

Recommendation on the Importance of Oral Health to Combat Coronavirus

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Abstract

The epidemic of viral infections, including the coronavirus pandemic, has been a public health concern for many countries globally. Such infections can spread through body fluids, such as saliva and body tissues, contaminated with a viral infection. Prevention of such outbreaks requires the maintenance of good oral health and oral hygiene practices. Infection control measures are needed to combat the virus from being transmitted from the infected to uninfected people. These measures help in controlling the spread of the viruses, hence assisting the countries in managing the epidemic health situations. In terms of oral health, strict measures and effective prevention protocols are needed. Daily brushing of teeth, use of a single toothbrush, changing the toothbrushes frequently, dental flossing, and mouth rinsing with the use of Chlorhexidine Gluconate Mouth rinses are recommended to assist in reducing the number and accumulation of viruses in the oral cavity that may increase the risks for viral infections.

Keywords: *Oral Health; Coronavirus; Miswak; Sewak; Virus; Oral Health Product; Oral Hygiene; Bacteria; Viral Infection; Toothbrush; Gingivitis; Periodontitis; Recommendation; Dental Education; Oral Hygiene*

Introduction

Oral health is an essential component of maintaining improved health, mental, as well as the physical wellbeing of people. Oral health exists as an essential aspect influenced by the attitudes and values of communities or people within a specific area [1]. Maintaining oral health is crucial as it allows people to speak, smile, touch, smell, and convey a message or emotions via facial expression with enough confidence without any disease or discomfort from the craniofacial complex [1]. Oral health is considered vital for overall wellbeing and health of the people, which ensure that oral cavities are well protected. It is a public health concern, which has been useful in protecting people from dental problems, including dental pain and dental challenges with speaking, eating, and swallowing. As such, maintaining good oral hygiene with the use of proper measures, such as the use of fluoride toothpaste and daily brushing of teeth, is among the primary measures to improve oral health [2].

As such, promoting oral health is essential for individual quality of life. It is well established that promoting oral health through healthy eating behaviors, has significant impact on the quality of life of all people, including children. As such, public social policies are the best ways to achieve oral health for all people in the community are crucial. The policies are aimed to improve individual perceptions about oral health and to enhance their quality of life [3]. People or communities that do not focus on oral health are more likely to experience oral infections due to viruses. The human oral cavity is the main ecological community for microbial flora, which includes viruses, bacteria, and fungi. As such, lack of oral health exposes oral tissues to such microbes, which can impact oral and systemic health status, hence increasing the emergence of oral diseases [4].

Viruses are the main microbes in the oral cavity and are known to cause complex oral diseases. Among the well-known viruses that cause oral diseases are herpes viruses, enteroviruses, and papilloma virus, which can cause health complications in the oral cavity, which include periodontitis, ulceration, such as recurrent herpetiform ulcerations or cold sores, and carcinomas in the mouth cavity [4]. A study by Li, *et al.* [5] showed a higher proportion of viruses in individuals infected by the human immunodeficiency virus (HIV) infections. The study revealed that in HIV-infected people, the microbial diversity in the oral cavity was high compared to that of the healthy controls. This suggests that people who are HIV positive essentially provide ecological community or harbor oral flora, which can increase the incidences of oral diseases. Additionally, the coronavirus increases the risk for oral diseases due to a lack of good oral hygiene, which affects individual oral health. More recent research conducted by Meng, *et al.* [6] showed that in the dental care settings, nosocomial or hospital-acquired infections are common, which are mainly acquired from the affected patients. The research revealed that dental patients with coughing, sneezing, or are receiving dental care with the application of ultrasound and high-speed handpiece instruments can make their blood, secretions, or saliva aerosolize to the environment or surrounding. Such instruments could be contaminated with a different microorganism or are exposed to a contaminated environment with microbes, like the coronavirus. As such, the patients and those not infected can get direct contact, which mainly results in infections between mucous membranes and contaminated human bodies, such as hands, which increase the infections [6]. The corona viral infections thus affect oral health in dental settings. The patients receiving dental treatments are highly infected. Another research by Peng, *et al.* [7] found that dental professionals and dental patients are at higher risks for poor oral health due to oral transmission of the Covid-19 virus, which mainly occurs due to the contact with contaminated oral mucous membranes. The professional and patients in dental care practice are exposed to tremendous risks to corona infections due to poor oral health, which in turn leads to oral transmission of the virus through saliva [7]. As such, good oral health is essential to reduce the load of coronavirus in the oral cavity.

