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A promising strategies for reducing the danger of SARS-CoV2 transmission during dentistry and medical procedures

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ABSTRACT

The leaves of Stevia The COVID-19 epidemic has presented serious difficulties for healthcare professionals, especially those working in dentistry and medical facilities. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus that causes COVID-19, is a high-risk infection in hospital settings since it is known to spread via respiratory droplets and aerosols. The purpose of this review paper is to determine whether preprocedural mouthwashes significantly lower the risk of SARS-CoV2 transmission during dental and medical procedures. in addition, antiseptics including Povidone-iodine, CPC, Benzalkonium Chloride, and Aromatic oils may indeed be capable of eliminating SARS-CoV2 by focusing on the virus's lipid envelope, that according in vitro study, as well as clinical experiments indicate that preprocedural mouthwashes potentially help to reduce intraoral viral load and infectivity in COVID-19 patients, but more research is required to verify this. Other infection control methods, such as PPE, high-volume evacuation (HVE), and air filtration, can also assist in minimizing SARS-CoV2 transmission during operations. The RT-qPCR alone is insufficient to determine the effectiveness of preprocedural mouthwashes against SARS-CoV2 transmission. Future research should also take into account employing supplementary techniques to evaluate the effectiveness of preprocedural mouthwashes, such as determining the virus's survival in cell cultures or using animal models to research the virus' transmission. Further research is needed to determine the best combination of infection control measures to reduce SARS-CoV2 transmission in healthcare settings, but preprocedural mouthwashes may be a simple, low-cost strategy to reduce transmission risk during dental and medical procedures, especially in high-risk patients.

INTRODUCTION

Anew strain of coronavirus called Severe acute respiratory syndrome coronavirus 2 (SARS‑CoV‑2) initially appeared in late 2019 in Wuhan, China. It is the primary cause of COVID-19, a respiratory condition that can be moderate, severe, or even deadly [1]. The virus is mostly transmitted by respiratory droplets produced whenever an affected individual coughs, breathes, or sneezes, but it can also spread through physical contact with infected people or contact with contaminated surfaces [2].

Since then, the virus has spread across the entire world, causing a pandemic that really has killed and sickened millions of individuals. Healthcare workers are more likely to contract an illness because of their close contact with patients, resulting in a particularly negative effect on the medical field[3]. It is important to understand how SARS-CoV2 spreads in order to establish infection prevention control measures in place to prevent it [4]. This involves steps including maintaining a distance from others, donning masks, performing good hand hygiene, and disinfecting surfaces. Preprocedural mouthwashes have also been proposed as a possible method to lessen viral transmission in medical settings [5]. Several infection control strategies were developed in dentistry clinics to

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protect both patients and healthcare staff in the event that SARS-CoV2 and the COVID-19 pandemics occur in 2020 [6]. Using antiseptic mouthwashes before dental procedures was one of these tactics to reduce the viral load and contagiousness in those who may be SARS-CoV2 positive. [7]. However, the scientific evidence supporting this practice was limited at the time, as noted by [8].

Overview of SARS-CoV2 structure, and replication

SARS-CoV2 is a single-stranded RNA virus that belongs to the family of coronaviruses. Its genome consists of about 30,000 nucleotides and encodes for several structural and non-structural proteins [9]. The virus has a characteristic spike protein on its surface that binds to receptors on host cells, particularly the angiotensin-converting enzyme 2 (ACE2) receptor, allowing the virus to enter and infect cells [10]. After entering host cells, the virus uses RNA genome to replicate and produce new virus particles. This replication process can cause damage to host cells and trigger an immune response, leading to symptoms of COVID-19 [11].

The importance of oral transmission in healthcare settings

SARS-CoV2 is primarily transmitted through respiratory droplets when an infected person talks, coughs, or sneezes, and these droplets can be inhaled by people in close proximity to the infected person [2]. According to current understanding, the virus spreads mostly through close human contact. Furthermore, new data shows that oral transmission of SARS-CoV2 is likely, especially in hospital environments [12, 13]. During dental operations, endotracheal intubation, and bronchoscopy aerosols can produce infectious droplets that have ability to remain and stay in the air for several hours and spread up to 3 meters from the source and may be inhaled by healthcare workers [14]. High viral loads have been identified in saliva, gingival crevicular fluid and also throat swabs which indicating that the oral cavity is a possible reservoir for SARS-cov2 [15]. This indicates that the virus can indeed be spread by oral secretions particularly following dental treatments or even other healthcare interventions involving the oral cavity. Considering the possibility of SARS-CoV2 oral transmission in healthcare location infection. The important control strategies such as pre-procedural mouthwashes have been suggested as a strategy to reduce the viral load and pathogenicity in potentially SARS-CoV2 positive patients [16]. Moreover, personal protective equipment (PPE) and also adequate hand hygiene as well as disinfection of surfaces and equipment are critical in avoiding the virus's transmission in hospital settings [17].

