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(REVIEW ARTICLE)

The role of preprocedural mouth rinse application in decreasing COVID-19 transmission in Dental Care Settings: A mini-review

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Abstract

The COVID-19 virus present in saliva and respiratory droplets is a possible high-risk source of viral transmission in health care settings. Dental practitioners and dentists in particular are highly susceptible to virus acquisition from their source patients. Mouthwashes before dental examination and procedures may be one possible solution to decrease the viral burden in the mouth, hence reducing transmission probability. Application of hydrogen peroxide, cetylpyridinium chloride, povidone-iodine, and chlorhexidine have been proposed to achieve this target. This paper aims to investigate for evidence in the literature for a decrease in the viral burden following preprocedural application of different mouthwashes.

Keywords: Covid-19; Mouthwash; Chlorhexidine; Cetylpyridinium chloride; Povidone-Iodine; Hydrogen peroxide

1. Introduction

Coronavirus Disease 2019 (COVID-19) particles are transmitted on a human-to-human basis via respiratory droplets and saliva [1]. These droplets may be generated during coughing, sneezing, talking, or simply by breathing [2]. Large respiratory droplets cannot remain suspended in the air long before settling on surfaces as far as 1 meter. The suspended droplets dry out and leave air-borne virus particles as a possible source of infectivity among individuals [2,3].

Manifestations of COVID-19 are diverse among individuals. The most prevalent symptoms are pyrexia, breathing difficulties, coughing, and fatigue. Neurological manifestations such as loss of smell or dermatological symptoms such as rashes or hives are also common among patients [4,5]. Several patients have experienced oral manifestations including vesiculobullous lesions and ulcers most commonly seen in the tongue, labial or buccal mucosa, and the palate [5,6]. Moreover, the COVID-19 pandemic has had a negative impact on the mental well-being of the population and it may have raised the stress and depression level among individuals [7]. Therefore, it is imperative to end the pandemic as soon as possible.

Vaccines play an essential role in terminating the coronavirus-2 pandemic. They are produced based on either conventional approaches like inactivated vaccines or they may be generated based on more novel platforms like RNA vaccines [8,9]. Additionally, other preventive strategies such as social distancing, hand washing, and wearing masks should be considered in order to decrease COVID-19 transmission [10].

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In dental settings, in particular, the performance of different dental procedures plays an additional role in this human-to-human transmission. Ultrasonic scalers and slow and high-speed handpieces are dental equipment that spatter aerosol and can transmit the virus [11]. The contaminated or unclean dental aerosol can be associated with the transmission of SARS-CoV-2 in the dental setting via direct or indirect contact [3].

Several researchers have suggested a set of safety measures for dental professionals, including the use of preprocedural mouth rinses by both patients and dental clinic staff [3]. Oral rinses decline the microbial load of the oral cavity therefore; they may be useful in decreasing the transmission of pathogens in a dental office [11]. A number of studies have suggested that mouth rinses have an antiviral role against SARS-CoV-2. However, more studies are warranted regarding their efficacy in COVID-19 viral load depletion in dental settings [3].

2. Discussion

The unknown and heritable mutations of coronavirus-2 are still a threat to developing countries. Respiratory hygiene and oral hygiene are crucial countermeasures in the battle against COVID-19 [12]. Many health care organizations suggested a set of countermeasures, including the use of preprocedural mouthwashes to decrease the risk of cross-infection and carrying COVID-19 infection among health professionals [13]. The American Dental Association (ADA) has proposed 2 categories of mouth rinses: cosmetic and therapeutic. Cosmetic mouthwashes are used to control bad breath temporarily but do not have any biological or chemical effects. On the other hand, therapeutic mouth rinses have active ingredients that are clinically effective in controlling or treating conditions such as plaque, halitosis, and gingivitis [14].

