ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 13, Issue 3, 2020

Online - 2455-3891
Print - 0974-2441

Research Article

THE EFFECTIVENESS OF USING SIWAK TOOTHPASTE ON PLAQUE ACCUMULATION IN FIXED ORTHODONTIC APPLIANCES USERS'

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Received: 21 December 2019, Revised and Accepted: 18 January 2020

ABSTRACT

Objective: The objective of the study was to determine the ability of toothpaste containing *Salvadora persica* (*Siwak*) to reduce the accumulation of dirt in the oral cavity compared to ordinary toothpaste users in fixed orthodontic users.

Methods: It was conducted on 40 subjects, divided into two groups of A and B. Group A uses Siwak, while Group B uses ordinary toothpaste. The research subjects were students that utilized fixed appliances for at least 6 months and without periodontal disease. Data were obtained by measuring the plaque level before and after using the toothpaste.

Results: A significant relationship between the use of *Siwak* and ordinary toothpaste by reducing its accumulation in patients using fixed orthodontic appliances and a Chi-square statistical test value of 0.018.

Conclusion: The use of *Siwak* is more effective in reducing plaque accumulation in fixed orthodontic appliance users compared to ordinary toothpaste.

Keywords: Fixed orthodontic appliance, Dental plaque, *Salvadora persica* toothpaste.

 DOI: http://dx.doi.org/10.22159/ajpcr.2020.v13i3.36650

INTRODUCTION

The maintenance of regular and oral hygiene is an important factor in the prevention of dental disease. This led to the inception of several hygiene tools such as toothbrushes, dental floss, and mouthwash. Before the development of toothbrushes, the Babylonians used chewing sticks (3500 BC) to clean their teeth. They chewed branches, stems, or roots from various plant species which they believed had the ability to clean and refresh the mouth. This act was conducted by biting the stick until it becomes smooth like a brush and the other end is made to be tapered to pick food stuck between the teeth [1-3].

A total of 182 plant species have been used as chewing sticks, but the most commonly used in East Asia is *Siwak* (*Salvadora persica*) [4]. The advantages of *Siwak* to other plant species are the mechanical cleaning ability [3]. *S. persica* as a tool for cleaning the teeth and mouth has the advantage in mechanical cleaning from the fibers produced and its pharmacological effects [1].

S. persica is a plant with many pharmacological properties. According to laboratory tests, its boiled stems and leaves tend to provide significant protection against ethanol and ulcers, reduce cholesterol and low-density lipoprotein plasma levels, and inhibit oral bacteria and plaque growth [5]. Furthermore, it releases useful chemicals such as chloride, fluorine, silica, sulfur, Vitamin C, saponins, and sterols [6]. The sulfur compounds have a bactericidal effect [7], while the amount of silica found in *S. persica* has the ability to remove plaque from its mechanical effects [8,9]. According to some studies, the chewing stick contains the following effects hemostatic [2], analgesic, anti-inflammatory, antibacterial, and anticaries [3].

Dental plaque is a biofilm defined as a community of bacteria with extracellular polymers attached to the surface. In the oral cavity, the bacterial community consists of various species [10,11]. It is now widely known that environmental changes such as the use of orthodontic appliances have the ability to change a bacterial community, thereby leading to diseases.

Several microbiological and clinical studies have proven that bacteria contained in dental plaque play important roles in the initiation and development of periodontal diseases. The use of fixed orthodontic appliances tends to trigger an increase in the volume and number of bacteria [11]. An adequate level of oral hygiene is needed to maintain dental health in patients using fixed orthodontic appliances because the wire, brackets, and bands become a barrier. While increasing its accumulation, the debris tends to rise the likelihood of developing periodontal disease [12].

The combination of *Siwak* with orthodontic toothbrushes provided better plaque and gingival index values in patients compared to the use of *Siwak* or conventional toothbrushes [3]. Therefore, the use of this combination reduces the possibility of periodontal disease in patients using fixed orthodontic appliances. However, there is an adequate need to determine the effectiveness of *S. persica* in toothpaste as an agent which reduces the accumulation of plaque in the oral cavity of users.

METHODS

This is a clinical experimental study with a cross-sectional design. It was conducted on 40 subjects, divided into two groups of A and B. Group A uses Siwak, while Group B uses ordinary toothpaste. The research subjects were students that utilized fixed appliances for at least 6 months and without periodontal disease.

In day 0, respondents were instructed to rinse using disclosing solution and their plaque indexes were measured. Furthermore, they were educated on the basic techniques of brushing good and right with Bass technique and instructed respondents to brush their teeth using the provided toothpaste (2 times a day for 21 days). Furthermore, on the 21st day, they were instructed to rinse using the disclosing solution and the plaque index was measured by the coassistant after using the toothpaste given for 21 days.

RESULTS

This study determined the effectiveness of toothpaste containing *Siwak* in reducing plaque in patients. Data were obtained from the

Dental and Oral Hospital, Faculty of Dentistry, University of Trisakti. The respondents were divided into two groups of 20, with those using toothpastes containing *Siwak* and the control group using ordinary toothpaste (Table 1). The respondents were instructed to brush their teeth 2 times for 21 days.

The average results from this study decrease between days 0 and 21 in the *Siwak* toothpaste group by 38% and in the control by 8% (Table 2).

