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AEROSOL PRODUCING PROCEDURES IN MAXILLOFACIAL SURGERY AND ADVOCATED PRECAUTIONS FOR HEALTH CARE WORKERS IN POST COVID ERA

Plastic Surgery

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ABSTRACT

Maxillofacial surgeries are high risk procedures as the surgeon is in close proximity to secretions from the nasopharynx and oropharynx. The nature of the COVID 19 virus' infectious route by direct implication of aerosol, has hazardous effect during conventional and standard oral health care procedures. An aerosol is defined as a suspension system of solid or liquid particles in a gas capable of transmitting the virus. We have highlighted the aerosol producing procedures encountered in maxillofacial practice and the minimum personal protective equipment (PPE) required in such situations to prevent the spread of COVID 19 among maxillofacial surgeons and other healthcare workers. Also, we have enumerated the procedures which can be done away with, and adopting new techniques to curtail the chances of spread of this deadly virus.

KEYWORDS

COVID 19, maxillofacial, aerosol

INTRODUCTION

The pandemic outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has had an unforgiving impact on the world. We are slowly moving towards a situation where we have to keep moving forward inspite of the dangers of COVID-19 virus. People working on the frontline are the health care workers, and among those, maxillofacial surgeons are at a severe risk of contamination[1]. Besides the public health and economic burdens of the coronavirus disease 2019, it is now evident that its massive spread around the world has imposed great occupational challenges in the way surgery will be performed in the future. As we resume normal routine activities post lockdown, the incidence of maxillofacial trauma is again on the rise. Operating in the oral cavity imposes a severe hazard to the maxillofacial surgeon and the whole team because of various aerosol producing procedures in maxillofacial surgery. We have highlighted the aerosol producing procedures encountered in maxillofacial practice and the minimum personal protective equipment (PPE) essential in such situations.

Route of transmission

The nature of the virus' infectious route, with direct implication of airborne droplets in the form of aerosol, has revealed certain potential hazards underlying conventional and standard oral health care procedures[2].An aerosol is defined as a suspension system of solid or liquid particles in a gas[3]. Coughing or sneezing can create aerosols in the range of 1-5mm in diameter. Smallest possible respirable size of aerosol is of the range of 1-10 µm while aerosols of 1-5 µm remain in the air for a much longer period[4]. Aerosol producing procedures are manoeuvres which generate aerosols lesser than 10 µm and can travel greater than 2 m[5]. As aerosol are smaller molecules compared to droplets, they travel long distances and therefore have airborne transmission.

Aerosol producing procedures (APP)

Working in the oral cavity is a high risk procedure as the surgeon is in close proximity to secretions from the nasopharynx and oropharynx. Moreover, maxillofacial surgery regularly utilises various machinery and high speed instruments like drills and saw. Blood and irrigation fluid coming in close contact with high-speed instruments also gets aerosolized and can travel further. Various aerosol producing procedures in maxillofacial surgery are:-

1. General Anaesthesia (GA) is a must in all maxillofacial trauma cases and it cannot be done away with. Intubation along with oral suctioning has shown to increase the production of aerosol leading to an increased risk of infection to the healthcare workers[6]. Use of closed circuit and closed suction catheter systems is advised. When GA is being given, number of health care workers should be limited to utmost minimum. Surgeons and staff should be allowed to go in the theatre only after 20 min of patient induction when the support staff of the anaesthesia team have left the theatre . The same applies when the patient is extubated[7]. Recovery of the patient is done in theatre, and once stable only then shifted directly to ward.
2. Electrocautery - Regularly used in every surgery, electrocauterisation creates aerosols of < 5 mm both in cutting and coagulation modes[8]. Higher current levels can lead to even more particle aerosolization.
3. Irrigation by mechanical hydrotherapy- Irrigation by pulsed lavage, use of a jet stream of saline to clean up clots, must be avoided to curtail spurting on the surgical team[9]. Instead a moist saline gauze piece can be used to clear the surgical field
4. Suctioning - has also shown to spread aerosols[9] and should be used to the minimum.
5. Power drills, burrs and high-speed saws - A commonplace in maxillofacial surgery, drilling and burring can generate high amounts of aerosols[10]. Nogler et al. demonstrated that high-speed cutters created a spread area of aerosols upto 6-8 metres during revision hip arthroplasty[11]. As these cannot be avoided, care must be taken to check the spread of aerosolized particles. Grant et al suggested an alternative method of drill activation with the drill tip fully submerged in saline which vastly reduces, if not entirely eliminates, aerosol generation and can be achieved with relative ease in the oral cavity. The operative field is fully submerged with saline before drill activation instead of the built in irrigation system and subsequently suctioned away before screw placement[12].
6. Heavy instruments like osteotomes, nibblers, gigli saw have to be used with extra caution, to avoid splashes on the operating team, and one must preferably avoid using such instruments in an aggressive manner.

Recommendations for surgeons in post COVID era

Oral and maxillofacial surgeons, like other specialists in otolaryngology and ophthalmology along with the ancillary staff working in these settings, have a high risk of exposure to the novel SARS-CoV2[13-15]. During the SARS epidemic in 2003, Health care workers accounted for one fifth of all infected cases globally.

