

ENDODONTIC APPROACH IN ORAL REHABILITATION DURING COVID-19 PANDEMIC

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ABSTRACT

World wide experience during COVID-19 pandemic disclosed that the endodontic pathology prevailed among all dental emergencies. The endodontist have to handle a large category of patients: COVID-19 positive, either symptomatic or asymptomatic, and unsuspected/nonactive. To minimize the cross-infection risk a rapid and accurate triage is highly asked since the suspected and active patients should be referred to the dedicated dental settings. In stabilized COVID-19 patients it is pivotal to carry out the treatment of endodontic emergencies as much as possible in a definitive and not palliative manner due to the risk of unpredictable worsening of clinical evolution.

Key words: COVID-19, pulp diseases, endodontic management

INTRODUCTION

Chinese experience during outbreak of COVID-19 pandemic highlighted that compared to pre-COVID-19 period the incidence of oral infection increased from 51 % to 71.9% and the non-urgency cases decreased to 30%, as patients in need were reluctant to visit dental offices due to the fear of epidemic. Similarly the dental trauma involved patients was reduced from 14.2% to 10.5% as a result of restriction in outdoor activities [1,2].

Though less asked, as it was reported that the need for treatment of painful dental conditions lowered at the occurrence of coronavirus disease, the

treatment of dental emergencies became a real challenge in pandemic circumstances [1,2]. Patients in need changed their attitude to look for dental assistance and dentists used new *modus operandi* for patients triage and handling [3].

In severe pain the fear of contagion resulted in increased occurrence of palliative treatments in order to postpone the urgent visit to dental office. Moreover it was generated a real abuse risk of analgesics, anti-inflammatory medication and antibiotics [3].

The endodontic emergencies prevail among the global dental emergencies [4]. The main professional

goal of activity intended by endodontists during COVID-19 pandemic was pointed to mitigate the pain accompanying the inflammatory pulpal and apical diseases [2].

Though it was related that in some places the endodontic procedures were done in 21% of encounters [4], depending on local state of the pandemic the guidelines and recommendations for adequate endodontic management could not be generalized. Accordingly the current treatment strategy of these emergencies in dental settings may fluctuate from palliative to a definitive one [2].

GENERAL PROTOCOL OF APPROACH IN EMERGENCIES

A tele-screening appointment is highly asked in order to evaluating the risk of disease transmission and reducing the danger of cross-infection. The patient has to relate whether experienced respiratory symptoms or smell and taste change. Equally important is also to find out whether the patient was in contact with people confirmed as COVID-19 positive or having the abovementioned symptoms of coronavirus disease [2,4].

If the patient gave acceptable answers is accepted in dental office for treatment. However he has to go through the same questionnaire, this time running within a screening accomplished by the dental team. It is mandatory for the dental professionals to wear adequate personal protection equipment consisting in protective gowns, face masks and face shield [2,3].

Accurate endodontic diagnosis and patient handling are pivotal in minimizing the transmission risk of viral infection in order to cover as large as possible affected patients [4].

There are accepted for treatment in common dental settings only patients that epidemiologically are considered infection-free or recovered after the disease that means negative laboratory tests or lack of any clinical symptoms after one month [2,3].

The patients confirmed as COVID-19 positive and the suspected ones as well have not the permission to be treated in a common dental office. They are guided to dedicated dental offices or to hospitals, which are properly equipped to take care of them. That means isolated well-ventilated or negative air pressure rooms that allow infection control protocols [2].

Depending on the disease progression, in stabilized COVID-19 patients might be carried out minimally invasive treatment of dental emergencies as much as possible definitive and not palliative due to the risk of unpredictable health worsening during the clinical evolution of coronavirus disease [2].

PREVENTION OF INFECTION IN DENTAL SETTINGS

There is worth full to know that over 50% of SARS-CoV-2 positive patients are asymptomatic carriers that means they represent a high risk for getting infected the dental personnel. Fortunately in these asymptomatic infected patients the use of a pulse oximeter may detect mute hypoxemia characterized by low blood oxygen saturation usually fewer than 94%. Accordingly the endodontists has to know that the measurement of hypoxemia by a simple to use device such as pulse oximeter might be extremely helpful to identify potential asymptomatic SARS-CoV-2 infected patients [5].

Regarding the protective role of face shield and goggles it has to be highlighted that goggles are primary claimed to be used as the face shield can not provide adequate eye protection due its deficient peripheral facial seal for small air borne infected droplets. However, to improving the global efficacy both of them have to be used [5].

