

COVID-19 Pandemic and its Impact on Craniofacial Surgery

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Abstract: In late 2019, a novel coronavirus strain, SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2), also known as coronavirus disease 2019 (COVID-19), triggered a global pandemic as the virus spread from the Wuhan Province, China, across all continents. Although infrequent, severe respiratory infection and death caused by SARS-CoV-2 is disproportionately high amongst healthcare providers such as craniofacial surgeons who work in the head and neck region. Factors that impact SARS-CoV-2 transmission include: (1) high viral loads in the mucosa of the oral and nasopharynx, (2) limited and/or imprecise disease screening/confirmation testing, (3) access to and appropriate use of personal protective equipment (PPE).

Key Words: Coronavirus, SARS-CoV-2, COVID 19, severe acute respiratory syndrome coronavirus 2

In late 2019, the Wuhan Province of mainland China experienced an outbreak of a novel coronavirus strain, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), also known as coronavirus disease 2019 (COVID-19).¹ Similar to outbreaks of 2 other coronavirus pathogens, SARS-CoV and Middle East respiratory syndrome (MERS-CoV), SARS-CoV-2 is capable of causing severe and occasionally fatal (<10%) respiratory tract infection as it grows better in human airway epithelial cells than in standard tissue culture cells.^{2,3} In the subsequent months, the global spread of this viral pathogen has created a healthcare crisis not experienced since the Spanish Flu pandemic of 1918. As concerns for this disease progress, efforts to curb its progression in both the general population and in the healthcare professionals who treat these patients have been scrutinized. Healthcare providers who treat orofacial pathology such as craniofacial surgeons, otolaryngologists, dentists, oral surgeons, and ophthalmologists have an innately high risk of contracting SARS-CoV-2 compared with other providers.⁴ This is a direct result of an infected person's viral load being highest in the pharynx and upper aerodigestive tract.⁵

Zou et al further reported that asymptomatic carriers of SARS-CoV-2 can have positive viral cultures from the oro/nasopharynx for 7 to 11 days with no clinical signs of fever, cough, or shortness of breath. In a recent *New England Journal of Medicine* publication, van Doremalen et al demonstrated that aerosolized droplets of SARS-CoV-2 were viable and capable of disease transmission

for a minimum of 3 hours. Furthermore, the virus can remain stable and viable on a host of innate (cardboard, metal, and plastic) surfaces for at least 72 hours.⁶ Following the recent Diamond Princess cruise ship outbreak, the Center for Disease Control found SARS-CoV-2 RNA on cabin surfaces 17 days after last occupancy; however, the clinical significance of this finding as related to its viability and transmission is unclear.⁷ Li et al reported a mean interval time of 9.1 to 12.5 days between the onset of symptoms and hospitalization in their early experience in the Wuhan province.⁸ This prolonged interval is why 14 days is most commonly used at the initial means of quarantine when a suspected or confirmed infection presents.

Electrosurgical smoke plume created in an operating room theater is a well-documented concern for aerosolization and disease transmission.⁹ Studies on the human papilloma virus have demonstrated that iatrogenic aerosolization is a risk factor for viral transmission.¹⁰⁻¹² The high SARS-CoV-2 viral load in the oral cavity and pharynx is easily aerosolized intraoperatively making iatrogenic transmission of this disease a distinct concern in craniofacial surgery. Since the reservoir for this disease is harbored in the oro/nasopharynx, wearing the appropriate personal protective equipment such as a mask and eye protection is the most essential means of prevention for iatrogenic spread among craniofacial surgeons.