Precautions should be taken as any patient taken for surgery may be infected with Covid-19 (symptomatic/asymptomatic). Even though they should all be tested preoperatively, we are aware of the large number of false negatives. Once patient has been admitted in the ward, movements of the relatives should be restricted and the patient shifted directly to the operation theatre. Patient should wear a surgical mask during movement at all times. In addition to the above mentioned recommendations, proper barrier protection should be used by the health care professionals to prevent infection and spread of COVID 19. The Centre for Disease Control has recommended that a higher level of respiratory protection is required for certain aerosol generating procedures[16]. A detailed description of specifications of personal protective equipment (PPE) is beyond the scope of this article. Recommended specifications for PPE in aerosol producing procedures are detailed in table 1.

Table 1: Recommended Personal Protective Equipment during aerosol producing procedures. Adapted from Lammers, Lea and Westerberg 2020[17].

Protective Equipment	High- and Moderate-risk procedures in COVID positive/ Suspected positive	High- and Moderate-risk procedures in COVID negative	Low-risk procedures and bedside care
Mask	N99 masks /FFP3 masks, elastomeric respirators with N-P 99-100 filters	N95 masks /FFP2 masks	2 layered Surgical mask
Eye protection	Fitted goggles/Face shields covering till chin	Fitted goggles	Face shield/Goggles
Gown	AAMI level 4 with knee-high shoe covers	AAMI level 3 with knee-high shoe covers	AAMI level 2 or 1
Head cover	Hood covering neck	Hood covering neck	Optional
Gloves	Double gloves	Double gloves	Single Gloves

During a maxillofacial surgery in a COVID positive/ suspected positive patient, respiratory protection above 95% is imperative. N99/FFP3 masks/respirators provide 99% minimum filtration efficiency to aerosols, compared to the 94-95% by N95/FFP2 masks/respirators[10,17]. Options in respirators include N99, R99, P99, N100, R100, P100, elastomeric respirators with N-P 99-100 filters, powered air-purifying respirators (PAPRs), and controlled air-purifying respirators[18]. Fitted goggles are required as face shields are inadequate for eye protection during splashes. If a face shield is used, it should be long enough to reach and cover the chin. This is followed by the first layer of surgical gloves and then gown. We recommend wearing an AAMI level 4 gown (Association for the Advancement of Medical Instrumentation). Level 4 essentially means a water impermeable gown with hood covering the neck, knee-high shoe covers and lastly outer gloves[4]. While donning and doffing PPE, it is advised that another person assists to ensure the adequacy of the procedure[17]. For long duration surgery, the use of PAPRs can provide a higher level of protection and comfort. However, high costs and limited availability restricts its use.

Level 2 PPE precautions are recommended in a COVID negative patient keeping the possibilities of false negatives in mind. Level 2 PPE essentially includes N95 masks /FFP2 respirators, fitted goggles for eye protection, hood covering neck, AAMI level 3 or 4 gown along with double gloves. Minor sterile procedures in the operating room advocates the use of these PPE in conjunction with a second sterile surgical gown.

Use of magnification and headlights

While doing microvascular surgery in the head and neck region, surgeons regularly use surgical loupes, headlights and microscopes. Standard respiratory PPE does not have a provision for them so they need to be modified to accommodate magnification equipments reassuring surgeon safety during microvascular procedures. Respirators can be used with loupes, headlights, and microscopes; however, their fit testing must be ensured[18].

Operating room

Maxillofacial surgery should preferably be performed in a negative pressure room with a minimum of 12 air changes per hour, as it prevents dissemination outside the room. The exhaust air is filtered through HEPA filters, which are capable of filtering essentially all particles, including nanoparticles (<0.01 mm)[5]. Movement in and out of the OR should be limited, only equipment and supplies required for the procedure should be retained in the theatre, and a runner should be stationed outside the OR to attend to additional supplies required[4,17].

Use of disinfectant like hypochlorous acid before and after each surgery for disinfecting the theatre is highly recommended. HOCl is one disinfectant that, when combined with adequate personal protective equipment, screening and social-distancing techniques, hand washing, and high-volume evacuation suction, may help reduce the transmission of COVID-19 in the operation theatre setting. It comprises many of the desired effects of the ideal disinfectant. It is easy to use, is inexpensive, has a good safety profile, and can be used to disinfect large areas quickly and with a broad range of bactericidal and virucidal effects[19].

Apart from these measures, a maxillofacial surgeon should avoid being aggressive in his approach in these tough times. Health of the healthcare workers is of utmost importance and should be given priority. Minimalistic procedures should be adapted like:-

- Use of IMF screws instead of arch bar for mandibular maxillary fixation.
- Closed reduction in favourable fractures of the mandible.
- Conservative management (nonoperative) in undisplaced zygoma fractures.
- Local / pedicled flaps instead of a time consuming microvascular free flap transfer in head and neck region.
- The number of team members exposed should be minimized.

CONCLUSION

The present COVID era requires the maxillofacial and head and neck surgeon to be extra cautious during operating as there is significant danger to both the surgeon and his team. Surgeon should take overprotective measures in dilemmatic situations to safeguard both the teams' and patient's interests, as prevention is better than cure. With the current Covid-19 pandemic situation, it is strikingly evident that the time taken for surgery and turnover time is exponentially longer than normal, but it is time well spent considering the safety of the health care personnel.

In conclusion, these challenges we face will continue for at least the foreseeable future, including the next 12 to 24 months. The correct selection and utilization of respiratory personal protective equipment is of the utmost importance in the current COVID-19 pandemic. This is especially true for healthcare workers exposed to high-risk aerosol generating procedures including oral maxillofacial surgeons, otolaryngologists, plastic surgeons, ophthalmologists and dentists.

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