The International Journal of Oral & Maxillofacial Implants

Manuscript:	JOMI-0-0 - (8561)
Title:	Limitation of Aerosol-Producing procedures during dental implants placement drilling in times of COVID-19
Keywords:	Epidemiology, Maxillofacial, Oral and maxillofacial
Type:	Personal

Abstract:

The coronavirus COVID-19 pandemic has led to a tragic global health crisis and it can be defined as the greatest challenge the world has faced in the last seventy years. Since the virus spread is facilitated by close contact, dentists and dental care teams are at higher risk for coming into contact with pathogenic micro-organisms. Their risk of exposure is associated with the infectious nature of their patients, interventions, or instruments that produce aerosols. Therefore, this urgent situation demands the reassessment of dental implant placement paradigms. Moreover, it is necessary to develop successful strategies for prevention, especially for oral surgeons who are daily involved in performing aerosol-generating procedures and issue new guidelines for combating this phenomenon and delivering safe and high-quality care.

Recently, a study by Kissler showed that measures of social distancing to prevent further expansion of COVID-19 may be necessary until 2022 (1). Under this scenery, dental workers must be informed of new techniques and strategies which could reduce the risk of contracting this infectious disease. Thus, traditional implant placement protocols require reevaluations, given the extraordinary COVID-19-specific risks of surgery.

Dental implant Placement Surgery (DIPS) has been a longstanding treatment option for edentulous patients. However, emerging data demonstrate that performing dental treatments at present may be less advisable and even imprudent due to the rapidly-evolving pandemic. Therefore, dental implant treatment doctrines must be reanalyzed for the welfare of patients, providers, oral surgery teams and society.

Barriers to Safe DIPS:

There are now numerous novel barriers to safe dental implant placement surgery (2):

- imperfect presurgical screening for COVID-19
- prolonged SARS-CoV-2 aerosolization
- the occurrence of multiple potentially lengthy, aerosol-generating procedures (AGPs)
- potential incompatibility of enhanced personal protective equipment (PPE) with routine operative equipment

Production of aerosols in dental work

Aerosols are defined as liquid or solid particles suspended in the air by humans, animals, instruments, or machines (3). Aerosol generating procedures (AGPs) are defined as any medical and patient care procedure that results in the production of airborne particles (3).AGPs can produce airborne particles (4). The production of aerosol during dental procedures has been described in many scientific publications (5). An aerosol cloud of particulate matter and fluid is often clearly visible during dental procedures (5). There are at least three potential sources of airborne contamination during dental treatment: dental instrumentation, saliva and respiratory sources, and the operative site (5). Aerosols can float in the air for a considerable time before being inhaled by dental staff and other patients (6). There is some evidence for a greater prevalence of respiratory diseases in dental workers (6). Aerosols are created during surgical and nonsurgical procedures that may include extractions, crown preparations, caries restorations, periodontal therapies, prophylaxes and endodontic treatment (7). The smaller particles of an aerosol (0.5 to 10 □m in diameter) have the potential to penetrate and lodge in the smaller passages of the lungs and are thought to carry the greatest potential for transmitting infections (5). These aerosols represent an infection hazard due to their gross contamination with

microorganisms and blood (6). Therefore, AGPs create the potential for airborne transmission of infections that may otherwise only be transmissible by the droplet route(4).

Bio-aerosols are aerosols consisting of particles of any kind of organism The characteristics of bio-aerosols differ depending on environmental influences such as humidity, airflow, and temperature (3). This suspension of particles in the air, liquid or solid, within size from 0.001 to above 100μm, may contain pathogens (8). Bioaerosols generated during dental treatment are a potential hazard to dental staff, and there have been growing concerns about their role in the transmission of various airborne infections and about reducing the risk of contamination (9). Viral infections were isolated in dental bio-aerosols(6) because they may contain different types of viruses like influenza, rhinoviruses, Varicella-Zoster Virus, Human metapneumovirus, Parainfluenza virus 1–3, Influenza A, Human adenovirus, Picornavirus, H1N1, Influenza B virus , Respiratory syncytial virus , Rhinovirus , Influenza virus,Toque teno virus, Influenza B, parainfluenza 1, 2, 3, (3)(13). However, no extensive review on existing evidence regarding bio-aerosols is available (3). Micik and colleagues stated that these particles behaved in a ballistic manner (5). This means that these particles or droplets are ejected forcibly from the operating site and arc in a trajectory similar to that of a bullet until they contact a surface or fall to the floor. These particles are too large to become suspended in the air and are airborne only briefly (5). Bio-aerosols are generated through multiple sources such as machines, different types of interventions,

instruments and human activity. Even so, it has to be affirmed that Bioaerosols can be hazardous to both patients and Health Care Workers (HCWs) (3). Dental instruments remove material from the operative site that becomes aerosolized by the action of the rotary instruments. It has been suggested that these aerosols contain large quantities of saliva(9). The water spray usually is the portion of the aerosol that is most visible to the naked eye and is noticed by the patient and dental personnel (5). Dental treatments are performed using a variety of hand tools, including micro-motor handpieces and water syringes(9). The latter produces a large number of particles and splattering which may contain microorganisms from the oral cavity of patients (9). It is important to control this aerosol to the greatest extent possible to reassure patients and dental personnel (5). It also should be recognized that contaminated aerosols are produced during dental procedures when there are little or no visible aerosols (5). Most of the minor oral surgical procedures require the use of a combination of hand instruments and rotary instruments under saline irrigation for bone removal (10). Oral surgical procedures can cause the spread of infections in the clinics through visually imperceptible, splattered, and aerosolized blood (10).

