Effect of Natural Oral Spray Products against Oral Bacteria and User Satisfaction in the Elderly Compared with Chlorhexidine Mouthwash

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Abstract

The natural oral spray is beneficial in elderly patients who become disabled to maintain their oral health because the elderly may have difficulties in using their hands. Chlorhexidine mouthwash retains unfavorable flavor, while the natural oral spray containing essential oil which tastes and smells better. Therefore, the purpose of this study is to investigate the antimicrobial activity of natural oral spray against oral bacteria compared with chlorhexidine mouthwash, and patient satisfaction when using the mouthwash. Participants had used two types of natural oral spray products, including essential oil and essential oil with mangosteen extract, and chlorhexidine mouthwash, with 2 weeks of washout period between each product. Unstimulated saliva samples were collected before and after using each product for microbial culture. Total colony forming units (CFUs) were enumerated and compared. Then, satisfaction score was recorded by questionnaire. The results demonstrated that natural oral spray products reduced the total colony forming units after continuous use for 2 weeks, similar to the antimicrobial effect of chlorhexidine, and most patients expressed better user satisfaction than chlorhexidine mouthwash. This study suggested that the oral spray with essential oil and mangosteen extract demonstrated effective antimicrobial activity and favored patient compliance.

Keywords: *Antimicrobial activity, natural oral spray products, total oral bacteria, essential oil, essential oil with mangosteen extract, chlorhexidine mouthwash*

1. Introduction

Nowadays, people in Thailand are living longer than ever before. This means a great increase in Thailand aging population. The progression of Thailand aging population has been accompanied by severe problem in oral health such as tooth loss, dental caries, oral candidiasis and severe periodontitis because aging can induce several risk factors. First, there are internal factors such as senescence of tissue, decline of immune functions. Second, there are external factors such as poly-medication due to systemic disease, malnutrition. Both factors which contribute to changes during aging may also disturb oral homeostasis. This can cause oral infectious disease (Bodineau A et al, 2009).

The primary care to prevent oral infectious disease is to alleviate of any predisposing factor and control plaque biofilm by using mechanical methods such as brushing, interdental cleansing or chemical methods such as mouthwash. Barnett (2006) has shown that the daily use of an antimicrobial mouthwash can play a role in controlling plaque biofilm and prevent oral infectious disease including periodontal disease. Moreover, the antimicrobial activity at mucosal sites throughout the mouth can have a significant impact on the supragingival and subgingival colonization of tooth by oral bacteria in six-month clinical study suggesting that effective mouthwash can be a useful component of oral hygiene regimens. The use of antiseptic mouthwash can improve oral hygiene and reduce oral bacterial flora.

For instance, dental caries is the one oral health problems that mostly occurred in the elderly. One of risk factors that can cause dental caries is oral bacteria. For example, *Streptococcus mutans* is the one that is a primary cause of enamel caries in young adults and root surface caries in the elderly. *Streptococcus mutans* can ferment sugar and generate weak acids such as lactic acid as metabolic end-product which can cause the plaque pH changes to below the critical pH for enamel demineralization and attain the critical pH more rapidly than other common plaque bacteria. Moreover, severe periodontitis is another oral health problem in the elderly. It is also caused by oral bacteria such as *Porphyromonas gingivalis*. The presence of bacterial plaque

represents the etiologic factor involved in the initiation and progression of periodontitis. Eliminating biofilm plaque by mechanical method or chemical method is the one that can prevent dental caries and severe periodontitis. Nowadays, a new approach in treating dental caries is the use of antiseptic agents which can control plaque biofilm (Krzyściak et al, 2014).

Chlorhexidine mouthwash is considered as the gold treatment for controlling the dental biofilm due to its efficacy against different kinds of bacteria, fungi, and viruses. However, it has some adverse effects such as changing in color teeth and mucosa, mucosal desquamation, alteration of taste perception, irritation, dryness of mouth, and side systemic effects as the result of swallowing were reported. Therefore, The World Health Organization (WHO) has recommended on finding the new natural sources such as the herbal extracts for overcoming on side effects of chemical agents (Rezaei et al, 2016).

