

Review Article

Active oxygen oral rinse: chairside treatments against coronavirus infections

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ABSTRACT

In 2020, many patients were infected with the coronavirus disease 2019 (COVID-19) worldwide. The identification of coronavirus in saliva have suggested the oral cavity as a potential reservoir for COVID-19 transmission, particularly in dental clinics. Chairside oral rinses have been widely used as a standard measure before routine dental treatment for many years. Recently, the use of chairside oral rinse has been recalled as a pre-procedural infection control measure by several health authorities, especially during the COVID-19 pandemic. Although there is still no clinical evidence, oral rinses containing active oxygen agents (e.g. BlueM formula) have been recommended to reduce the viral load in aerosols and drops during oral procedures. This paper aimed to provide an overview of the current guidelines and recommendations on the use of active oxygen oral rinse as chairside treatment against the COVID-19 pandemic in dentistry.

Keywords: COVID-19, Coronavirus, Oral rinses, Active oxygen

INTRODUCTION

Worldwide, the COVID-19 pandemic has infected more than 455 M people with 6.04 M deaths.^{1,2} At present, several therapeutic strategies and vaccines have been proposed.^{3,4} COVID-19 can be transmitted from person to person via droplets or contact transmission.¹ Hence, the individual infection control measures (hand hygiene, wearing mask and social distancing) are the most effective key to curb the spread of coronavirus infection.^{5,6}

The detection rate of coronavirus has been reported to be higher in saliva than nasopharyngeal swabs.⁷ For instance, cross-sectional studies have confirmed the presence of coronavirus in saliva of more than 90% COVID-19 infected patients.^{7,8} Thus, the risk of coronavirus transmission in dental clinics has been highly concerned.⁹⁻¹² Dental professionals can be exposed to

aerosols from the oral cavity of COVID-19 patients.^{9,11} Therefore, reducing viral load in saliva could be one of the key approaches to prevent transmission of COVID-19, particularly in the dental settings.^{8,13}

In fact, chairside oral rinses have been widely used as a standard measure before routine dental treatment for many years.^{14,15} They have an essential role in reducing the number of microorganisms in the oral cavity.¹⁵ Recently, the use of chairside oral rinse has been recalled as a pre-procedural infection control measure by several health authorities, especially during the COVID-19 pandemic.¹³

PATHOGENESIS OF CORONAVIRUS INFECTIONS

Coronavirus represents crown-like spikes on the outer surface of the virus (65-125 nm in diameter) and contain

a single-stranded RNA (26 to 32 kb in length).^{16,17} The subgroups of the coronavirus family are alpha (α), beta (β), gamma (γ) and delta (δ).¹⁷ In late December 2019, many patients were infected with a novel virus named SARS-CoV-2 by the International committee of taxonomy of viruses (ICTV).^{1,18} The new disease is named coronavirus disease 2019 (COVID-19).¹ Coronavirus is an enveloped RNA virus with spike protein structure in its membrane.¹⁷ The spike protein interacts with angiotensin-converting enzyme 2 (ACE2) receptors, which is responsible for the entry of the virus into cells and cause infection.¹⁹ ACE2 is found in different tissue cells, including mucosal tissues, gingiva and epithelial cells of the tongue and salivary glands.¹⁹ Clinically, patients with COVID-19 present with fever, dry cough, sore throat and myalgia.²⁰ Dyspnea and hypoxia are becoming the prominent symptoms at days 7-14 of illness.^{18,20} Some patients develop acute respiratory distress syndrome, which is requiring an intensive care. Death might be occurred in some cases with severe respiratory illness.^{20,21}

