Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Oral and Maxillofacial Surgery Cases 6 (2020) 100160

Contents lists available at ScienceDirect

Oral and Maxillofacial Surgery Cases

journal homepage: www.oralandmaxillofacialsurgerycases.com

Reducing transmission of COVID-19 using a continuous negative pressure operative field barrier during oral maxillofacial surgery

Luis F. Gonzalez-Ciccarelli, MD [a,*], James Nilson, MD PhD [a], Daniel Oreadi, DMD [b], Dimitrios Fakitsas, DMD [b], Pavan Sekhar, MD [a], Sadeq A. Quraishi, MD MHA MMSc [a]

[a] Department of Anesthesiology and Perioperative Medicine, Tufts Medical Center, Boston, MA, United States
[b] Department of Oral and Maxillofacial Surgery, Tufts Medical Center, Boston, MA, United States

ARTICLE INFO

Keywords:
COVID-19
Oral maxillofacial surgery
Continuous negative pressure
Operative field barrier
Aerosolization
Droplets

ABSTRACT

Oral and maxillofacial surgery in patients with suspected or confirmed COVID-19, presents a high risk of exposure and cross contamination to the operative room personnel. We designed, simulated and implemented a continue negative pressure operative field barrier to provide an additional layer of protection, using standard equipment readily available in most operative rooms during oral and maxillofacial procedures.

1. Introduction

Salivary and mucosal secretions have been described as a reservoir for high concentrations of COVID-19, even in asymptomatic patients [1,2]. Oral and maxillofacial surgery in patients with suspected or confirmed COVID-19 present a high risk of exposure to operating room personnel [3], since many procedures are known to generate aerosols during interventions performed inside the oral cavity or in close proximity to the oral and nasal mucosa [4]. Therefore, our team designed a continuous negative pressure operative field barrier using standard equipment readily available in most operating rooms to provide an additional layer of protection to all staff during oral and maxillofacial procedures.

2. Material and methods

A simulation of the continuous negative pressure environment was designed and develop in order to validate the concept and proof that continuous negative pressure would clear aerosolized particles from the surgical field (Video 1). After obtaining informed consent, a patient with a symptomatic left maxillary sinus lesion, pending COVID-19 testing, was scheduled to undergo time-sensitive enucleation and curettage with buccal fat pad advancement. The patient was nasally intubated, followed by a standard preparation and drape of the surgical field. A Bookwalter retractor table post was mounted to the side of the operating room bed. The oval ring was placed over the operative site, securing it to the table using the extension bar and adjusted for the convenience of the surgical team. Self-adhesive sterile drapes (3M Steri-drapes, commonly known as 1000 drapes) were placed circumferentially around the oval ring in order to create a drop-like curtain from the edge of the ring down to the surgical field (Fig. 1). A transparent sterile plastic sheet,

* Corresponding author. Department of Anesthesiology and Perioperative Medicine, Tufts Medical Center, 800 Washington Street, #298 Ziskind Building, 6th Floor, Boston, MA, 02111, United States.
E-mail address: lgonzalezciccar@tuftsmedicalcenter.org (L.F. Gonzalez-Ciccarelli).

https://doi.org/10.1016/j.omsc.2020.100160
Received 27 May 2020; Accepted 27 May 2020
Available online 30 May 2020

serving as an operative field barrier for droplets and debris, was draped over and secured to the oval ring using non-penetrating towel clamps. In order to create a continuous negative pressure environment under the operative field barrier, a commercially available surgical waste manager with a filtered smoke evacuator was utilized (Neptune 3®, Stryker Corporation, Kalamazoo, MI). A 7/8-inch tubing secured to the flex bar with the tip facing the surgical field was connected to the 7/8-inch smoke evacuator port (Fig. 2). Surgery was performed with no complication (Fig. 3) (Video 1); patient was transferred to the recovery area and discharge home the same day.

Supplementary video related to this article can be found at https://doi.org/10.1016/j.omsc.2020.100160.

3. Discussion

The surgeons were able to safely and successfully perform the intraoral procedure while operating under a continuous negative pressure environment. The transparent sterile plastic sheet allowed the surgeons to have a clear view of the surgical field even after the use of high speed drill with copious irrigation. Glare was minimized when the surgical lights where dimmed and the surgical field was illuminated with the use of headlights. Placing multiple self-adhesive sterile drapes allowed for good mobility and range of motion of the surgeon's hands.