At the present, there are many commercially available oral antiseptic agents that can treat oral infectious disease. Essential oils and mangosteen extract are both natural extracts. Natural extracts have been widely used in Thai medicine for treatment and for maintaining healthy condition. For instance, Janjić-Pavlović et al. (2017) showed that the use of essential oil mouthwash as an antiseptic solution can be treated denture stomatitis which is caused by *Candida albicans*. Moreover, essential oils also have an antibacterial effect against some cariogenic bacteria including *Streptococcus mutans* and *Lactobacillus casei* with minimal inhibitory concentration (MIC) values ranging from 31.2 to 500 mg/ml. Essential oil that extracts from *Tetradenia riparia* has a bactericidal effect against *S. mutans* for first 12 hours with direct cell contact similarly to chlorhexidine dihydrochloride. Another one is mangosteen extract. Mangosteen extract consisted of alpha-mangostin. Alpha-mangostin has a potential for oral candidiasis therapy. Kaomongkolgit et al. (2009) showed that alpha-mangostin was effective against *C. albicans* and more effective than Clotrimazole and Nystatin. As above, essential oils and mangosteen extract can treat oral candidiasis. Furthermore, alpha-mangostin showed the most potent antibacterial effect by inhibition of tyrosinase enzyme associated with glucan synthesis, against the pathogenic bacteria in the oral cavity including *S. mutans*, *Porphyromonas gingivalis*, and *Streptococcus pyogenes* at minimum inhibitory concentration (MIC) of 0.01 mg/ml, and *Staphylococcus aureus* at MIC of 0.1 mg/ml by agar dilution method (Tadtong et al, 2009). Owing to the strong bactericidal activity of mangosteen pericarp extract, it has been conclusively suggested to add into the composition of oral spray, oral paste and toothpaste for further development as an antibacterial agent.

Beside toothpaste and mouthwash, natural oral spray is another option that can be used for reducing bacterial flora in oral cavity. Oral spray is easy to use and beneficial in the elderly who has difficulties in brushing or become disabled to maintain their oral health. However, most of the studies of natural oral health care products are limited in the in vitro studies, and the antimicrobial activity of the Thai natural oral health care products including oral spray that extract from essential oils and mangosteen extracts in the in vivo studies remains unknown. Therefore, the purpose of this study is to investigate the antimicrobial activity of natural oral spray against oral bacteria and user satisfaction compared with chlorhexidine mouthwash.

2. Objective

The aim of this study is to investigate the antimicrobial activity and user satisfaction of natural oral spray products against oral microbiota compared with chlorhexidine mouthwash.

3. Materials and Methods

Two oral care natural products were selected based on a literature survey:

1. Myherbal mybacin trospray (Greater Pharma Co., Ltd.) – essential oil group
2. Myherbal mybacin trospray with mangosteen extract (Greater Pharma Co., Ltd.) – essential oil with mangosteen extract group. And 0.2% chlorhexidine mouthwash (Faculty of Dentistry, Chulalongkorn University) was used as positive control.

This randomized, double-blind controlled clinical trial and crossover clinical study was conducted at Geriatric Dentistry and Special Patients Care Clinic and the Department of Microbiology, the Faculty of Dentistry, Chulalongkorn University. Prior to inclusion criteria in this study, subjects were informed about the purpose and the protocol of this study and also provided their consent to participation. This study was

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conducted on 21 patients who came to visit at Geriatric Dentistry and Special Patients Care clinic. Criteria for inclusion of patients in the study was good general health conditions or well-controlled chronic disease aged up to 50. Exclusion criteria was as follow: the use of any antibiotics or corticosteroids during this study in last 1 month, history of HIV or any immunosuppressive therapy and radiotherapy in the head and neck area, severe periodontitis and high caries risk assessed by oral hygiene caries risk assessment of the Faculty of Dentistry Chulalongkorn University modified from caries risk assessment by American Dental Association. This assessment has been used in operative dentistry and also geriatric dentistry and Special Patients care clinic, Faculty of Dentistry, Chulalongkorn University.

Sociodemographic data was obtained by filling out the questionnaire. The data consisted of age, gender, occupation, medical conditions, marital family situation, oral hygiene care, dietary habits, smoking habits, alcohol drinking, and presence of prosthesis. After collecting the sociodemographic data, saliva samples will be collected as described as baseline before routine scaling and oral hygiene instructions were given to all participants to remove all dental deposits and tried to set the same mechanical approach of oral care by the researcher.

Two weeks after routine scaling, participants were appointed to collect saliva samples. For collecting the saliva, the participant was instructed to avoid food intake for 2 hours before saliva collection. Unstimulated saliva was collected from all subjects by spitting method into a sterile container (50 ml. collection tube) during a 20-min period. Then, participants were randomly allocated into 2 interventions with different sequence uses of oral spray natural products. All interventions had the same duration of time included 14 days for the first oral spray product, 14 days for wash out period, then 14 days for the second oral spray product, 14 days for second wash out period and 14 days for chlorhexidine mouthwash as a positive control. Chlorhexidine mouthwash was used as a spray with the same container of oral spray natural products in order to mimic the same situation as natural oral spray and maintain the same volume flux. Participants were instructed to point the spray nostril towards buccal mucosa of both sides in the mouth and spray 2 times on each side and used 2 times a day. The researcher also emphasized all participants to maintain the volume flux and the distance between oral spray and oral cavity through the study.

One day after each period of time, participants were appointed for saliva collection with the same protocol of the first visit. Consequently, each participant was appointed for saliva collection 7 times (baseline before scaling, before and after using the first oral spray, before and after using the second spray, before and after chlorhexidine mouthwash). And after use of each oral care product for 14 days, all participants were informed their use as a satisfaction score as an analogue scale categorized including taste, smell, burning sensation, ease of use, and overall of oral care product. As you see below (Figure1).

Figure1 Chart of the method of this research

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