CONVENTIONAL ORAL ANTISEPTICS

In fact, a high coronavirus viral load has been detected in saliva as well as in periodontal pockets.^{22,23} This confirmed that virus transmission can be closely connected with saliva interactions during coughing, sneezing, talking and even during dental care.^{9,10,24} Therefore, it can be suggested that some commercially available oral rinses may be useful in reducing the coronavirus transmission, especially inside dental practices.^{10,13} Indeed, this would allow a set of guidelines and recommendations that could be extended to other health professionals and general population to eventually prevent the risk of coronavirus transmission. As examples, chlorhexidine (CHX) is the gold-standard antiseptic that causing oral bacteria lysis by increasing its cell wall permeability.^{25,26} It is commonly used to treat periodontal disease.²⁶ However, 0.12% CHX gluconate was suggested to have little or no effect against coronaviruses when compared with other mouthwashes.²⁷ Cetylpyridinium chloride (CPC) is used as an alternative in patients who develop mucosal irritation and stains related to CHX.^{27,28} The antiviral effect of CPC against had been demonstrated only in some influenza patients.²⁸ The virucidal activity of CPC against coronavirus has not been confirmed. Povidone-iodine (PVP-I) has also an antimicrobial action by iodine that rapidly penetrates microbes and oxidizes nucleic acid structures causing microbial death.^{29,30} According to unconfirmed reports, it has been claimed that rinsing with a 0.23% PVP-I may reduce salivary viral load in COVID-19-positive patients.^{25,28} Therefore, the use of these conventional antiseptic before intra-oral procedures to prevent coronavirus transmission is questionable. In addition, Bescos et al had strongly argued the routine use of the preoperative conventional antiseptic (e.g. chlorhexidine), because they can negatively affect the oral flora ecosystem.^{31,32} The normal oral microflora is essential to

improve immunologic response against viral infections.^{33,34} Thus, researches examining new oral rinse reagents is urgently needed as it may help to protect dentists treating patients with COVID-19 infections.

ACTIVE OXYGEN ORAL RINSE: CHAIRSIDE TREATMENT

For dental applications, an oxygen-producing product has recently been available in the market.^{35,36} The active oxygen formula is based on different antimicrobial mechanisms of action than other conventional antiseptic products.^{35,37} Interestingly, oxygenating mouthwashes containing peroxoborate (e.g. sodium perborate) are able to generate low concentration of hydrogen peroxide (H_2O_2) in aqueous solutions.³⁵ For instance, a group of Dutch researchers have developed the BlueM formula, which is formed by chemical complexation of sodium perborate with specific carriers such as glycerol and cellulose.^{36,38,39} This produces sodium perborate-1,2-diol-glycerol/cellulose-ester adducts (hydro-carbon-oxo-borate complex).⁴⁰ Interestingly, BlueM formula provides controlled release of active oxygen (0.5-1% H_2O_2) without generating hydroxyl radicals.^{35,40} Clinically, the BlueM formula showed potential antimicrobial efficacy against the colonization and growth of pathogenic biofilms that associated with oral infections (e.g. periodontitis, peri-implantitis and endodontic infections).^{36,38,39,41}

Since coronavirus is vulnerable to oxidation, oral rinses containing oxidative (active oxygen) agents such as 0.5-1% H_2O_2 have been suggested to reduce the salivary viral load effectively.^{27,42} The antimicrobial action of 0.5-1% H_2O_2 is also including the induction of an innate inflammatory antiviral response by overexpression of toll-like receptor 3 (TLR3).^{13,27} In addition to the active oxygen advantages, BlueM oral rinses contain lactoferrin in their formulations, which has an inhibitory function against pathogenic organisms such as viruses.^{43,44} The effectiveness of lactoferrin has been proven in many cases with viral infections.^{43,44} For this reason, it can be recommended, before any dental procedure, to use oral rinses containing active oxygen (0.5-1% H_2O_2) as well as lactoferrin to decrease an eventual viral load in the patient's oral cavity.^{10,45,46}

Recently, the American dental association (2020) has strongly recommended the use of chairside oral rinses containing oxidative reagents (H_2O_2) before dental procedures.^{47,48} In addition, several Cochrane reviews recommended the use of an oxygen-producing oral rinses prior to dental/oral treatments with the aim of reducing the viral load of aerosols.^{10,27,42,48,49} One of the most important characteristics that such oral rinse should have enough prolonged virucidal activity against coronavirus in the oral cavity. Recently, it has been reported that oral rinse containing active oxygen (1% H_2O_2) shows a reduction of coronavirus level in saliva for up to 45 minutes.¹³ This may be a valuable infection control

strategy in dental settings.^{24,46} However, it is imperative that researches have to produce more evidence supporting the potential therapeutic effects of active oxygen oral rinse agents in preventing the transmission of coronavirus.

CONCLUSION

It can be concluded that active oxygen formulated oral rinses may have a sustained effect on reducing the salivary viral load in COVID-19 patients. The oxidative-containing oral rinses could be a useful prevention strategy against coronavirus transmission in dental clinics, where aerosol generation is unavoidable. Also, the routine use of active oxygen formula (e.g. BlueM) could be a cost-effective approach in reducing viral outspread, with potentially no risk on oral tissues or normal microflora. Finally, in dental clinic, it is highly recommended to apply all appropriate personal protection equipment to control aerosol-generating procedures, especially with COVID-19 patients.

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