Existing research indicates that good oral health with antimicrobial mouth rinse is one of the preventive measures to reduce the number of microbial pathogens in the oral cavity [8]. Also, dental education on oral health and clinical treatment with antimicrobial mouthwash could be essential in increasing people's knowledge that would help them undertake the necessary measures to reduce oral infections [6,9]. Dental measures assist to help in reducing the number of other viruses in the oral cavity. A single-blinded, cluster randomized controlled trial that examined the effects of adopting oral health promotion programs in dental decay showed that the programs are an efficient framework to provide behavior-led training is essential in promoting oral health [10]. The study revealed that the program increases individual knowledge, subjective norms, attitudes, behavioral intentions, and behavioral control among those with dental decay, which improves their oral health status [10].

Literature Review

The intent of this section is to provide detail discussion of the topic under investigation. An extensive search was done on this section to find appropriate empirical studies to describe the topic of oral health and coronavirus. A literature search process was conducted using appropriate databases and keywords. The databases used in finding the relevant articles on the topic were CINAHL, MEDLINE, PubMed, Cochrane Library database and Elsevier. In addition, the Google Scholar search was also used during the literature search process to find additional articles related to the topic in question. The keywords developed to assist in finding relevant articles included oral health, oral cavity, viruses, corona virus, oral health programs, and microbial flora. The Boolean operators 'AND' and 'OR' were used to combine the keywords into researchable sentences. For instance, oral health AND oral cavity, oral cavity and viruses, and viruses OR microbial flora in the oral cavity were used.

The following sections are organized using sub-themed sections of viruses in the oral cavity. How virus combined with oral bacteria, removal of viruses in the oral cavity, good oral hygiene, use of good tooth brush/sewak (miswak) a traditional stick toothbrush and its importance in cleaning teeth, and use of other oral health products to remove the accumulation of viruses in the mouth.

Viruses in the oral cavity

Viruses are common in the oral cavity, and they are known to cause ulcerations in the oral tissues. Viral infections in such tissues develop following cellular destruction and immune reactions, which leads to the formation of multiple blisters in the oral cavity [11]. A qualitative case report that explored the viral infections in the oral cavity with a focus on oral cancers and diseases in the HIV context showed that the human herpesviruses, human papilloma viruses, and Epstein-Barr viruses are common in the oral cavity, which causes oral cancers and related diseases in the mouth. The study revealed that the presence of such viruses negatively influences immune responses in the oral cavity, which in turn facilitates the development of oral diseases, such as cancer of the mouth, salivary glands, neck region, and cancer of the lymph nodes [12]. The presence of viruses in the oral cavity facilitates the development of oral caries. A systematic review and meta-analysis of randomized controlled trials showed that Herpes viridea is common in the oral cavity and is among the leading bacteria that cause oral cancer [13]. The prevalence of Herpes viridea and oral herpes simplex virus are common in patients with oral cancer. Such viruses cause oral ulcers and related viral infections due to the lack of good hygiene in the oral cavity [13].

In comparison to a recent systematic review and meta-analysis that explored and examined the existence of human papilloma virus in patients with oral cancer, the study indicated that lack of oral hygiene provides a favorable condition for the growth of human papilloma virus [14]. The review indicated that overgrowth of viruses like human papilloma virus in the oral cavity increases the patient risk for viral diseases like cancer. The review indicated that the growth of human papilloma virus is attributed to poor oral health, which mainly leads to the development of oral squamous cell carcinoma [14]. The studies thus revealed that different types of viruses exist in the oral cavity, and if the appropriate measures of oral health are not taken into considerations, it facilitates the onset of oral cavity infections, which affect the quality of life and wellbeing of people affected. While the prevalence of viruses in the oral cavity varies, people with viral infections develop different types of diseases and transmit their infections to other people through direct contact in their oral mucous membranes.

A case report by Speicher, *et al.* [12] indicated that whilst the incidences of oncoviruses, such as human papilloma virus and human herpesviruses varies greatly and in other regions, the percentage can be over 50%, a few of the infected people are more likely to develop different oral infections, which include oral hairy leukoplakia, herpes labialis, Kaposi's sarcoma-associated herpesvirus, and upper aerodigestive tract cancers. Such individuals thus transmit viral infections to uninfected people through oral-oral contact, specifically through saliva [12]. Such viruses are not the only microorganisms in the oral cavity. The oral cavity is also a natural habitat for bacterial species, including multi-resistant bacteria, *Mycobacterium* species, *Pseudomonas* strains and *Legionella* species [15]. The existence of viruses and bacterial species in the oral cavity thus increases the risks for healthcare-associated infections if there is poor oral hygiene in the oral cavities.