Various clinical evidence is presently associated with the antiviral action of mouth rinses and the main mechanism of action is most likely through the destruction of virus envelopes [15]. A number of studies have reported the effectiveness of different mouth rinses against COVID-19 [3]. A study assessed the antiviral effect of 8 commercially available mouth rinses on SARS-CoV-2 and concluded that 1. dequalinium chloride and benzalkonium chloride active components, as well as 2. 1% Povidone-Iodine (PI), and 3. ethanol combined with essential oils, markedly decrease the virus infectivity [16]. A recent in-vitro study showed that mouthwashes with cetylpyridinium chloride (CPC) significantly drop the infectivity of different variants of SARS-CoV-2 and can decline the transmission among infected patients regardless of the variant [17]. A recent study determined the virucidal activity of PI and found that it can inactivate SARS-CoV-2 at the minimum concentration of 0.5 %. The results support the utilization of PI preprocedural mouth rinse for patients to avoid transmission of COVID-19 in dental settings [18]. A clinical study assessed the effect of chlorhexidine (CHX) mouthwash on the viral load and showed that 0.12% CHX was effective in lowering the SARS-CoV-2 viral load for 2 hours [19].

Oral rinse application prior to dental visit is recommended since it may decrease the viral burden present in oropharyngeal tissues. However, more studies are warranted to determine the ability of mouthwashes for the total elimination of the viral load. There is also an explicit need for a detailed analysis of the effectivity of various mouth rinses against COVID-19 during dental care [3].

2.1. Chlorhexidine (CHX)

CHX is the most commonly used oral antiseptic agent in dentistry. It is a broad-spectrum disinfectant with long-lasting activity against bacteria and can be prescribed to decrease dental plaque accumulation, and treat gingivitis and periodontitis [20]. Though several side effects have been described for CHX mouthwash, it is considered a safe agent. The most prominent adverse reactions of CHX are xerostomia, taste alterations, and tooth staining or discoloration [21].

A study evaluated the antiviral effectiveness of 0.12% CHX by applying virucidal assays in tissue cultures and suggested that it is effective against a variety of lipid-enveloped viruses such as cytomegalovirus influenza A, parainfluenza, hepatitis B, and herpes simplex virus in only 30 seconds. However, the viruses respond differently to CHX due to minor differences in the physicochemical properties of their envelopes [22]. Another study has shown the possible effect of CHX against the contaminants present on various inanimate surfaces such as metal, glass, or plastic and has observed that CHX is less effective against coronavirus compared to other compounds such as ethanol and hydrogen peroxide (HP) [23]. Nevertheless, these findings cannot be extended to the oral cavity.

An *in vitro* study assessed the antiviral effect of CHX and PI against COVID-19 and demonstrated that while both agents are effective against the virus, 0.2% CHX causes inactivation of 99.9% the virus in a short time duration of 30 seconds and acts stronger than 1% PI [24].

A recent clinical study on 2 COVID-19 positive patients has shown that CHX mouthwash (0.12%, 15 mL) reduces the viral load of SARS-CoV-2 for almost 2 hours, which can prevent the transmission of the virus in the dental setting. However, the study indicates a number of limitations such as a small sample size and recommends further large-scale studies to find out the effectiveness of the CHX mouth rinse in reducing the transmission of COVID-19 [19].

2.2. Cetylpyridinium chloride (CPC)

CPC is a quaternary ammonium, soluble in both water and alcohol. It is considered a safe and effective antimicrobial mouth rinse frequently used to control gingivitis and periodontitis [3,25]. Long-term usage of mouthwashes containing CPC may result in oral paresthesia, calculus formation, and tooth discoloration. However, their temporary or short-term application does not typically result in tooth stain formation [23].

A randomized clinical trial suggested that CPC mouth spray is effective in reducing the duration and severity of manifestations of viral upper airways infections. The researchers stated that the spray works by providing a barrier between the host mucous membrane and the virus and its CPC component destructs the lipid envelope of viruses [26].

A study on COVID-19 virus-like particles demonstrated that the application of CPC in concentrations above 0.05% leads to a disruption in the particles however, no significant effect was observed in lower concentrations of the agent [27]. Another *in vitro* study stated that 0.075% CPC combined with 0.05% sodium fluoride has efficient antiviral activity against COVID-19 in only 30 seconds [28].

