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Effective Role of Saliva in Rapid Diagnostic Test and its Potential of Transmitting SARS COV 2 Through Aerosols During Dental Procedures

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ABSTRACT

Background: Since the beginning of Novel Coronavirus or SARsCov2 Pandemic, it has created havoc in the whole world and taken the lives of more than one million people. This has made researchers and scientists around the world make extraordinary efforts so as to tackle this global emergency by joining hands with research labs to find a drug and a preventive vaccine. Preventive and safety measures are very crucial to contain the spread of SARS-CoV-2 among Health-Care Professionals specifically dental surgeons as they deal with aerosol generating procedures which make them fall under the very high risk category. Some studies suggest that saliva expelled during cough, sneeze, during aerosol generating procedure represents a mode of SARS-CoV-2 transmission. This narrative article aimed to gather evidence in order to propose standard operative guidelines to reduce the risk of coronavirus transmission in the dental operatory and emphasize on developing rapid diagnostic test from patients saliva, as it can be easily collected from patient without performing any invasive procedures and even by patients themselves, thus, reducing the risk of the health care professional from getting infected to this novel coronavirus.

Results: Operative guidelines to reduce the risk of transmission and need for rapid salivary diagnostic test.

Conclusion: A rapid and reliable diagnostic test detecting COVID-19 positive patients upon arrival at the dental office could allow dental surgeon to prevent from getting infected and be cautious about turned positive patients.

Keywords: Saliva, COVID-19, Dental procedures, Diagnostic.

INTRODUCTION

The episode of coronavirus illness 2019 (COVID-19) in the zone of Wuhan, China, has developed quickly into a general well-being crisis(1) and has spread exponentially to different parts of the world .(2) The epic coronavirus has a place with a group of single-stranded RNA viruses known as Coronaviridae.(3) This group of infections are known to be zoonotic or transmitted from animals to people. These incorporate severe acute respiratory syndrome coronavirus (SARS-CoV), first recognized in 2002, and the Middle East respiratory syndrome coronavirus (MERS-CoV), first distinguished in 2012.(4) There is solid proof that this novel coronavirus has comparability to coronavirus species found in bats and possibly pangolins, affirming the zoonotic idea of this new cross-species viral-intervened malady.(5,6) International centers for disease control and

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prevention are observing this irresistible illness episodes and fever, cough, and acute respiratory disease, with serious cases prompting pneumonia, kidney disappointment, and even demise are the symptoms of COVID-19 infection. COVID-19 was as of late found in saliva of infected patients (7), the COVID-19 episode is the call that dental/oral and other wellbeing experts should consistently be persevering in ensuring against the spread of irresistible malady, and it gives an opportunity to decide whether a non-invasive salivary diagnostic tests for COVID-19 could help with recognizing such infections and decreasing the spread.

Saliva can have a crucial role in the human-to-human transmission, and non-invasive salivary diagnostics may give an advantageous and practical purpose of-care stage for the quick and early identification of COVID-19 contamination.

The COVID-19 transmission courses are still to be resolved, yet human-to-human transmission has been affirmed .(8, 9) The research center indicative tests ought to be performed utilizing nasopharyngeal, oropharyngeal, and blood tests. Expectorated sputum and different examples in serious respiratory sickness ought to be considered as lower respiratory tract tests. (2, 10, 11) A few potential situations of COVID-19 transmission have been depicted. The transmission by means of contact with droplets from talking, hacking, sniffling (identified with human respiratory exercises), and aerosol produced during clinical techniques is normal, as it would be for other respiratory contaminations. The starting point of droplets can be nasopharyngeal or oropharyngeal, connected with saliva. Bigger droplets could add to viral transmission to subjects close by, and, on the opposite side, the significant distance transmission is conceivable with littler droplets infected with air-suspended viral particles.(12) Taking into account that research center demonstrative tests are additionally acted in blood tests, the transmission by infected blood ought to likewise be thought of. In this specific circumstance, medicinal services professionals, for example, dental specialists might be unwittingly giving direct consideration to tainted, yet not yet analyzed COVID-19 patients, or those viewed as speculated cases for reconnaissance. (10, 11) Asymptomatic contaminations appear to be conceivable (13) and transmission may happen before the symptoms appears.