How virus combined with oral bacteria

Oral bacteria exist in the oral cavity because of the favorable environment characterized by low pH. Such an environment thus provides a clinical environment for the bacteria to grow, and lack of oral health can result in more advanced caries in the mouth [16]. Some clinical trials and systematic reviews that have been conducted have shown the existence of different types of bacteria in the oral cavity, which facilitate oral infections if oral health is not maintained.

A randomized controlled multicenter trial Keller, *et al.* [17] that investigated the full mouth infection with a focus on the use of probiotic supplements to reduce the infections indicated that dental caries results from poor oral hygiene in the mouth, which creates a favorable condition or environment for the aciduric strains of bacteria, such as mutants streptococci that occur due to increased use of carbohydrates and low salivary flows that result in a prolonged period of low levels of pH, which favors the harboring and overgrowth and aciduric or acid-tolerating species of bacteria, such as *Streptococcus mutans* [17]. Another placebo randomized controlled trial that was conducted among patients with gingivitis indicated that in human saliva, the proportion of oral bacteria is high [18]. The clinical trial

indicated that such bacteria are common with the majority of the microbes, such as *Lactobacillus* species growing in the human oral cavity in which they cause the development of gingivitis and related dental health problems [18]. Thus, the combination of viruses and oral bacterial species in the oral cavities influences oral health conditions. The viral-bacterial interactions exist in the oral cavity, and they occupy the same niche; therefore, their potential interaction in enhancing individual wellness or disease emergence.

A research conducted by Almand, Moore and Jaykus [19] investigated human infections with a focus on the combination or interaction of viruses with bacteria in the same niches. The research revealed that the combination or interactions of viruses and bacteria increase infections through their collaboration. It also indicated that viruses and bacteria combine directly in a way that they help each other to penetrate the host cells. The penetration facilitates bacterial pathogenesis as a result of viral infections, which may increase the risks for infectious diseases in the oral cavity [19]. The research thus reflects that viruses and bacteria exist in a similar niche within the oral cavity, and they collaborate in promoting wellness or disease status in the host cells.

Clinical research by Laheij, *et al.* [15] indicated that in oral care practices, such as in dentistry, viruses and strains of bacteria cooperate and enhance cross-transmission of infections due to lack of oral health like hygiene procedures. The research disclosed that the combination of these microorganisms, specifically in the oral cavity, facilitates cross-transmission of healthcare-associated infections, which are mainly acquired through direct contact with blood and saliva of the infected people [15]. Such transmission is also common in people with the coronavirus. Two clinical types of research that have examined the recent cases of coronavirus, mainly the Covid-19 virus, support cross-transmission of the infections by being in direct contact with the blood and saliva of the infected people [6,7]. The research demonstrated that the unaffected individuals, including dental practitioners in oral care settings, are at higher risks for COVID-19 infections when they come into direct contact with contaminated sharp devices or saliva and other fluids of the affected patients [6]. Similarly, a more recent clinical research that investigated the implications of COVID-19 infections in clinical oral care showed that the virus is mainly transmitted through respiratory droplets and direct contact with fluids of infected people (Ather, *et al.* 2020). As a consequence, the virus may combine with other respiratory bacteria and cause healthcare-acquired infections that affect the wellness and quality of life of the community or individuals.

Ghinai, *et al.* [20] explained that coronavirus and other bacteria in the host cells combine in the oral tissues and cause viral and bacterial-associated infections, like respiratory infections, which are transferred to non-affected individuals through direct contact with the infected persons or by being in contact with objects contaminated with the infections. Such infections can occur during hospital admissions, which occur between the affected patients and service providers [20]. Therefore, removing the viruses and bacteria from the oral cavity may reduce the transmission of infections to healthy people. Zhang, *et al.* [21] discussed that current control with a focus on improving oral health through the use of appropriate measures, such as the use of antibiotics and probiotics as well as prebiotic supplements might assist in promoting oral health.