Pre-procedural mouthwash to reduce virus spreading

Pre-procedural mouthwashes have been suggested as a potential way to decrease SARS-CoV2 viral load and infectivity in the oral cavity particularly in healthcare settings where aerosol-generating procedures are performed [18, 19]. Several mouthwashes contain antiseptic ingredients that really can reduce infection rates and disrupt viral envelopes and lowering the likelihood of transmission [20]. Many studies have been done to explore the effectiveness of pre-procedural mouthwashes in preventing SARS-CoV2 transmission. This study [21] discovered that washing with 1% hydrogen peroxide (H2O2) or 0.2% povidone-iodine for 30s before to dental procedures significantly reduced the salivary viral load of SARS-CoV2 in infected persons. A further study showed that a 15s rinse with 0.5% H2O2 significantly decreased the viral load in the saliva of asymptomatic SARS-CoV2 carriers[22, 23].

According to a comprehensive evaluation and analysis of 16 studies demonstrated that mouthwashes such as chlorhexidine, pre-procedural, povidone-iodine, and H2O2 substantially reduced the viral load in the saliva of COVID-19 patients.[24]. The analysis also showed that utilizing pre-procedural mouthwashes before surgical procedures could decrease the possibility of SARS-CoV2 transmission. It should be noted although that pre-procedural mouthwashes are capable of reducing SARS-CoV2 viral load and transmission, it have to be employed in combination with other infection control measures such as personal

protective equipment, appropriate hand hygiene, and surface and equipment cleaning [25]. Furthermore, pre-procedural mouthwashes should not be used in place of additional steps such as patient screening and triage to detect possibly contaminated patients.

The science of pre-operative mouthwashes

Pre-procedural mouthwash active substances contain veridical characteristics that may penetrate the envelope of the virus and decrease the viral load in the mouth therefore it is possibly can be reducing the possibility of transmission. [20]. Povidone iodine an increasingly common an element in pre-procedural mouthwashes and it has been scientifically demonstrated to be highly effective towards a range of viruses particularly SARS-CoV2. Povidone iodine operates by interfering with viral replication and damaging the viral envelope [26]. On the other hand, Hydrogen peroxide has become a further prevalent material which has been scientifically demonstrated to possess veridical capabilities against SARS-CoV2. In addition, H2O2 works by producing reactive oxygen species that damage the viral envelope and genome [23, 27].

Chlorhexidine is another ingredient commonly found in pre-procedural mouthwashes as well as CHX is a broad-spectrum antimicrobial agent that has been shown to be effective against a variety of bacteria, viruses, and fungi. CHX works by disrupting the cell membrane of microorganisms, which can lead to their death [28]. Other ingredients that have been investigated for their virucidal properties include essential oils such as tea tree oil, eucalyptus oil, and thyme oil [29]. Essential oils work by disrupting the lipid envelope of the virus and inhibiting viral replication. Many factor must be consider to note that the effectiveness of pre-procedural mouthwashes against SARS-CoV2 may depend on factors such as the concentration and duration of exposure to the active ingredients, as well as the pH and temperature of the oral cavity [23].

The mechanisms by which mouthwashes reduce viral load and infectivity

As mentioned above the active ingredients of mouthwashes have veridical properties that can disrupt the viral envelope and reduce the viral load in the mouth, which may lower the risk of transmission [20]. Therefore, one of the main mechanisms by which mouthwashes reduce viral load and infectivity is by disrupting the lipid envelope of the virus. The lipid envelope is a vulnerable component of the virus that can be targeted by a variety of active ingredients found in mouthwashes[30]. Hydrogen peroxide (H2O2) is another ingredient that works by producing reactive oxygen species that damage the viral envelope and genome [27]. Another mechanism by which mouthwashes reduce viral load and infectivity is by interfering with viral replication. PVP has been shown to interfere with viral replication by inactivating viral proteins and enzymes while Chlorhexidine can inhibit viral replication by disrupting the cell membrane of the virus and essential oils such as tea tree oil, eucalyptus oil, and thyme oil have been shown to have virucidal properties by disrupting the lipid envelope [26, 31, 32].

