

The Antimicrobial Effect of Miswak Drenched with Listerine Mouthwash used for Orthodontic Patients

Zahraa M. Al-Fadily, B.D.S., M.Sc.

B.D.S, M.Sc. Department of POP, College of Dentistry, University of Kufa, Najaf, Iraq

Abstract

Objective: This study was aimed to estimate the antimicrobial effect of miswak drenched used as mouthwash for orthodontic patients and compare this effect with Listerine mouthwash. **Materials and method:** Thirty two patients wearing fixed orthodontic appliance and have good oral health were haphazardly separated into: group I used miswak drenched and group II used Listerine mouthwash. The first samples were taken 3 weeks after bonding of fixed appliance (pre-using the mouthrines). The second samples were taken 4 weeks (post-using the mouthrines). The colonies forming units were compared between the groups and within the same group (pre and post-using mouthrines). **Results:** The result showed highly significant difference between group I pre and post-using miswak drenched with p value=0.000. Also, there was highly significant difference between group II pre and post-using of Listerine mouthwash with p value=0.000. The comparison between group I and group II pre and post-using of mouthrines showed no significant difference. **Conclusion:** The miswak drenched greatly effective in reducing microbial growth when used for orthodontic patients under treatment with fixed appliance and this effect appear to be similar to antimicrobial effect of Listerine mouthwash.

Keywords: Miswak drenched, Listerine, Antimicrobial, Orthodontic.

1. Introduction

Dental plaque accumulations are primary factor in development of enamel demineralization¹, gingival inflammation and periodontal problems.² The individual is mainly responsible of his oral hygiene control, more specifically removing supragingival plaque.³ The challenge faced orthodontic patients wearing fixed appliance is how to maintain good oral hygiene because additional retentive areas formed by orthodontic attachments like brackets, bands, molar tube, ligature wires, ligature elastics, arch wires, cleats, elastics which are facilitate plaque accumulation.⁴ Therefore, the mechanical plaque control methods includes tooth brushing, dental flossing, interdental brushing, using of wood sticks may become difficult and required great skill and motivation for the patient undergoing treatment with fixed appliance.⁵ Many studies found that with poor oral hygiene of orthodontic patients will leads to development of white spot lesions and demineralization on the buccal surfaces of teeth⁶⁻⁹ and development of gingivitis and hyperplastic gingiva.¹⁰⁻¹³ Additionally several studies have shown that the levels of *Streptococcus mutans* and *Lactobacilli* increased (which are the main pathogens associated with development of dental caries) in the plaque following bonding of orthodontic attachments.¹⁴⁻¹⁶ So become recommended for patients undergoing orthodontic treatment with fixed appliance to use mouthwash as chemical method for plaque control.¹⁷ The mouthwashes are very useful in reducing plaques and pathogenic microorganisms accumulate around teeth and oral cavity.^{18,19}

Listerine is one of the most frequently used mouthwash, used firstly for bad breath treatment.²⁰ Several studies have found that the Listerine mouthwash has efficacy in improving oral hygiene.²¹⁻²⁴ Listerine is combined triclosan and cetylpyridinium chloride which are antibacterial substances and additionally combined with oil that binds bacteria.²⁵

Miswak originally Arabic word is known in English as natural tooth picks, used since many centuries by Babylonians, Greeks, very old Egyptians, Romans and Muslims in scattered parts of Africa and Asia, predominantly in the Middle East.²⁶ There are about 182 species of plant from which a miswak can be prepared, but the most popular choice is *Salvadora persica*.²⁷ It was reported that *Salvadora persica* plant has anti-microbial, anti-dental plaque and anti-caries effects, either when being used as a chewing stick in natural forms or even in aqueous extracted forms.^{26,28}

This study was aimed to estimate the antimicrobial effect of miswak drenched used as mouthwash for orthodontic patients and compare this effect with Listerine mouthwash.

2. Material and method

2.1 Subjects

Thirty two patients ranging in age from 15-25 years wearing fixed orthodontic appliance were selected from two private orthodontic clinics in AL-Najaf city in Iraq. The participant patients were informed about the study and consent was obtained. The patients involved in the study must fit the following selection criteria:

1. At least ten maxillary and ten mandibular teeth should be bonded with fixed appliance.
2. The gingiva should be healthy without inflammation.
3. No active dental caries and/or periodontal disease.