Removal of viruses in the oral cavity

The use of antiviral products has been found to be effective in removing harmful viruses in the oral cavity. Clinical research by Asai and Nakashima [4] indicated that the removal of pathogenic viruses in the oral activity through antiviral compounds is a significant process to prevent and reduce cases of viral infections in the cavities. Similarly, Peng, *et al.* [7] showed in the findings that viral removal with the use of an anti-retraction handpiece is more effective in reducing disease infection. The authors shared that an anti-retraction handpiece with well-designed anti-reflux valves anti-retractive valves are the most strongly recommended method as the preventive measure for cross transmission of infectious viral diseases. The method is mainly applicable for the removal of the COVID-19 virus during oral care practice, including a dental procedure to prevent the growth of virus-causing infections in the setting [7]. Antiviral agents are very effective in the removal of virus-causing pathogens in oral health care because they are cytotoxic and have antiviral-active nucleosides, which make them the potential agents to remove bacteria in the oral cavity [4]. The natural products, such as resveratrol, curcumin, and indolocarbazoles, are more effective in removing viruses like HIV and HSVs in oral cavities. These products have a significant role in different pathways. For

instance, curcumin, a natural polyphenol compound obtained from the medicinal plant known as the *Curcuma longa* Linn, acts by down-regulating the transcription of Human papilloma virus by inhibiting the activator protein 1. Such inhibition prevents the viral replication and prevents viruses from growing in the cavities; hence preventing their multiplication and spread of infections [22].

Additionally, removing the main source of viruses that cause viral infections in oral activity also assists in eliminating harmful pathogens. Individuals with viral-related infections can use Chlorhexidine to remove the main sources of viruses in the oral cavity. Chlorhexidine assists in improving oral health by eliminating infection-causing viral microbes in the oral cavity of people with infectious diseases [23]. Further, maintaining oral hygiene helps in removing viruses in the oral cavity. Existing research indicates that daily use of fluoride and brushing of teeth daily with appropriate kinds of toothpaste or use of traditional stick method assists in removing viruses in the oral cavities [2,24].

Good oral hygiene (Good toothbrush, use of sewak (miswak) a traditional stick toothbrush and its importance in cleaning teeth)

Good oral hygiene with the use of a good toothbrush and sewak or miswak (Figure 1) is effective in removing viruses in the mouth. A study by Fukuda, *et al.* [25] examined the use of the chewing stick and the use of toothbrushes to determine oral hygiene status among primary school children aged 12 years old. The study aimed to examine whether the use of traditional sticks and toothbrushes remove viruses in the mouth as a way of promoting oral health among primary school children. The study results thus disclosed that despite that, children indicated poor hygiene with the use of chewing sticks compared with toothbrushes; both methods were useful in improving the status of oral health [25]. The study revealed that daily use of good toothbrushes and kinds of toothpaste with one brush improves oral health status in children, which reflects that frequent use of toothbrushes and chewing sticks remove viral-causing pathogens in the oral cavity. The chewing sticks are the most recommended traditional methods to use in rural communities because they are readily available and cost-effective for all populations [25].



Figure 1: Miswak or Sewak, a traditional Arabs and Muslims toothbrush.

In addition to the daily use of toothbrushes and chewing sticks, sewak or miswak method has also been found to be useful in removing the accumulation of viruses in the oral cavity. Saha, *et al.* [26] conducted a descriptive cross-sectional study to examine the efficiency of using miswak as an oral health method to reduce cases of gingivitis in Muslim school children aged between 12 years and 15 years from residential and nonresidential institutions in Lucknow city. The status of oral hygiene was assessed after the utilization of miswak to

clean their teeth. The results on the use of miswak were compared with the outcomes of students who used toothbrushes and those who combined the two methods of kinds of toothpaste and toothbrush [26]. The study exhibited better improvement in gingivitis conditions among users of miswak compared to students who used toothbrushes and kinds of toothpaste to brush their teeth. The authors concluded that miswak has strong efficacy in improving and maintaining oral health status than with the use of toothbrushes. The method assists in removing virus-causing pathogens for periodontal and dental caries [26].

Therefore, from a personal point of view, the reviewed articles on the use of toothbrushes and toothpaste, as well as miswak, provide valuable information on the efficacy of the methods in removing the accumulation of viruses that cause infections in the oral cavity. Although miswak is more effective than the use of toothbrushes and toothpaste, both methods are useful for viral removal to improve oral health and to maintain oral hygiene status in the cavities. Other natural products, which include the use of floss and mouth-rinsing, have been found to be effective in preventing and reducing the number of viruses that accumulate in the oral cavities. It is well established that flossing and the use of mouthwash have an indispensable role for effective oral health routine and to prevent oral infections, such as chronic periodontitis and gingivitis [27,28]. The practices help in removing viral plaques and in controlling their accumulation and growth in the oral cavities [27]. As such, using appropriate flossing and mouth-rinsing products has significant clinical benefits in preventing and reducing viral infections in the cavities.