One of contemporary unwanted shortcomings revealed during Covid-19 pandemic in order to minimize the nosocomial transmission of infection is also the lack of dental settings relying on airborne infection isolation room and especially of those rooms equipped with negative air pressure that could offer a better protection for dental personnel [5].

However, such environmental conditions hardly could be achieved in a common dental office as the negative-pressure rooms have to be built respecting special guidelines. Additionally a permanent measurement of pressure and checking of unwanted leakage are required as well as the adequate training of dentists and dental assistants [6].

This aimed microclimate for dental management of SARS-CoV-2 infected patients rather different to usual working conditions requires a complex simultaneous control of some ventilation parameters among the most important are the air flow exhausted per hour depending on room volume, negative-pressure air maintenance, appropriate air distribution to reducing the dental personnel exposure to Covid-19 virus, and high quality air filtration [5].

Actually such a proper control may be achieved when the air changes per hour is higher than 12, the exhausted air is 10-15% higher than the supplied one, the supplied air is initially directed over

the dentist-assistant working position and later on comes up to the infected patient, and eventually to accomplish the air filtration the air flow was to enter the dental office room from ceiling and leave it through registers situated at minimum 15 centimeters from floor [5].

Usually the root canal treatments are undergoing under operating microscope and the dentist is obviously facing a high risk of contamination with aerosols due to the proximity of oropharynx of infected patient. On the other hand a common dental office does not own negative-pressure rooms to mitigate the aerosols distribution. In that respect various attempts were also done in order to hinder the unimpeded circulation of generated aerosols by joining to microscope a polycarbonate shield with attached high-speed vacuum pipe. It was reported such as a protective device which allows an exhaust outflow reaching 3.9 ft/min and ensuring a sneeze safeguard too [6].

Another way to further reduce the risk of aerolization in dental office is to prevent the aerosols dispersion by attaching to extra-oral suction systems an aerosol box equipped with interior filter system. This device is based on neutralizing SARS-CoV-2 and other microorganisms by using a 2% hypochlorite solution before the air expired by infected patient returns from the aerosol box to the external milieu of dental office [7,8].

It is thought that this additional equipment might improve the protection against SARS-CoV-2 transmission by reducing the viral load exposure of dental personnel and offering a better control of cross-infection in dental setting [7].

As ergonomic limitations of this device might be mentioned the reduced

visualization of operating field and mobility of dental maneuvers, disturbed communication patient-dental team, possible anxiety and claustrophobic reactions of the patients due to the restriction of movements and impossibility to spit [7].

DENTAL STAFF PROTECTION

The primary protection strategy is focused to limiting transmission among humans, more exactly “human-to-human” transmission [9]. Since the effectiveness of this strategy relies on early detection, isolation and treatment of the COVID-19 infected patients, the quick and accurate laboratory diagnosis of the condition is crucial [9].

Initially for diagnostic testing were used nasopharyngeal and oropharyngeal swabs. Nevertheless the hazard of coughing during the clinical maneuver induced a complementary contagious risk for medical staff. It has to be added that excepting the typical unpleasant sensation, in particular case of thrombocytopenic patients bleeding also occurs [9,10].

In addition to aforementioned diagnostic test sputum coming from lower respiratory tract may be also collected. Unfortunately despite the non-invasive value of the method it was reported that not more than 28% presumed infected patients could deliver sputum for diagnostic purpose [11].

Unlike the nasopharyngeal or oropharyngeal and sputum sampling it seems presently that saliva might be a promising noninvasive opportunity to early detection of COVID-19 infected patients as the live virus was found in salivary samples collected from 91.7% of infected patients. Moreover, the salivary testing avoids discomfort in

patients significantly reduces the transmission risk to medical staff during sampling [12].

Both dentists and dental assistants are particularly vulnerable due their active involvement especially for the management of endodontic emergencies in COVID-19 infected patients. Accordingly, as the dental personnel is considered a very high risk group of health care providers they have to be defended by adequate personal protective equipment (PPE) mandatory wearing masks, face shields, goggles and impermeable gowns [3,13]. Moreover, in addition to standard protective measures against pandemic challenges, N95 face piece or better respirators are recommended [14,15].

Face shields are not indicated as primary eyes and face protection as they did not ensure an effective peripheral seal of the face against viral particles as compared to goggles. It is better to use both goggles and face shield [19].

During COVID-19 pandemic it was proved that respirators either tight half-mask filtering face piece such as N95 or powered air-purifying, which provided a close-fitting seal around nose and mouth, gave a better protection against aerosols, droplets or fluid penetration. Most familiar N95 half-mask filtering face piece is nowadays the best choice for a disposable respirator as guarantees at least 95% filtering efficiency against virus infected particles of around 0.3 μm [13].