4. No prior use of any antibiotic or mouthwash for at least one month.
5. No sensitivity to any mouthwash previously.
6. No mouth breathing.
7. No corticosteroid use in the last three months.
8. No systemic disease.
9. Good co-operation and follow instructions of good oral hygiene maintenance during study.

2.2 Miswak powder preparation

Many miswak sticks are brought from regional market in Al-Najaf city. Knife used to cut the sticks into a small pieces and left to dry for 3 days at room temperature. Then by using food blender (Kenwood), the miswak ground to powder (figure 1). The powder divided into 16 sterile cans till used by the patients.

2.3 Method

Before bonding the fixed appliance, all of the patients were well motivated and given directions on the way of teeth brushing and flossing properly after each meal for standardization. The patients were haphazardly divided into two groups (sixteen patients for every group). Group I used miswak drenched and group II used Listerine mouthwash. Following bonding of fixed appliances by three weeks the first samples (S1) was collected from patients using swap with media by rubbing a cotton swab over the surfaces of upper and lower anterior teeth and insert the cotton swap immediately in its media. The samples transmitted quickly to the lab. After next four weeks, the second samples (S2) collected from patients using same method as in first samples but for group I following use of miswak drenched (placing about one cup spoon of miswak powder in a 20 ml cub of hot distilled water and left until become cold then filtering it and rinse the mouth with it vigorously for 30 sec. two times daily), for group II following use of Listerine mouthwash (about 20 ml for 30 sec. two times daily).

2.4 Microbiological Method

After immediate transfer to laboratory, method of pour plate was used with ten-fold serial prepared dilutions of normal saline to select the most appropriate dilution to determine the colony forming unit (CFU), 0.1 ml of dilutions was carried into sterile empty plates, then mueller hinton agar poured into each plate following cooling to 50°C. After hardening of agar, incubation of plates were done for 48 hrs at 37°C and the colony forming units (CFU) were counted (S1). Similar procedure of samples inoculation was done again after four weeks of using miswak drenched and Listerine mouthwash (S2).

3. Result

At S1 (pre-mouthrines application), the statistical result showed no significant differences in the number of bacterial colonies between group I (7.139 ± 0.026) and group II (7.136 ± 0.023). The comparison done by using independent sample t-test. The descriptive statistics and comparison are presented in table (1).

After miswak drenched application (S2) in group I the mean of bacterial colonies (CFU) decreased to (6.574 ± 0.049) and when compared with group I at S1 by using paired sample test, the result showed highly significant difference.

After application of Listerine mouthwash (S2) in group II also the mean of CFU decreased to (6.557 ± 0.056) and showed highly significant difference when compared with group II at S1 (table 2).

At S2 (post-mouthrines application), the result showed no significant differences in the CFU between group I (6.574 ± 0.049) and group II (6.557 ± 0.056). The comparison done by using independent sample t-test. The descriptive statistics and comparison are presented in table (3).

4. Discussion

For more than past 1500 years, some peoples used several accessory to maintain oral health like miswak before discovering new mouth care ingredients like toothpaste and mouthwashes, in the last three decays, WHO has recognized its numerous advantages.²⁹

Fixed orthodontic appliance connected with accumulation of biofilm, which may cause gingival inflammation and enamel demineralization.^{30,31} Many studies found the association of fixed appliance with poor control of oral hygiene.³⁰⁻³⁵

Miswak plant sticks was used for cleaning of teeth due to a mechanical ability of its fiber to clean deep areas between dentition and by chemical effects of its phytochemical components and minerals.³⁶ Miswak has the ability to stop bacterial growth in oral cavity and has similar effect to tooth paste, as it contain high concentration of sodium chloride, potassium chloride³⁷, and also contain sulfur in moderate concentration.³⁸ Presence of fluorides in miswak sticks give it the a ability to resist demineralization of enamel surfaces and subsequently will prevent caries.³⁹ Resin one of miswak chemical components which also help in prevention of tooth decay.⁴⁰ Furthermore, silica material work as a remover for food debris and dental plaque. Miswak also

contain vitamin C which has a role in the process of repair and healing of oral tissue.⁴¹ In addition to others component like tannins, organic compound, saponins, salvadoura, flavonoids, alkaloids, sterols, all have a positive role in good oral health.^{42,43}