Use of other oral health products to remove accumulation of viruses in the mouth

Natural products, including flossing and mouth-rinse with Chlorhexidine, have shown significant benefits in viral removal in the oral cavities. This is evident in a randomized, double-blind, three-way crossover clinical trial that investigated the efficacy of using Dental Floss and 0.12% Chlorhexidine Gluconate Mouthrinse in addition to toothbrushing [29]. The study aimed to uncover the effectiveness of the flossing and mouth-rinsing in reducing the accumulation of viral plaques and gingival inflammation. The study found that when dental flossing and mouth-rinse with the use of Chlorhexidine Gluconate as an adjunct to toothbrushing has string efficacy in reducing gingival inflammation and plaque accumulations than the use of toothbrush alone. The study revealed that the use of such a method assists in improving fresh breath while reducing and preventing the presence of viruses that cause the early formation of plaques in the oral cavity [29].

Such results are supported in a recent cross-sectional descriptive study by Kayombo and Mumghamba [30] that examined oral hygiene practices with the use of toothbrushes, dental flossing, tongue cleaning, gum bleeding when brushing teeth, and the presence of halitosis and hard deposits on the teeth. The study was conducted among four hundred workers working in different work stations, including offices, garages, schools, shops, and factories. Based on the quantitative data collected, the study found that flossing, mouth rinsing, tongue cleaning, and brushing teeth daily with frequent changes in toothbrushes reduces the incidences of halitosis and gum bleeding [30]. The study illustrated that such oral health practices are closely associated with the removal of pathogen-causing microbes, which improves people's socialization, wellness, and quality of life [30]. Further, flossing and mouth rinse for help in preventing the accumulation of virus that increase the risks for periodontitis and gingivitis. This is supported in a cross-sectional study that utilized the National Health and Nutrition Examination Survey (NHANES) data from 2011 - 2014 [31]. The study investigated the use of dental flossing, inter-dental cleaning and its efficacy in preventing and reducing cases of periodontitis. The study showed that dental flossing frequently and for approximately 2 to 4 days per week has clinical benefits in reducing the prevalence of periodontitis [31]. The results of the study demonstrated that frequent flossing enhances the removal of inter-proximal plaques, which may help in mitigating the initiation and progression of oral diseases [31].

From the findings and information from the reviewed studies and clinical research, it can be concluded that maintaining oral hygiene by adopting appropriate measures, such as daily brushing of teeth with the toothpaste and changing the toothbrushes daily, dental flossing, and use of Chlorhexidine Gluconate mouth rinse is effective for viral removal in the oral cavities. Such measures prevent the growth and accumulation of infections-causing pathogens in oral cavities, hence preventing the onset of viral and bacterial infections. As a conse-

quence, recommendations on the best measures to undertake to improve oral health and oral hygiene are necessary to improve wellness and quality of life.

Conclusion and Recommendations

The reviewed articles presented valuable information that forms the basis to recommend appropriate measures that can be implemented to improve oral health and reduce attack with the coronavirus. Frequent or daily brushing of teeth with the use of toothbrushes or miswak or both is recommended when cases of coronavirus infections, specifically COVID-19 infections, are reported. Frequent use of daily brushing of teeth with toothbrushes and Sewak helps in reducing the number and accumulation of viral pathogens in the oral cavity that cause increased infections. In addition, the use of single brush and changing toothbrushes frequently is recommended to prevent the onset, progression, and return of the viruses from using similar toothbrushes. People who are at risk for coronavirus infections are recommended to change their brushes daily to avoid the recurrence of the infections.

Further, the study provides valuable information on the prevention of viral accumulation in the oral cavity by keeping the toothbrushes in safe conditions. As such, keeping the brushes in proper places and not covering them when storing is also recommended to prevent viral accumulation and onset of viral infections. Information on the flossing, tongue cleaning, and mouth rinsing provides the basis to recommend for daily dental flossing and frequent use of Chlorhexidine Gluconate mouth rinse to reduce the accumulation of viruses while improving fresh breath that enhances socialization. Implementing such measures should be the key concern, specifically in the current situations of COVID-19 infections, which have affected many people and caused increased mortality globally. The measures may assist in reducing cross transmission of infections through oral-oral contact, especially by being in contact with bodily fluids and tissues of affected people.

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