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Limitations in aerosols production in dental implant placement surgery during COVID-19 pandemic

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ABSTRACT

Aim 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 this virus. Medical action involves risks that in this case correspond to direct contact with patients, carrying out procedures and using devices generating aerosols.
Conclusion This critical situation demands the reassessment of dental implant placement. Moreover, it is necessary to recommend safer strategies, with the aim of preventing exposure for oral surgeons, who during their clinical activity generate aerosols, and issue new guidelines for combating this phenomenon and delivering safe and high-quality care.

KEYWORDS COVID-19, Dental implants, Aerosol.

INTRODUCTION

Recently, a study by Kissler showed that measures of social distancing to prevent further spread of COVID-19 may be necessary until 2022 (1). Unfortunately recent information demonstrate that performing dental treatments at present may be less advisable and even imprudent due to the rapidly-evolving pandemic. 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 re-evaluations, becaise of the inherent risks of COVID-19 during oral surgery.
Dental implant Placement Surgery (DIPS) is a frequent therapy for edentulous patients. Therefore, dental implant treatment protocols, especially aerosol producers, should be examined in order to prevent the spread of infection.

COVID-19

Barriers to safe DIPS

There are new situations that increase the risk of contagion among people involved in DIPS (2):
Incorrect or unreported detection of COVID-19;
The execution of aerosol generating procedures (AGPs) containing.

Production of aerosols in dental work

The production of aerosols is a result of human activities, instruments or machines. These aerosols are made up of liquid or solid particles suspended in the air (3). AGPs correspond to a series of medical procedures that are characterized by the production of airborne particles (3,4). The production of aerosol during dental procedures has been described in many scientific publications (5). During dental procedures, it is possible to observe with the naked eye the formation of an aerosol cloud (5). The potential sources of contamination can come from (5):

1. The instrumentatio;
2. Saliva;
3. Respiratory sources;
4. The operative site.

Aerosols have been described as having the characteristic of floating in the air for some time. During this time there is a possibility that patients and staff may inhale these particles (6). The highest prevalence of diseases of the respiratory system in dental workers has been described (6). The generation of aerosols has been described during the execution of dental surgical procedures such as dental extractions and periodontal therapies (7). The floating particles of the aerosol can lodge in the

deeper structures of the lungs. For this reason it has been described that they have a great potential in the transmission of respiratory infections (5).

These aerosols have a great infectious capacity since they carry microorganisms and blood (6). This is how AGPs could be related to the transmission of airborne infections (4).

Bio-aerosols are aerosols that have the main characteristic of being made up of particles of any type of organism (3). This suspension of particles may contain pathogens (8). The presence of dental bioaerosols can be harmful to dental personnel, therefore, in recent times there has been interest in the potential risk associated with the transmission of infections through this route (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). The ballistic behavior of the particles contained in the aerosols has been described (5). This ballistic action of the particles or drops of the aerosol is observed when being expelled from the operative site and making an arcuate trajectory and coming into contact with the surface or the floor. Due to their size, these particles are transported in the air for a short time (5).

Rotary dental instruments generate aerosols whose particles come from structures cut or worn by their action. The presence of saliva in dental bio-aerosols has been described (9). Among the instruments used in dentistry there are micromotors, handpieces and irrigation syringes (9). The activity of irrigation produces a large number of particles that carry microorganisms found in the oral cavity (9). The relevant situation is to achieve control of aerosol production (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).

COVID-19 in saliva

Coronavirus produces a viral respiratory disease and has spread rapidly around the world from Wuhan China (8,11). Its fast expansion has caused the World Health Organization (WHO) to declare a pandemic outbreak of COVID-19 (12). This viral disease can be transmitted by the droplet mechanism during close and unprotected contact between humans (11). This is a new type of coronavirus that has been named Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). This virus has been reported to spread via drops of saliva and nasal secretion (8). The presence of SARS-CoV-2 nucleic acid has been described in saliva samples. Because of this the WHO states that small drops of saliva can be a mechanism of infection (8).

Presence of COVID-19 in dental aerosols

It has been described that COVID-19 in the aerosol state can remain in the air for up to three hours (2). It has been proposed that the risk of being infected with COVID-19 by breathing during AGEs in surgical activity is highly due to the use of rotating instruments and irrigation (12). COVID-19 can infect through the aerosol produced during surgeries on infected individuals, since it works with saliva, blood and mucous membranes of the patient (12).

Proceeding with drilling in DIPS during COVID-19 pandemic

DIPS in this period involves exposure to a risky situation. This risk can affect from the individuals involved in the surgery to all society. DIPS must be carefully indicated during this period avoiding all risks as possible. It is highly recommended to reduce, as far as possible, the aerosol generation during this period (12). To achieve this target, it is suggested to avoid and reduce the use of handpieces, use surgical site aspiration (12).

Despite the fact that 2019-nCoV has been found in blood samples in patients with COVID-19, there is a lack of information to link the aerosolization of this virus in surgical procedures (12).

Due to this global situation, it is necessary that decision making is as safe as possible. This produces the adjustment of procedures to act in the most

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

TABLE 1 Different implant systems could be related to the production of bioaerosols at DIPS.

responsible way. In the case of carrying out AGEs, the smallest possible production of aerosols is suggested. This involves different decisions such as limiting the use of the handpiece and, if possible, dental implant procedures should be performed with hand tools.
Traditional doctrines in dental implant placement strongly favor high-speed drilling while using saline solution for irrigation of surgical site to maintain the bone temperature (12). Here we can use techniques of DIPS with low-velocity protocols and the absence of saline irrigation to decrease aerosol production. As it is known, in the generation of aerosols an inverse proportionality phenomenon occurs in which the applied force is linked to the size of the generated particle. A higher force generates a smaller particle size (4). In implant dentistry, there are various methods to place implants, and, in Table 1, 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

In this difficult global pandemic situation, dentistry has been strongly affected. Due to the characteristics of the SARS-CoV-2, its transmission route and its place of development, maximum precautions must be taken. Among them, in dental implantology work, it is necessary to recommend the lowest possible production of aerosols. Meanwhile, there are implant systems that appear to be capable of achieving this therapeutic goal, which will be very useful in a critical period like this, when reducing the chances of COVID-19 transmission risk is of great importance. It is an exceptional and extraordinary period and adaptation to this new reality will allow the safe development of professional activity for patients, caregivers and society as a whole.

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