For all previously mentioned benefits of miswak plants, Islam strongly encourages its use, non-expensive and because of difficult to orthodontic patients wearing fixed appliance to use miswak stick for dental cleaning as there is danger of debonding of brackets and harm the appliance, the present study try to investigate its effect in its drenched form.

Firstly made comparison between group I and group II following bonding of fixed appliance by three weeks pre-mouthrines application for standiraziation and the result showed no significant difference since the patients have the same selected criteria. Furthermore, the patients well-motivated and given directions on the way of teeth brushing and flossing properly after each meal by the same subject.

The comparison of group I pre and post-using miswak drenched showed highly significant difference with p value=0.000, which refer that the miswak has antimicrobial effect in its drenched form and can be used for orthodontic patients to assist in maintaining good oral hygiene during treatment. This result belong to fact that miswak (*Salvadora persica* plant) has active component work against microbes present in oral cavity⁴⁴⁻⁴⁶ and prevent development of dental plaque, gingivitis and periodontitis.^{47,48} There was no previous study test the antimicrobial effect of miswak drenched on orthodontic patients in vivo or even in vitro. Two other studies test the antimicrobial effect of the miswak extract present in Persia mouthwash against streptococcus mutans and compared its effect with chlorhexidine mouthwash, first of them agree with our result as the Persia mouthwash showed significant reduction in streptococcus mutans colonies numbers⁴⁹, while the second one showed reduction in the CFU but not statistically significant⁵⁰ which can be explained due to difference in employed method.

The effectiveness of Listerine was explained in previous studies on orthodontic patients⁵¹⁻⁵⁴, so the present study used it as a positive control group. The result showed that there was highly significant difference with p value=0.000 in group II pre and post-using Listerine mouthwash same the result of previous studies.

Post-mouthrines application, the result showed no significant differences in the CFU between group I and group II. This confirm that there is no difference in the antimicrobial effect of miswak drenched and Listerine. No previous studies make this comparison miswak drenched and Listerine on orthodontic patients in vivo or in vitro. Previous study was compare the antimicrobial effect of miswak extract with Listerine on biofilm in vitro⁵⁵, which find same result.

5. Conclusion

The miswak drenched greatly effective in reducing microbial growth when used for orthodontic patients under treatment with fixed appliance and this effect appear to be similar to antimicrobial effect of Listerine mouthwash.

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Figure.1 Miswak powder preparation

Table 1. Descriptive statistics of bacterial colony (CFU/ml) and comparison between two groups at S1

Groups	Descriptive statistics		Comparison			
	Mean (CFU/ml)	S.D.	Mean difference	t-test [^]	d.f.	p-value
Group I	7.139	0.026	0.003	0.385	30	0.703 (NS)
Group II	7.136	0.023				

[^] Independent sample t-test (for comparison between groups)

Table 2. Descriptive statistics of bacterial colony (CFU/ml) and comparison the antimicrobial effect in each group

Groups	Descriptive statistics		Comparison			
	Mean (CFU/ml)	S.D.	Mean difference	t-test*	d.f.	p-value
Group I at S1	7.139	0.026	0.565	42.806	15	0.000 (HS)
Group I at S2	6.574	0.049				
Group II at S1	7.136	0.023	0.578	40.440	15	0.000 (HS)
Group II at S2	6.557	0.056				

*Paired sample test (for comparison between S1 and S2 of the same group)

Table 3. Descriptive statistics of bacterial colony (CFU/ml) and comparison between two groups at S2

Groups	Descriptive statistics		Comparison			
	Mean (CFU/ml)	S.D.	Mean difference	t-test^	d.f.	p-value
Group I	6.574	0.049	0.017	0.907	30	0.372 (NS)
Group II	6.557	0.056				

^ Independent sample t-test (for comparison between groups)