Unfortunately, the first documented healthcare provider death attributed to SARS-CoV-2 was an otolaryngologist in Wuhan, China.¹³ In addition, *China Newsweek* reported that a single operation to remove benign pituitary tumor resulted in the infection of 10 nurses and 4 physicians. Inadequate protection and a poor understanding of the disease transmission are 2 major concerns in healthcare related transmission.⁴ Unfortunately, in the Wuhan experience, N95 masks were not enough to control viral spread in the operative theater. Not until the routine use of PAPRs (Powered, Air Purifying Respirators) was implemented, did the SARS-CoV-2 spread become controlled. Furthermore, colleagues in China, Italy, and Iran have warned that N95 masks are not sufficient to protect ourselves during procedures involving prolonged, close proximity, multi-hour instrumentation of the nasal and oral cavity, pharynx, larynx and trachea with electrocautery, laser, high-speed instruments, and suction that generate aerosol and plumes containing viral material.

Pulmonary complications are often the most serious manifestation of SARS-CoV-2 and severe cases often requiring prolonged ventilator dependency. Systemic medications have showed limited efficacy of treating severe manifestations. Investigations studying antiviral drug agents such as lopinavir-ritonavir, interferon- β , remdesivir, and chloroquine \pm azithromycin are underway. Drug availability and shortages is a serious limitation to these studies, making routine use unlikely in the near future. As the pandemic progresses, intravenous hyperimmune globulin collected from recovered persons with monoclonal antibodies is another possible treatment for SARS-CoV-2.

Understanding and managing SARS-CoV-2 efficiency of transmission is essential for disease mitigation. Currently, studies indicate an estimated reproduction number (R_0) of 2.2, meaning that an infected person will spread the disease to more than 2 persons.¹⁴ Until this number is below 1.0 the disease will continue to spread. Appropriate screening and diagnostic testing will be one important factor in the identification and management of SARS-CoV-2 patients. However, SARS-CoV-2 testing is more complicated and difficult than is readily transparent. First, obtaining appropriate test samples from the deep nasopharynx respiratory epithelium (not the nasal cavity) is one limitation of SARS-CoV-2 testing. In addition, even when appropriate sampling is performed, all diagnostic screening tests are limited by their sensitivity and specificity. A meta-analysis examining the effectiveness of influenza virus tests

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demonstrated pooled sensitivities of 62.3% and specificities of 98.2%.¹⁵ Finally, the small island nation of Iceland currently offers SARS-CoV-2 screening to its population of 540,000. Of the first 3.4% of the population tested at the time of this publication, roughly 50% of those screened were positive for SARS-CoV-2 even though they demonstrated no clinical symptoms. As such, healthcare workers should heed caution and presumptively assume all patients are positive as the pandemic continues.

Multiple professional societies ranging from the fields of dentistry to oral and maxillofacial surgery and otolaryngology have issued recommendations that surgery be limited during the COVID-19 pandemic to urgent or emergent procedures. The American Dental Association indicates that viral transmission can occur throughout a range of patient interactions including oral photography, suctioning, and drilling procedures.¹⁶ The American Academy of Otolaryngology-Head and Neck Surgery additionally indicates that viral exposure can occur in any setting, ranging from the office, to the hospital and operating room and that if a patient has not been or cannot be tested, they should be treated as though they are COVID-19 positive.¹⁷ All three societies have indicated that appropriate personal protective equipment should be used including N95 masks when available. Ultimately, it has been left to specific institutions and surgical departments to identify what qualifies as urgent or emergent procedures and to identify strategies to protect both patients and healthcare providers. The Center for Disease Control has provided extensive information to help the public reduce risk of COVID-19 transmission, and recommendations regarding routine hand washing, avoiding sick contacts, maintaining social distancing, and cleaning/disinfecting surfaces are available on their website.

With this information in mind, we would like to highlight the following points and recommendations for surgeons engaging in cranio/maxillofacial procedures:

- COVID-19 may be heavily concentrated in the oral cavity, nasopharynx, and oropharynx.
- Cranio/maxillofacial procedures should be limited to urgent and emergent cases.
- A craniofacial patient requiring surgery who cannot undergo COVID-19 testing should be treated as though they are infected.
- Given the potential viral burden associated with lengthy cranio/maxillofacial procedures and the fact that COVID-19 testing does not have 100% sensitivity and specificity, these cases should be approached with maximal personal protective equipment as guided and supplied by your institution.

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