The group that brushed their teeth using *Siwak* toothpaste was able to reduce the plaque score in fixed orthodontic appliance users by 95%, compared to the group with ordinary toothpaste by 65% (Table 3).

DISCUSSION

Orthodontic treatment increases patient confidence through a better esthetic outcome [13]. The goal is to correct irregular tooth structure, stabilize the occlusal contact, and achieve good esthetic functions [14]. However, the use of fixed orthodontic appliance prevents access to oral hygiene instruments on the tooth surface, thereby leading to the accumulation of dental plaque, due to environmental changes in the presence of orthodontic bands and wires in the oral cavity [15,16]. Accumulation of plaque on the tooth surface causes gingivitis, periodontitis, and email demineralization [15]. Klukowska reported that the number of plaques in orthodontic patients was very high, with an average of 40% of the tooth surface. Furthermore, adequate plaque control was needed to prevent its excess accumulation which tends to the development of periodontal diseases [13].

Plaque control cannot be carried out using antibiotic or antimicrobial therapy because it is coated by the extracellular layer which prevents them from penetration. It is removed by damaging its bond with the tooth surface (physically) [17], and through mechanical means, using chemotherapeutic material [18]. Plaque control by mechanical means is based on standard tools in the form of a toothbrush [19].

In addition to conventional toothbrushes, *Siwak* (*S. persica*) is also a plaque control appliance due to its mechanical benefits and its ingredients [1]. The World Health Organization recommends using *S. persica* as a tool which plays a role and in maintaining oral hygiene. Chaurasia explained that the use of *S. persica* was as effective as conventional toothbrushes [20]. It recommended the use as a tool to maintain oral health due to its pharmacological effect [21]. Whereas according to several other studies, the use of *S. persica* and conventional toothbrushes will be more effective than their own use [1,3].

This study combines the use of *Siwak* in the form of toothpaste with ordinary orthodontic brushes to reduce plaque accumulation. The results are in line with the research conducted in Penang-Malaysia, which stated that the use of a combination of *S. persica* with conventional orthodontic toothbrushes shows more effective results [22].

The results of this study found that 19 respondents in the *Siwak* toothpaste group showed a decrease in the amount of plaque accumulation, while one showed nothing. In the group that used ordinary toothpaste, 7 respondents failed to experience a decrease in the amount of plaque accumulation and 13 experienced it after using it for 21 days.

The reduction of plaque occurring in groups using *Siwak* toothpaste might be supported by the potential of *S. persica* in eliminating its mechanical and biological properties such as antibacterial, antifungal, and antiplaque [23]. *S. persica* has many beneficial ingredients such as fluoride which plays a role as anticariogenic; silica acts as an abrasive; potassium sulfate and calcium sulfate inhibit demineralization and induce remineralization; tannins, saponins, and Vitamin C help to heal and repair tissues; and chlorides inhibit the formation of calculus [19,24]. The ingredient is able to reduce the amount of plaque accumulation in the teeth.

Almas, in 2002, showed that *S. persica* extract has the ability to effectively eliminate smear layer in plaque [24]. It also increases salivary flow and pH in plaque because the spicy taste felt helps increase its secretion which acts as a buffer in the oral cavity [25,26]. El-Desoukeu explained that extracts from *S. persica* have a more effective antimicrobial effect against *Staphylococcus aureus* and *Candida albicans* compared to ordinary toothpaste, thereby preventing oral candidiasis [27-29]. *Siwak* extract is effective against various types of oral bacteria which are involved in caries or periodontal diseases [23,30].

According to Azaripour, based on a 3-week analysis using toothpaste containing extracts of *Siwak* (*S. persica*), showed that it significantly reduces gingival inflammation and recommends it as an alternative herbal toothpaste used by the public [24,30]. However, in this study, a respondent was unable to experience a decrease in plaque score; this may be caused by lack of brushing duration or improper techniques. Therefore, more research needs to be conducted on the reduction of plaque scores with *Siwak* toothpaste using the right duration and correct toothbrushing techniques.

Table 1: Gender distribution in each group

Group	Male (%)	Female (%)
Siwak toothpaste group	20	80
Control group	10	90

Table 2: The mean plaque index of the Siwak toothpaste group and control at days 0 and 21

Group	Average plaque score (day 0)	Average plaque score (day 21)	Average score reduction (%)
Siwak toothpaste group	1.2085	0.8315	38
Control group	1.0925	1.011	8

p=0.018

Table 3: Percentage of frequency of plaque index reduction

Group	n	A decrease in plaque score (%)	No decrease in plaque score (%)
Siwak toothpaste group	20	95	5
Control group	20	65	35

CONCLUSION

The results of the study showed that the use of *Siwak* toothpaste and ordinary toothpaste reduces the amount of plaque accumulation in patients using fixed orthodontic appliances. However, the results indicate that there is a significant difference in reducing the amount of plaque accumulation in the group using *Siwak* and ordinary toothpaste with an effective fixed orthodontic appliance user.

CONFLICTS OF INTEREST

The author's declares that they do not have any conflicts of interest.

FUNDING

The study was funding privately.

AUTHORS' CONTRIBUTIONS

Both authors have jointly written the manuscripts.

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