Clinical studies AND reducing SARS-CoV2 viral load and infectivity

Research studies have discovered that pre-procedural mouthwashes decrease the probability of SARS-CoV2 transmission. A randomized controlled research found that using a 0.2% CPC mouthwash prior to dental treatments decreased the SARS-CoV2 viral load in saliva as well as the number of copies of the virus in the aerosols generated during dental procedures [33, 34]. Another clinical study found that the use of a 1% povidone-iodine mouthwash prior to dental procedures significantly reduced the risk of SARS-CoV2 transmission compared to a control group [35]. In general the evidence suggests that preprocedural mouthwashes can be an effective and safe measure in reducing the risk of SARS-CoV2 transmission during dental procedures. However, further research is needed to determine the optimal concentration, duration, and frequency of use of these mouthwashes in different clinical settings[8].

Systematic reviews

There have been several systematic reviews and meta-analyses of pre-procedural mouthwash studies evaluating their effectiveness in reducing SARS-CoV2 viral load and infectivity [36]. One meta-analysis published has been found that pre-procedural use of mouthwashes was effective in reducing SARS-CoV2 viral load in saliva and/or oral fluids [20, 37]. Another meta-analysis published in the Journal of the American Dental Association 2022 included 9 studies and reported that pre-procedural use of mouthwashes was effective in reducing SARS-CoV2 viral load in the oral cavity [21]. A systematic review published in the Journal of Clinical Medicine in 2021 evaluated the effectiveness of pre-procedural mouthwashes in reducing SARS-CoV2 transmission in dental settings. The review included 15 studies and concluded that pre-procedural mouthwashes have the potential to reduce SARS-CoV2 transmission in dental settings [14]. Overall, these reviews and meta-analyses suggest that preprocedural use of mouthwashes may be an effective strategy in reducing SARS-CoV2 viral load and transmission in dental settings. However, further studies are needed to determine the optimal type and concentration of mouthwash to use, as well as the duration of the antiviral effect.

Limitations and gaps in the current evidence base

Although there is evidence that supports the efficacy of pre-procedural mouthwashes in avoidance of SARS-CoV2 transmission in dental environments also there are several drawbacks and discrepancies in the present data base[38]. Firstly, the majority of previous investigations have been in vitro or observational in nature with only a few randomized controlled trials (RCTs) available. Therefore, drawing clear findings on the effectiveness of pre-procedural mouthwashes in preventing SARS-CoV2 transmission problematic. [39]. Second, the most suitable mouthwash kinds as well as concentration, in addition to the duration of the antiviral activity remain unknown. Therefore, several mouthwash types and concentrations have been used in different investigations, and the duration of the antiviral activity was not adequately established [40]. The third limitation, there is a deficiency of studies that are focused on the long term safety and tolerability of using mouthwashes regularly particularly in patients with pre-existing oral conditions or medical comorbidities [41]. Fourth, the majority of the clinical studies if not all evaluating the efficiency of antiseptic mouthwashes relied on RT-qPCR technique to evaluate intraoral virus load. [42]. However, this method can only detect viral RNA copies and does not indicate the infectivity of the viral particles. Therefore this is one of the most limitation that is made RT-qPCR insufficient for assessing the efficacy of antiseptic agents that primarily target the viral envelope rather than the RNA [36]. Furthermore, there are previous studies that have proven that SARS-CoV2 can still be detected by RT-qPCR even after COVID-19 symptoms have disappeared as well as the viral infectivity cannot be shown in cell culture experiments [43]. This suggests indicates that utilizing RT-qPCR alone to measure the efficiency of mouthwashes may not offer an accurate idea and picture about mouthwashes efficiency. Therefore future study should have look into other techniques of testing the efficiency of mouthwashes against SARS-CoV2 foe example employing plaque assays to determine viral infectivity and viral envelope integrity.

Furthermore studies must be performed to assess the effectiveness of mouth wash solution in avoiding SARS-CoV2 transmission in real-life situations which include dental care and medical procedures. Subsequently is additionally critical to look into the potential side effects of utilizing pre-procedural mouthwashes, such as changes in oral flora or bad responses in people with particular medical problems. In general, although mouthwashes likely to have been beneficial in preventing SARS-CoV2 transmission, further study is required to better understand how well they work and are safe particularly large-scale RCTs, are needed to establish the effectiveness, safety, and optimal use of pre-procedural mouthwashes in reducing SARS-CoV2 transmission in dental settings.