Commonly the respirators are delivered in various shapes such as flat-fold, cup-shaped duckbill and currently it was demonstrated that along with approved N95, due their rather similar medical performance, some other respirators like FRP2, KN95, P2 Particulate respirator, Korea 1st class,

and DS can be also successfully used in practice [13].

However, regardless the model of chosen face-mask, the gold thumb rule is to never forget its appropriate donning and doffing [13].

The COVID-19 positive and suspected patients should be treated in negative-pressure rooms or in airborne infection isolation rooms. Regular dental offices are completely contraindicated [17].

However, the endodontist working in these isolated rooms has to know their microclimate parameters such as high-standard air filtration, negative pressure maintenance, ensured by 10-15% more exhausted air than the supplied one air changes per hour, which should be higher than 12 and appropriate air distribution, that initially means to guide fresh air from the ceiling over the dental team and later on over the patient so that to avoiding the exhausted air to leave the isolated room at a level of at least 15 cm from the floor [17].

To eliminate the risk of cross-infection along with the universal precaution, careful prescreening to separate suspected or already infected patients is vital. Crucial is to detect the infected patients in presymptomatic stage as they already are delivering the viruses in the milieu and they may account up to 50% [17].

To avoiding cross contaminations single use mirrors and syringes are highly recommended. In order to reduce reducing the aerosols and droplets generation it is also suggested to minimize the use of high speed hand pieces, ultrasonic equipment and 3-way syringes [17].

INITIAL EXPERIENCE OF TREATMENT IN COVID-19 PANDEMIC

The Chinese experience during first year of COVID-19 pandemic showed that symptomatic irreversible pulpitis were placed on the top of dental emergencies and the vital pulpotomy succeeded to be a valuable treatment decision for both, reducing the treatment time and mitigating the painful symptoms [16].

Other reports recommended to suppressing pain a cocktail of ibuprofen and acetaminophen or dexamethasone as primary treatment in symptomatic irreversible pulpitis and apical periodontitis. The secondary treatment, consisting in full vital pulpotomy, was performed only in failures. Also in symptomatic tooth fractures the secondary treatment based on pulp capping or vital pulpotomy was beneficial [2].

Concerning the antibiotics as primary treatment, the indication was accepted in acute apical abscesses while performed in association with incision for drainage [18] while other opinions suggested vital pulpotomy as primary clinical management in symptomatic irreversible pulpitis or symptomatic cracked, respectively crown fractures of teeth, as an alternative to general medication in pain control [19].

Moreover, even in pandemic circumstances, root canal treatment in two visits by using temporary dressing was proposed in pulp necrosis, symptomatic apical periodontitis and acute apical abscess. A particular attitude, based on occlusal cusps reduction and systemic medication was proposed in endodontic retreatments weather the clinical access in root canals was unsuccessful [19].

DISTINCTIVENESS OF ENDODONTIC MANAGEMENT

Commonly in pandemic era the endodontic treatments are addressed to a broad range of patients both uninfected and infected the last ones either symptomatic or asymptomatic [2,17,19].

Pulp sensibility test can be performed riskless [2].

The conventional intra-oral radiographs are allowed only in unsuspected or recovered patients. In COVID-positive patients intra-oral radiographs should be as far as possible avoided as they may initiate gagging or cough reflexes. If mandatory, to avoiding perforation and cross-contamination the sensor should be double barriered [17]. The preferred recommended imagistic examination is CBCT (cone beam computed tomography) or panoramic radiography in dental settings less radiological equipped [2].

While using dental operating microscope further protection is recommended by using an additional plastic barrier between endodontist and patient that aims to eliminate a direct contact with splatter and droplets generated by high-speed hand-piece [2].

Other supplementary protective means might be a hard plastic barrier of multiple uses, which is disinfected after each patient or the relatively inexpensive Russel device attached to the endodontic microscope, which relies on a transparent polycarbonate shield and a high speed vacuum hose delivering an airflow exhaust of 3.9 ft/min. Though beneficial this exhaust airflow does not obtain a significant reduction in aerosol transmission. This is the reason why Russel device can not meet the terms asked for mandatory air isolated rooms

recommended in dental treatments of COVID-19 infected patients [2, 6].

In addition to the main goal to mitigation of airborne viruses in dental room, among other advantages of Russel device it has to be underlined that offers a good protection against sneezing, it is friendly to patient and does not impede the endodontic management [6].

