Opinion

BIOMEDICAL Journal of Scientific & Technical Research

ISSN: 2574 -1241

DOI: 10.26717/BJSTR.2021.37.006075

SARS-CoV-2 and its Transmission Ability Through the Nasal and Oral Cavities

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ARTICLE INFO

Received: July 31, 2021

Published: August 06, 2021

Citation: Carlos Uriel Torres Estrella, Eduardo García Salazar, María Guadalupe Frías De León, María del Rocio Acosta Reyes, Gustavo Acosta Altamirano. SARS-CoV-2 and its Transmission Ability Through the Nasal and Oral Cavities. Biomed J Sci & Tech Res 37(5)-2021. BJSTR. MS.ID.006075.

ABSTRACT

Abbreviations: ACE2: Angiotensin-Converting Enzyme 2; S Protein: Spike Protein; TMPRSS2: Transmembrane Serine Protease 2

Opinion

Since the beginning of the pandemic caused by the SARS-CoV-2 virus, it was identified that its ligand Spike Protein (S protein) is the receptor of the Angiotensin-Converting Enzyme 2 (ACE2), which is present in epithelial cells of the nasal mucosa, the surface of the tongue in the oral cavity, the pharynx, and the salivary glands [1]. These last have a higher ACE2 expression, which facilitates the virus to infect a person. Because saliva is a secretion from the oral cavity produced by the parotid, sublingual, and submandibular glands, it is in constant contact with perioral tissue, such as the tongue, which due to its mobility, facilitates saliva to be in contact with the entire oral cavity [2]. The presence of viral RNA in saliva has allowed the detection of the SARS-CoV-2 virus in the early stages of infection and promptly identify asymptomatic individuals [2,3]. Saliva also contains IgA and IgG isotype antibodies which could be relevant in immunized people against SARS-CoV-2 [2]. In general, if a healthy person comes into contact with aerosols contaminated with the virus, the following alternatives can occur:

a) If the virus enters through the open oral cavity, it will come into contact with saliva. The viral particles could go into the digestive tract because the epiglottis blocks saliva access to the lungs [4], thus reinforcing findings of the virus in feces [5] and gastrointestinal symptoms.

b) The virus may be introduced through the nostrils. Since it is the first route of contact with the respiratory system, it can replicate in nasal cells expressing ACE2 receptors and migrate to the lower respiratory tract during inhalation. Even

though the expression of ACE2 receptors is less compared to saliva, this is a more vulnerable area because the target cells (pneumocytes type II) are directly involved in gas exchange and the blood-alveolar barrier. Consequently, it leads to further tissue damage and possible viremia, as shown by viral RNA found in plasma [6].

c) The virus can enter by the conjunctival route through fomites and respiratory aerosols, as the corneal and sub-palpebral conjunctival epithelium of the eye has ACE2 receptors and Transmembrane Serine Protease 2 (TMPRSS2). The viral particles migrate from the conjunctival sac to the acinar cells of the lacrimal gland through the nasolacrimal duct reaching the nasal cavity [7] to enter the respiratory tract.

Saliva can encapsulate infected epithelial cells, so when a person speaks, potentially contagious saliva droplets are expelled. However, the contagion capacity of these particles depends on several factors. One of them is the size of the droplets expelled through the mouth either when coughing or sneezing (although the latter also includes drops of nasal mucosa) [3]. It has been proved that respiratory aerosols can infect a healthy person with an unprotected oral cavity (open), nostrils, and eyes. Based on these findings, different strategies have been implemented to prevent a first contact with the upper respiratory tract, i.e., the nose, as it becomes a vulnerable area for accessing the central nervous system through the olfactory bulb. In addition, it must be noted that nasal mucosa can suffer metaplastic changes due to factors such as inflammation and infectious processes, which conditions the mucociliary transport leaving the respiratory tract even more exposed [8]. Thus, intending to protect the population during essential activities where the face mask is removed, such as the intake of food and beverages and dental consultations, the proposal called "Eating mask" came about, which is a "nose mask" that covers only the nostrils [9,10]. Only following sanitary measures, handwashing, face masks, and protective glasses will prevent the contagion, including variants with greater viral replication and adherence to epithelia.

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ISSN: 2574-1241

DOI: 10.26717/BJSTR.2021.37.006075

Gustavo Acosta Altamirano. Biomed J Sci & Tech Res