241549721-eng.pdf?sequence=1&ua=1>. Accessed 27 June 2020.

29. World Health Organization (WHO) (2020) Water, sanitation, hygiene, and waste management for the COVID-19 virus: interim guidance. Available: <https://www.who.int/publications/i/item/water-sanitation-hygiene-and-waste-management-for-the-covid-19-virus-interim-guidance>. Accessed 27 June 2020.
30. Collins AS (2008) Preventing Health Care–Associated Infections. In: Hughes RG (ed.). Patient safety and quality: An evidence-based handbook for nurses. Rockville (MD): Agency for Healthcare Research and Quality (US). Available: <https://www.ncbi.nlm.nih.gov/books/NBK2683/> Accessed 17 May 2020.
31. Rautemaa R, Nordberg A, Wuolijoki-Saaristo K, Meurman JH (2006) Bacterial aerosols in dental practice – a potential hospital infection problem? *J Hosp Infect* 64: 76-81.
32. Judson SD, Munster VJ (2019) Nosocomial Transmission of Emerging Viruses via Aerosol-Generating Medical Procedures. *Viruses* 11: 940.
33. Fiorillo L, Cervino G, Matarese M, D'Amico C, Surace G, Paduano V, Fiorillo MT, Moschella A, Bruna A, Romano GL, Laudicella R, Baldari S, Cicciù M (2020) COVID-19 Surface Persistence: A Recent Data Summary and Its Importance for Medical and Dental Settings. *Int J Environ Res Public Health* 17: 3132.
34. Kampf G, Todt D, Pfaender S, Steinmann E (2020) Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. *J Hosp Infect* 104: 246-251.
35. Ather A, Patel B, Ruparel NB, Diogenes A, Hargreaves KM (2020) Coronavirus Disease 19 (COVID-19): Implications for Clinical Dental Care. *J Endod* 46: 584-595.
36. Centers for Disease Control and Prevention (CDC) (2020) Interim Infection Prevention and Control Guidance for Dental Settings During the COVID-19 Response. Available: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/dental-settings.html>. Accessed 18 May 2020.
37. 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: 249–259.

Corresponding author

Milan Miljkovic, PhD.

Research Center for Biomedicine, Faculty of Medicine
University of Nis.

Bulevar Dr. Zorana Djindjica 81, 18108 Nis, Serbia.

Phone: +381 64 24 76 273

Email: milan.miljkovic@medfak.ni.ac.rs

Conflict of interests: No conflict of interests is declared.