Using the 7/8-inch smoke evacuator port allowed the creation of a continuous negative pressure that circulates 33 cubic feet per minute of air when regulated to 100% flow (per the manufacturer). The in-line ultra-low particulate air filter used in the Neptune 3® will remove 99.999% of particles 0.1 μm or larger within the surgical field [5]. It is important to delineate that in order for the airflow to circulate and create the continuous negative pressure environment, the operative field barrier cannot be hermetically sealed, its mandatory to have airflow under the self-adhesive sterile drapes for the negative pressure to function effectively. If there is no airflow, the system will collapse due to a contained negative pressure.

4. Conclusion

In conjunction with an operative field barrier, using a commercially available surgical waste manager with a filtered smoke evacuator creates a continuous negative pressure environment around the surgical field, which could minimize exposure and decrease cross-contamination to the operating room personnel while performing high risk procedures in COVID-19 patients. Our case suggests that oral and maxillofacial surgeries (particularly those that are time sensitive) can be safely performed under such continuous negative pressure environments, while adding an extra layer of protection to healthcare workers.

Informed consent

Written informed consent was obtained.
Authors keep a copy of the informed consent.

Consent

Written informed consent was obtained.

Fig. 1. Intraoperative view - Placement of self-adhesive sterile drapes as a drop-like curtain.

Fig. 2. Surgical waste manager 7/8-inch smoke evacuator port.

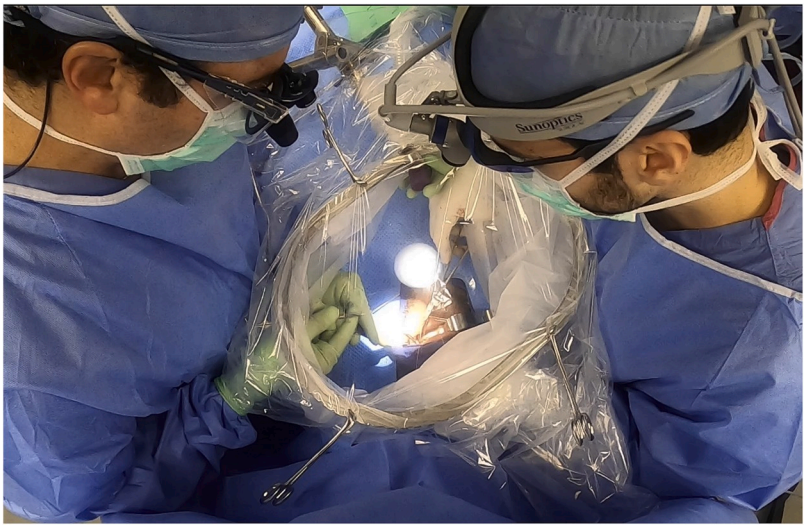

Fig. 3. Intraoperative view - Continuous negative pressure operative field barrier.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Credit author statement

Luis F Gonzalez Ciccarelli: Conceptualization, writing original draft, investigation, software, simulation. **James Nilson:** Data curation, conceptualization, resources, supervision. **Daniel Oreadi:** Performed surgical procedure, supervision, resources, validation, supervision. **Dimitrios Fakitsas:** Performed surgical procedure, supervision, resources, validation, investigation. **Pavan Sekhar:** Data curation, Conceptualization, simulation, supervision. **Sadeq A. Quraishi:** Funding acquisition, Project administration, Writing - Review & Editing.

Declaration of competing interest

None of the authors have conflict of interest to disclose.

References

[1] To KK, Tsang OT, Chik-Yan Yip C, et al. Consistent detection of 2019 novel coronavirus in saliva. Clin Infect Dis 2020.
[2] Zou L, Ruan F, Huang M, et al. SARS-CoV-2 viral load in upper respiratory specimens of infected patients. N Engl J Med 2020;382(12):1177–9.
[3] Zimmermann M, Nkenke E. Approaches to the management of patients in oral and maxillofacial surgery during COVID-19 pandemic. J Cranio-Maxillo-Fac Surg 2020.
[4] Kobza J, Pastuszka JS, Bragoszewska E. Do exposures to aerosols pose a risk to dental professionals? Occup Med 2018;68(7):454–8.
[5] Neptune® 3 Waste Management System. http://www.neptunewastemanagement.com/wp-content/uploads/2017/07/9100-003-550-Rev-A_SI160646-N3-4-Page-Slick-v9_single_page.pdf.