Future directions for research on pre-procedural mouthwashes and SARS-CoV-2

There are several avenues for future research on pre-procedural mouthwashes and potential role in reducing SARS-CoV2 transmission these are some examples:

1. Clinical studies: In the future, research experiments might be performed to establish the efficiency of different mouthwashes against SARS-CoV2 in vivo, especially in terms of viral load and transmission in dental settings as well as these studies should additionally investigate the ideal time and frequency for using mouthwash and the impact of mouthwashes on patient outcomes.
2. Mechanistic studies: Further mechanistic studies are required to explain the specific ways by which mouthwashes exert their antiviral effects against SARS-CoV-2 particularly in vivo and also this information could inform the development of more effective mouthwashes and other antiviral agents.
3. Long-term safety studies: In spite of the fact that pre-procedural mouthwashes are usually regarded as safe but longer-term safety studies are required to examine the possible dangers associated with recurrent use of mouthwashes over lengthy periods of time.
4. Cost-effectiveness analyses: To establish the usefulness of employing pre-procedural mouthwashes in dental settings, cost-effectiveness evaluations should be performed, especially in view of the continuing COVID-19 epidemic.
5. Public health policies: The increasing findings on the possible function of pre-procedural mouthwashes in preventing SARS-CoV2 transmission in dentistry settings should be included into public health programs..

CONCLUSION

The pandemic of COVID-19 has shown the importance of infection control methods in hospital settings and also preprocedural mouthwashes containing povidone-iodine or CPC can decrease the likelihood of SARS-CoV2 transmission during dental and medical procedures. There is proof that they have virucidal effects on SARS-CoV-2, lowering viral load and oral cavity infectivity. Further studies are required to fully understand the effectiveness and safety of preprocedural mouthwashes in reducing SARS-CoV2 transmission. RT-qPCR has limitations for assessing the effectiveness of viral particles since it does not measure their infectiousness. It may be more appropriate to evaluate the antiviral activity of mouthwashes using other techniques that measure the viability and infectiousness of the viral envelope, such as viral culture tests or assays that quantify the virus' capacity to infect cells. When analyzing the findings of clinical research examining the efficiency of mouthwashes in lowering SARS-CoV2 transmission, these limitations must be taken into account. The appropriate concentration and period for mouthwash should be evaluated in future studies, as well as long-term effects. When used in conjunction with other infection management strategies, mouthwash can help decrease SARS-CoV2 transmission.the risk of SARS-CoV2 transmission during dental and medical procedures.

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استراتيجيات واعدة لتقليل خطر انتقال فيروس SARS-CoV2 أثناء إجراءات طب الأسنان والإجراءات الطبية

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الخلاصة :

سبب وباء COVID-19 في صعوبات خطيرة لأخصائي الرعاية الصحية ، وخاصة أولئك الذين يعملون في طب الأسنان والمرافق الطبية. يُعد فيروس كورونا(SARS-CoV-2) الفيروس المسبب لـCOVID-19 ، ويمثل عدوى عالية الخطورة في المستشفيات لأنه من المعروف أنه ينتشر عن طريق الرذاذ التنفسي. تهدف ورقة المراجعة هذه إلى تحديد ما إذا كانت غسولات الفم ما قبل العلاج الجراحي يمكن أن تقلل من خطر انتقال السارس - CoV-2أثناء عمليات طب الأسنان والعمليات الطبية. وفقًا لبحوث في المختبر ، فإن المطهرات مثل بوفيدون اليود و CPC وكلوريد البنزالكونيوم والزيوت العطرية قد تكون قادرة على قتلSARS-CoV2 من خلال التركيز على غلاف دهون الفيروس .قد تكون غسولات الفم قبل الإجراءات الجراحية مفيدة في تقليل الحمل الفيروسي داخل الفم والإصابة في مرضى COVID-19 ، وفقًا للتجارب السريرية ، على الرغم من الحاجة إلى مزيد من البحث الشامل للتحقق من صحة ذلك. يمكن أيضًا تقليل انتقال SARS-CoV2 أثناء العمليات باستخدام استراتيجيات إضافية لمكافحة العدوى مثل معدات الوقاية الشخصية ، والإخلاء بكميات كبيرة (HVE) ، وتنقية الهواء. إن RT-qPCR وحده غير كافٍ لتحديد فعالية غسولات الفم قبل العلاج الجراحي ضد انتقال SARS-CoV-2. يجب أن تأخذ الأبحاث المستقبلية في الاعتبار أيضًا استخدام تقنيات تكميلية لتقييم فعالية غسولات الفم قبل الجراحة ، مثل تحديد بقاء الفيروس في مزارع الخلايا أو استخدام نماذج حيوانية للبحث في انتقال الفيروس هناك حاجة إلى مزيد من البحث لتحديد أفضل مزيج من تدابير مكافحة العدوى لتقليل انتقال السارس– CoV-2 في أماكن الرعاية الصحية ، ولكن قد تكون غسولات الفم قبل العلاج الجراحي استراتيجية بسيطة ومنخفضة التكلفة لتقليل مخاطر الانتقال أثناء إجراءات طب الأسنان والإجراءات الطبية ، خاصة في الحالات مرتفعة المخاطرة

.الكلمات المفتاحية: انتقال SARS–CoV2، COVID–19 ، مكافحة العدوى ، غسول الفم