A nasopharyngeal (NP) swab and additionally an oropharyngeal (OP) swab are frequently suggested for screening or conclusion early disease (14, 15, 16). A solitary NP swab has become the favored swab, as it is endured better by the patient and is more secure to the administrator. NP swabs have a characteristic quality control in that they for the most part arrive at the right zone to be tried in the nasal depression.

Simultaneously, the presence of 2019-nCoV in different other human secreta and excreta, for example, sputum, defecation and pee have additionally been accounted for. All things considered, as one of the most promptly available and effortlessly gathered natural liquids, it has not been affirmed whether there are distinguishable levels of 2019-nCoV inside the saliva of COVID-19 patients

Like blood, saliva is rich in various natural markers, for example, DNA, RNA, proteins, with promptly measurable quantity of microorganism, as the two biofluids share numerous likenesses in sub-atomic components.(17, 18) Hence there is a high likelihood of antibodies and infections of the human body being available in saliva. It has been accounted for that some infections of majorly irresistible illnesses, especially respiratory diseases, for example, Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS), can be found in saliva.(19,20) Additionally, saliva has just been used for the diagnosis of human immunodeficiency infection (HIV), hepatitis B infection (HBV), and different medications like cocaine and liquor. (21, 22) Subsequently, it is basic to decide if 2019-nCoV can be found in saliva, just as describe the earlier oral signs showed in COVID-19 patients.

Single-cell RNA-seq information investigation of angiotensin-converting enzyme II (ACE2) expression and serological examination of patient examples have uncovered ACE2 to be the presumable cell receptor of 2019-nCoV.(23,24) along these lines proposing that ACE2-expressing cells might be the significant objective cell type that are powerless against

2019- nCoV contamination. There is regularly higher quantity of ACE2 receptor of 2019-nCoV on the epithelial cells of oral mucosa, which is especially improved in the epithelial cells of the tongue.(25) Prior to this examination study, there have been scarcely any reports that explicitly explored whether the salivary organ epithelial cells show ACE2 receptors.

Furthermore, to verify that there are detectable levels of 2019-nCoV nucleic acids in saliva, we have to screen the saliva of COVID-19 patients (who displayed positive results for 2019-nCoV nucleic acid.

Conclusion of COVID-19 can hypothetically be performed utilizing salivary analysis tests. Some infection strains have been found in saliva up to 29 days after contamination (26,27), demonstrating that a non-invasive stage to quickly mark the biomarkers utilizing saliva could improve illness discovery. (20) Saliva tests could be gathered in patients who present with oropharyngeal secretion as a manifestation (28, 29). Remembering the prerequisite of a nearby contact between medicinal services professionals and infected patients to gather nasopharyngeal or oropharyngeal tests, the chance of a saliva self-collection can firmly diminish the danger of COVID-19 transmission. Additionally, the nasopharyngeal and oropharyngeal collection advances soreness and may progress draining particularly in contaminated patients with thrombocytopenia. The sputum of a lower respiratory tract was delivered by just 28% of COVID-19 patients, which demonstrates a solid impediment as example to indicative assessment. (7) Hence, suggest that there is possiblity of three distinct pathways for COVID-19 to found in saliva:1) from COVID-19 in the lower and upper respiratory tract (2, 3) that enters the oral cavity together with the fluid droplets often traded by these organs,

2) COVID-19 present in the blood can get to the mouth by means of crevicular liquid, an oral cavity explicit exudate that contains local proteins got from extracellular matrix and serum- inferred proteins. (30) Attempt are made in three ways in controlling the spread of covid-19 such as:- (1) travel restrictions to be imposed so as to reduce new cases in the society.

(2) segregation of all the known cases from the uninfected population as soon as possible (quarantine).

(3) contact between the individuals should be minimized by inducing self isolation, social distancing, hand hygiene so as to suppress silent transmission in the community.