2.3. Povidone-Iodine (PI)

PI acts against bacteria, fungi, viruses, and spores. The agent affects viruses with lipid envelopes more efficiently than non-lipid enveloped viruses. It is assumed that PI influences the proteins present on the surface of enveloped viruses and also reacts with the fatty acids of the membranes [3]. Transient burning sensation, mild itching, irritation, and discoloration are major side effects of using PI and it is contraindicated in individuals with thyroid or renal disorders, or pregnant women [3,29].

A study tested PI oral rinse in a concentration of 0.23% on SARS-CoV and MERS-CoV in a 15-second time duration and observed that it exerts antiviral activity. The researchers suggested that it could be an effective and preventive measure for people more susceptible to respiratory or oral infections [30]. PI is also a crucial compound effective against coronavirus-2 [3]. An *in vitro* study evaluated the effectiveness of mouth rinses containing PI in different concentrations and demonstrated that even the lowest dose applied (0.5%) leads to a reduction in SARS-CoV-2 viral burden in 15 seconds [18]. This was in line with another study concluding that 0.5% PI causes inactivation of the virus in a 15-second time duration [31].

A study on 4 patients with SARS-CoV-2 infection revealed that 1% PI mouthwash administered for 1 minute can be effective in the reduction of saliva viral load in patients with a higher viral burden. The researchers recommended that the oral rinse could be useful for symptomatic COVID-19 patients, particularly during the first week of their symptoms, when greatest viral changes occur in the saliva. However, the study suggested further clinical studies to confirm the results [32]. In another clinical study on 315 patients undergoing nasopharyngeal endoscopies, they were asked to use PI oral rinses and nasal drops. The researchers stated that since PI mouthwash and nasal drops are safe agents, the protocol may be effective in controlling the COVID-19 viral burden and preventing transmission of the virus among healthcare workers and patients [33].

2.4. Hydrogen peroxide (HP)

HP is a powerful oxidizing agent readily available to consumers in different concentrations. Due to its broad-spectrum antimicrobial role, it may be used for disinfection and sterilization purposes [3]. HP works by generating oxygen-free radicals, which disrupt various parts of the cell, including its lipid membrane. While HP may cause toxicity at concentrations above 5%, its usual concentration as an oral rinse (1–3%) causes no harm [34].

An *in vitro* study compared HP to PI regarding inactivation of COVID-19 and observed that HP in 1.5% and 3% doses has minute antiviral activity against SARS-CoV-2 even after 30 seconds of exposure. However, PI in concentrations of 0.5% to 1.5% leads to complete inactivation of the virus in only 15 seconds [35]. Another study comparing various oral rinses together, also found HP's virucidal role less effective than PI [16].

In a clinical study on patients attending a dental clinic, the researchers placed HEPA filters in the waiting room and the therapy rooms. In the waiting room, patients had not used gargles but they wore masks while in the treatment rooms,

they were asked to use a 1% HP for 1 minute and to take off their masks. The researchers observed the COVID-19 viral burden only in the waiting room and stated that HP mouthwash might decrease the viral transmission significantly during aerosol-producing dental procedures [36]. Another study conducted on ten individuals with COVID-19 showed that using 1% HP oral rinse for 30 seconds does not have a beneficial effect on the reduction of the SARS-CoV-2 viral load and suggested further studies on other possible preprocedural agents [37].

3. Conclusion

Use of preprocedural mouth rinses may reduce the viral load of SARS-CoV-2 in saliva and the oral cavity, thus it may be helpful to decrease the chance of transmission of the virus from person-to-person contact in dental offices. There may be less chance of viral transmission in dental clinics if the patients and dental practitioners use preprocedural mouth rinses. Nevertheless, more *in vivo* and clinical studies are warranted to prove the efficacy of mouthwashes against COVID-19.

Compliance with ethical standards

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Disclosure of conflict of interest

All of the authors have read this manuscript, and there are no conflict of interest.

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