Presence of COVID-19 in saliva

The coronavirus is a kind of viral pneumonia with its epicentre in Wuhan China(11). (COVID-19) is emerging and rapidly spreading worldwide(8) and its fast expansion has led to the declaration of a pandemic outbreak of the coronavirus by the World Health Organization (WHO)(12).Covid-19 can be efficiently transmitted between humans via droplets during close unprotected contact between infector and infectee (11). The new coronavirus isolated by researchers afterward was named as 2019 novel coronavirus (2019-nCoV). WHO has claimed that 2019-nCoV spreads primarily through saliva droplets or discharge from the nose (8). To et al. recognized saliva as a reservoir of SARS-CoV-2 in infected individuals(12) Saliva, has been reported 2019-nCoV nucleic acid positive. Close contact or short-range transmission of infectious saliva droplets is a primary mode for 2019-nCoV to disseminate as claimed by WHO(8). Recent research suggests that saliva can be used as a viable biosample for the detection of Covid-19, further studies are required to validate the same(11).

Presence of COVID-19 in dental aerosols

SARS-CoV-2 is aerosolized and it can remain airborne for at least three hours. This has been detected in airborne samples in the hallways of COVID-19 units (2). Biologic risk of COVID-19 inhalation transmission is extremely high when performing dental procedures due to the use of handpieces under irrigation, which favors the diffusion of aerosol particles of saliva, blood, and secretions(12). SARS-CoV-2 transmission during dental procedures can, therefore, happen through inhalation of aerosol/droplets from infected individuals or direct contact with mucous membranes, oral fluids, and contaminated instruments and surfaces (12).

Proceeding with drilling in DIPS During the COVID-19 Pandemic

The risks of DIPS must be assessed in light of their potential impact on patients, providers,oral surgery team and society. The risks of operating during this pandemic are high and DIPS patients should be carefully selected for surgery.

Therefore, the reduction of aerosol-generating procedures is recommended during these phases of COVID-19 diffusion(12), dental practitioners should perform only emergency treatments and reduce as much as possible the production of aerosol/droplets during the procedure(12).

It is advisable to :

- avoid and reduce the use of handpieces to lower aerosol/droplet production and instead use handpieces with antiretractive or antireflux valves(12);
- use surgical aspiration to control airborne particles diffusion(12).

Although SARS-CoV-2 circulates in the blood of COVID-19-positive patients, there is inadequate data to assess the risk of viral aerosolization in routine(2), such as DIPS. Deviation from the traditional standard of care may be appropriate or necessary in light of the current, extraordinary circumstances.

Handpiece use should be limited and, if possible, dental procedures should

be performed with manual instruments (12). Traditional doctrines in dental implant placement strongly favor high-speed drilling while using the saline solution for irrigation of surgical site to maintain the bone temperature. Assessment of surgery-level- risk should account for: risk and duration of AGPs(2) DIPS may consider avoiding minimize AGPs and limit the length of these procedures whenever possible. Here we can use techniques of DIPS with low-velocity protocols and the absence of saline irrigation to decrease the aerosol production. As it is known, in the generation of aerosols the greater the force the smaller the particles that are produced (4). In implant dentistry, there are various methods to place implants, and, in the Table I, six different systems are compared, showing that according to the drilling speed and the necessity of saline irrigation, each of them has a different production of bioaerosols.

Conclusion

Given the exposure risk for different working categories, dental practitioners are the workers facing the greatest coronavirus risk (12). The mucosa of the oral cavity has been recognized as a potentially high-risk route of SARS-CoV-2 infection(12). Therefore, dental implant placement surgeries are extraordinarily high-risk due to COVID-19SARS-CoV-2 viral aerosolization and transmission to operating room personnel, endangering their safety. The COVID-19 pandemic needs temporary modification of current dental implant treatment paradigms. For dental implant placement is recommended to produce the least amount of bioaerosol possible(9), because it is still very uncertain when and whether the COVID-19 pandemic's end will occur (1). In the meanwhile, the Bicon system seems to be able to achieve this therapeutic objective, that will be very useful in a critical period like this, in which the reduction of the chances of COVID-19 transmission risk is of great importance. Despite the amplified risks, surgery will still be indicated for many patients and appropriate preparation will be critical to ensure the safety of the patient, provider, and all other involved HCWs.

The author have no conflict of interest related to the study.

Acknowledgment: Giulia Di Martino

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Table I- This table shows how different implant systems could be related to the production of bioaerosols at DIPS.

System	Maximum Velocity recommended(rpm^2)	Use of sterile saline irrigation
Nobel Biocare	2000	yes
Zimmer	600-850	yes
Astra Tech	1500	yes
Bicon	50 (1000 Pilot drill)	no
Biohorizons	850-2500	yes

Straumman	300-300	yes

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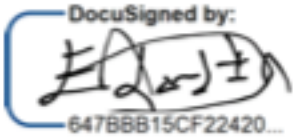
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