Implementation in Dentistry

Recently the saliva of infected patients was detected with COVID-19. Further elaborates the potential transmission possible through the saliva of COVID-19. During dental treatments the transmission of covid-19 is expected through the droplets and aerosols generated from it. Improvement in the assessment of covid-19 in oral space and its possible outcome on the transmission of this virus which is important for the advance effective strategies for prevention, most importantly for dental specialists and associated healthcare workers that help in performing aerosol generating dental treatments.

Patients received dental treatment incorporating the use of high – speed air rotor or other ultrasonic equipments which led to the secretion, saliva or to aerosolize in the nearby space that could cause the contamination of clinic surrounding with certain pathogenic microorganisms after use or have chances to get exposed. Even with the puncture of sharp instrument or direct exposure of mucous membranes with the contaminated hands. (31) In dental clinic the standard preventive measures are inadequate when the possibility of droplet and aerosol generated from high speed instruments are higher and the probability of spreading of covid -19 always higher in special situation where the patients are under incubation period or infected or hiding information about it.

Every possible measure for reduction of droplets and aerosols was done by the use of high volume aspiration and others for the emergency dental care with advice under strict personal protection as had been recommended in earlier phase of SARS widespread.(32) Dental professional are well familiar with common occupational hazards and heath concerns such as hepatitis B and Hepatitis C and other risk assessments which are not very common in

other profession. As per recent publication in New York Times dentistry had the most risk out of other professions during covid-19. (33) Many studies published that covid-19 could spread from aerosol generated directly during procedure and indirectly from saliva. (34,35) One study reported with transmission of covid-19 through contact with asyptomatic patient in germany.(36) Dental specialists are well aware of detecting cross infection risk and shouldn't be place in unnecessary situation when this would be morally unpalatable. The origin of aerosol and splatter commonly infected with the various microbes such as bacteria, viruses, fungi even blood also which generated by the high speed equipment used in the common dental procedure and even invasive oral procedures.(37,38,39) Aerosol are also known as vaporizer or Mist concentrates are fluid and strong particles (<50 µm breadth) suspended in air for extended periods. Splatter is a blend of air, water and additionally strong substances (50 µm to a few millimeters breadth). Both are danger to the dental group. Common surgical face masks utilized in dentistry when effectively worn and as often as possible changed proposal around 80% filtration rate. This is acceptable assurance for elective dentistry in typical conditions, realizing that most of our patients are healthy. The COVID-19 measures around 120 nm (0.12 µm) and airborne molecule sizes extend from 3–100 nm. The utilization of a FFP3 respirator offers a filtration pace of 99% of all particles matching 0.6µm. (40) Dental specialists should follow strict individual insurance quantifies and evade or limits the activities that can create aerosol or pressurized canned products. The 4-handed method is helpful for controlling disease. The utilization of saliva ejectors with low or high volume can decrease the creation of aerosol and vaporizers.(31,41,42) Preoperative antimicrobial mouth wash could diminish the quantity of microorganisms in the oral cavity.(31, 43) Cough inducing procedures should evaded if possible or performed with intensive care.(44) The utilization of a

3-way syringe, should be limited however much as could reasonably be expected to reduce the formation of aerosol. Intraoral x-beam assessment is the most widely recognized radiographic procedure in dental imaging; be that as it may, it can animate saliva production and coughing.(45) Thusly, extraoral dental radiographies, for example, all encompassing radiography and cone shaft CT, are proper choices during the outspread of COVID-19. Rubber dams and high-volume salivation ejectors can help limit vaporized or scatter in dental techniques. Besides, face shields and goggles are basic with utilization of high or low-speed boring with water splash .(46) As per various center understanding during the pandemic, if a carious tooth is determined to have suggestive irreversible pulpitis, introduction could be made with chemomechanical caries expulsion under rubber dam and a high-volume salivation ejector after nearby sedation; at that point, devitalization can be performed to lessen the pain. The filling material can be supplanted tenderly without a devitalizing operator later as per the maker's suggestion. We likewise met a patient who had an unconstrained toothache as a result of a broke tooth without dental rot, and a fast handpiece must be utilized to get to cavity readiness. Given that the patient needed to hold the tooth, she was planned as the last patient in the day to diminish the danger of nosocomial contamination. After treatment, natural cleaning and purification systems were followed. On the other hand, patients could be dealt with in a isolation and well ventilated room or adversely forced rooms if accessible for suspected cases with COVID-19.