Though dedicated to reducing the oro-pharyngeal aerosols transmission of viral particles the Russel device is also useful to protect the dental personnel against other airborne pathogens [6].

Despite its aforementioned limitations the Russel device might be useful in dental settings in case of emergencies that can not be forwarded to special hospitals for COVID-19 infected patients if endodontists and dental assistants wear adequate personal protective equipment [6].

Dental loupes may be used if they have protective side coverage and are accompanying the compulsory face shield and mask. However, the magnifying devices, either surgical microscope or loupes, may be practically helpful only when they do not impede the visibility of operating field [2].

PROTECTION AGAINST AEROSOLS IN ENDODONTICS

Considering the endodontic emergencies during COVID-19 pandemic it has to emphasize that the dental staff is facing to more categories of patients: COVID-19 positive either symptomatic or asymptomatic and obviously healthy ones [2,3,24].

Though symptomatic COVID-19 patients are the major transmission cause of coronavirus the asymptomatic infected patients are also involved as carriers. Moreover it is still unknown how long after clinical recovery the

former affected people may preserve an infective risk [24].

During dental treatments may be used some therapeutic maneuvers stimulating the aerosols occurrence. As the viral particles became airborne for at least 3 hours and contaminate all surfaces around in the office the endodontist should care only these patients who can not be postponed or referred to dedicated clinics for coronavirus infected people [24].

Since the coronavirus is abundant in saliva of asymptomatic infected patients (91.7%) both diagnostic and management of endodontic emergencies oblige to special care due the high risk of direct contact [24].

First experience in the world regarding the occurrence of pulp and periapical pathology during COVID-19 pandemic related that the endodontic emergencies such as symptomatic irreversible pulpitis, acute apical abscess, symptomatic apical periodontitis and dental traumatic lesions were higher than other dental emergencies (50.6%) [16].

Actually the main clinical maneuvers able to generate aerosols such as caries, restorations, crowns removal, and access cavity meet up at the beginning of endodontic treatment. However, the final occlusal adjustment may also release aerosols due to the necessary grinding procedure [2].

The other steps of treatment such as root canal enlargement, irrigation, filling and final coronal restoration does not produce any risk of generating infective aerosols [2].

Definitely the rubber dam is presently the best protective device as it hampers up to 90% oro-pharyngeal borne aerosols. Moreover it can be

disinfected with familiar sodium hypochlorite before use [2,20].

A practical procedure to reducing the aerosols is high vacuum suction. It was observed that a suction capability of $2.83 \text{ m}^3 \text{ min}^{-1}$ succeeded a high rate decontamination of 90% [21] and the air filter up to 99,97% [22]. Unfortunately, additionally to high costs of procedures, due to the very small size of corona viruses, these suction equipments are not able to be efficient [23].

UNIVERSAL RECOMMENDATION IN ENDODONTIC EMERGENCIES

It is mandatory that in suspected/active COVID-19 patient the endodontic treatment should be provided in dedicated dental facilities. Moreover, before any endodontic surgery as the management is done without isolation with rubber dam it should find out if the patient is COVID-19 positive in order to take the appropriate protective precautions for dental staff [2].

Vital pulp therapy, namely pulp capping and pulpotomy, may be successfully managed resulting in short time to pain abolition. More advanced pulp pathology such as symptomatic apical periodontitis and acute or chronic apical abscess should be conservatively solved in a single-visit endodontic procedure [2].

In complicate orthograde conservative retreatments, where a two-visit endodontic approach might be considered, a temporary dressing of calcium hydroxide as antiseptic medication should be placed after the accurate debridement of infected root canal [2].

Extended swellings accompanying acute apical abscesses that may produce an increased risk of interfering the

patient's upper airways should be referred without delay to oral surgery clinic [2].

SPECIFIC RECOMMENDATION IN ENDODONTIC EMERGENCIES

Symptomatic irreversible pulpitis (Ather) [Oliveira Silva].

Primary attitude

In suspected/active COVID-19 patient: pain medication [2].

- in mild symptoms: analgesia with ibuprofen 600 mg + acetaminophen 325-500 mg or naproxen sodium 220 mg + acetaminophen 500 mg [2,25]

- in increased discomfort when analgesia is unsuccessful may be considered additional medication such as dexamethasone 0.07-0.09 mg/kg +/- long lasting local anesthetic [2].

- in severe symptoms conservative management is no longer efficient, so vital pulp therapy has to be considered [2].

In unsuspected/nonactive patient vital therapy or root canal treatment in a single visit [2].

