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

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INTRODUCTION
The maintenance of regular and oral hygiene is an important factor in the prevention of dental disease. This led to the invention 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 antacaries [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].

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. 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.

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

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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.

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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 antibiotic, 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 spiccy 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.

**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.

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The study was funding privately.

**AUTHORS’ CONTRIBUTIONS**

Both authors have jointly written the manuscripts.

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