Table 1: Techniques for the reduction of aerosol generation in various dental procedures.

S no.	Speciality	Dental procedure
1	Endodontics	Rubber dam must be applied during endodontic treatment. Root canal treatment usually requires a number of endodontic instruments and devices, therefore minimizing unnecessary hand contact with surfaces and equipment in the dental office to reduce possibility of fomite transmission
2	Restorative dentistry and pediatric dentistry	Avoid using rotary instruments during cavity preparation . In selective cases, consider using chemomechanical caries removal or

		atraumatic restorative techniques. If rotary instrumentation must be performed, rubber dam isolation should be applied
3	Periodontics	Hand instruments are equally effective as compared with ultrasonic instrumentation in removing plaque and calculus deposits; if required, manual scaling and polishing are recommended (Krishna and de Stefano, 2016)
4	Prosthodontics	Salivary suction must be performed with care to avoid gagging. Select and adjust trays to the right size for impression taking to avoid cough reflex. For highly sensitive patients, consider applying oral mucosa anesthesia to the throat before impression taking During fixed partial denture or single-crown preparation, treatment alternation may be considered to incorporate rubber dam application. For example, design supra-gingival margin for posterior bridge or use a split-dam technique (Li et al., 2004) During removable partial denture or complete denture try-in, avoid touching other objects in the dental office after contacting patients' saliva Upon removal from patient's mouth, dental prosthesis, impressions, and other prosthodontics materials (e.g., bite registration) should be thoroughly disinfected by a disinfectant having at least intermediate level activity.
5	Oral-maxillofacial surgery	When performing simple extraction, treat the patient in a supine position to avoid working in the breath way of a patient

CONCLUSION

With the outspread of COVID-19, new responsibilities and challenges are arising for the dental professionals. For better handling of aerosol generation procedures and to transmission and its effects on dentistry can help and improve the ignorance of routine dental practice. By getting enforced the standard and special precaution helps in controlling the current situation of covid-19. Viral RNA Real-Time-PCR (RTPCR) currently embodies the gold standard for COVID-19 diagnosis; it is the only reliable diagnostic test developed so far.(47,15) However, this test presents some limitations: results take 2-3 hours to be obtained, laboratories should be certified, expensive equipment and trained technicians are required. Moreover, nasopharyngeal viral load is not constant from the incubation to the convalescence period. Virus can be detected in a 10-15 days span, whereas it cannot be detected during other phases.(48) It was shown that nasopharyngeal swab test for SARSCoV- 2 retains a 63% sensitivity, therefore it generates many false negatives.15 SARS-CoV-2 infection has its onset at pulmonary level, not in the upper airways, therefore nasopharyngeal sampling during the initial stage of infection could not detect the virus. This could explain the high number of false negatives in the PCR test on nucleic acid. Nonetheless, it is the only available test for SARS-CoV-2 diagnosis.(49)

Saliva can be easily collected from patients without performing any invasive procedures. The time and cost associated with the collection of saliva were reported to be 2.26-fold and 2.59-fold lower than that of nasopharyngeal sampling.(50) In addition, collecting the saliva specimen is safe and efficient during a novel infectious disease epidemic because patients are able to provide samples of their saliva themselves. Recent studies have shown that the saliva might be a valuable specimen for the diagnosis of respiratory virus infections compared to nasopharyngeal swabs. (51) Similarly, the results in some study also suggest that saliva specimens can be used for the diagnosis of SARS-CoV-2 infection. However, the viral load in the saliva might decrease during the late stage of the infection. Further research is needed to determine whether saliva specimens can help diagnose SARS-CoV-2 infection in patients with advanced pneumonia.Large-scale studies, including control subjects, are required to minimize the confounding effects of disease severity, sampling errors, and other factors. In addition,

environmental surveillance should be included in the study design of future studies. During the early stage of infection, the viral load of SARS-CoV-2 was remarkably high in the nasopharynx and the saliva. Chlorhexidine mouthwash could be beneficial in controlling droplet transmission in addition to mask wearing and hand washing.(52)

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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