Secondary attitude

- full pulpotomy / pulpectomy that should be done in dedicated dental facilities in suspected/active COVID-19 patient [2].

Symptomatic apical periodontitis

Primary attitude

In suspected/active COVID-19 patient: pain medication [2,17,24].

- in moderate discomfort: ibuprofen 600 mg + acetaminophen 325-500 mg or naproxen sodium 220 mg + acetaminophen 500 mg [2,25].

- when unsuccessful: dexamethasone 0.07-0.09 mg/kg

- when both unsuccessful, a supplementary long lasting local anesthetic for abrupt pain relief

- in severe symptoms where analgesics are inefficient: appropriate treatment protocol according to guidelines

In unsuspected/nonactive patient: root canal treatment in a single visit if applicable [2].

Secondary attitude

- full pulpotomy/complete root canal treatment according to current guidelines [2,17,24].

Chronic apical abscess

Usually the patient has mild to moderate symptoms that may be relieved by appropriate analgesia [24].

Primary attitude

In suspected/active COVID-19 patient: pain medication [2].

In unsuspected/nonactive patient: root canal treatment in a single visit [2].

Secondary attitude

Root canal treatment in a single visit, if applicable [2].

Acute apical abscess

Primary attitude in intraoral swelling

In moderate swellings with mild to moderate symptoms: [17,24]

- 5 days antibiotics augmentin 500 mg b.i.d. / clindamycin 300 mg q.i.d. and ibuprofen 600 mg + acetaminophen 325-500 mg

- when all of above unsuccessful: a supplementary long lasting local anesthetic

In moderate symptoms and localized fluctuant swelling that does not interfere with the systemic status of health: [17,24]

- incision + drainage

- 5 days antibiotics augmentin 500 mg b.i.d. / clindamycin 300 mg q.i.d. and ibuprofen 600 mg + acetaminophen 325-500 mg

In severe symptoms progressing to systemic involvement: [17,24]

- incision + drainage
- appropriate antibiotics

Secondary attitude in intraoral swelling progressing to systemic involvement

- consideration for referral to oral surgery clinic [17,22-32].

Early soft tissues swelling

Primary attitude

- 5 days antibiotics augmentin 500 mg b.i.d. / clindamycin 300 mg q.i.d. and ibuprofen 600 mg + acetaminophen 325-500 mg [17,24].

- consideration for referral to oral surgery clinic [17,24].

Secondary attitude

Severe symptoms and soft tissues swelling compromising upper respiratory airways:

- referral to hospital in oral surgery clinic, intense antibiotic therapy and tooth extraction [17,24].

Tooth fracture

Complicated crown fracture

Primary attitude

In suspected/active COVID-19 patient

- pain relief: ibuprofen 600 mg + acetaminophen 325-500 mg [2,17].

In unsuspected/nonactive patient:

- vital pulp therapy (pulp capping/pulpotomy) [2,17].

Secondary attitude

In suspected/active COVID-19 patient vital pulp therapy (pulp capping/pulpotomy) [2,17].

Vertical root fracture (Azim)

Primary attitude

In both suspected/active COVID-19 patient and unsuspected/nonactive patient is recommended tooth extraction [2].

Suspected/active COVID-19 patient should be referred to dedicated dental facility for extraction [2].

Tooth luxation

Primary attitude

In both suspected/active COVID-19 patient and unsuspected/nonactive patient

- pain relief: ibuprofen 600 mg + acetaminophen 325-500 mg [2,17].
- follow current guidelines [2,17].

Secondary attitude

- follow current guidelines [2,17].

Tooth avulsion

Primary attitude

In suspected/active COVID-19 patient:

- pain relief ibuprofen 600 mg + acetaminophen 325-500 mg [17].
- place the tooth in a proper medium and refer to dedicated dental facilities [17].

In unsuspected/nonactive patient follow guidelines [17].

Secondary attitude

- follow current guidelines [17, 33-43].

CONCLUSIONS

During COVID-19 pandemic the endodontists have to manage emergencies in both COVID-19 positive, either symptomatic or asymptomatic, and unsuspected/nonactive patients. To minimize the cross-infection risk a rapid and accurate triage is highly asked in order to refer the suspected and active patients to dedicated dental settings. Depending on general status of coronavirus affected patients the

endodontic treatment may be either palliative or definitive. In stabilized COVID-19 patients it is pivotal to carry out the treatment of endodontic emergencies as much as possible in a definitive and not palliative manner due

to the risk of unpredictable worsening of clinical evolution.

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