

SALIVARY PH CHANGES AFTER USING FLUORIDATED MOUTH RINSE AND MISWAK IN HIGH CARIES RISK PATIENTS

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ABSTRACT

Aim: The current study was performed to assess the changes in salivary pH in high caries risk patients using sodium fluoride mouth rinse and Miswak.

Materials and Methods: A total of 20 patients were selected randomly according to inclusion and exclusion criteria. They were divided into 2 groups of ten patients each; (n=10). G1: used Miswak sticks, G2: rinsed with (0.05%) sodium fluoride mouth rinse. Patients used their corresponding interventions, for 2 minutes, twice per day for one month. Resting saliva samples were assembled at baseline and after one month. A quantitative method was used for measurement of salivary pH using pH meter. Data were analyzed statistically, and the significance level was set at $p \leq 0.05$.

Results: At baseline a higher mean value of salivary pH values was recorded in Miswak group (7.43 ± 0.39) in comparison to Fluoride group (6.93 ± 0.43). The difference between groups was statistically significant ($p=0.014$). After one month: a higher mean value was recorded in Miswak group (7.52 ± 0.8) in comparison to Fluoride group (7.23 ± 0.62). The difference between groups was not statistically significant ($p=0.377$).

Conclusion: Both Miswak and sodium fluoride mouthwash reported impact positive effect by enhancing and maintaining the salivary PH.

KEYWORDS: Miswak, Fluoride mouth rinse, Salivary pH.

INTRODUCTION

Among the oral diseases, dental caries is the most common prevalent dental disease all over the world. It occurs due to the imbalance between the re-mineralization and de-mineralization activity

and in conjunction with pathogenic biofilm formation in the oral ecosystem. Streptococcus mutans produce acids causing pH fluctuation and initiating tooth structure demineralization.⁽¹⁾ Usually, in balanced oral ecosystem, the acid exposure would be

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for a short time as saliva neutralizes the pH and decreases the acidic challenge exerted on tooth structure.⁽²⁾ Salivary pH has a very critical role affecting caries initiation and progression. It is an important parameter for determination of the pathogenicity of the oral biofilm. Human saliva not only acts as a lubricant for the oral tissues to make speaking, eating, and swallowing possible, but also protects the teeth and oral mucosa.⁽³⁾ Prevention of dental caries was achieved by using several oral hygiene measures such as toothpastes and mouthwashes that contains distinct medical or natural extracts agents. Fluoridated mouthwashes are deemed the most eminent anti-cariogenic agents used in dental caries prevention and treating protocols.⁽⁴⁾ Taking into account, that surplus fluoride can have toxic effect causing enamel stains and dental fluorosis.⁽⁵⁾ Thus, in the last decade, naturally extracted agents have been raised to exploit their benefits without any harmful side effects. The merging of many natural products as anti-cariogenic agents has been put forward in the market because they are distinguished by their biological activities, safety, availability, lack of bacterial resistance, and low cost.^(5,6) Those products may be beneficial for caries control especially in countries with low financial resources as they are available at low costs.⁽⁶⁾ Like, Propolis, Chitosan and Miswak are natural products introduced anti-cariogenic agents as they have anti-plaque, anti-microbial and re-mineralizing potentials against oral bacteria.^(7,8) Miswak (*Silvadora persica*) is a long established popular plant. It has a wide distribution mainly in the Arab world region as well as between African population.⁽⁹⁾ Miswak extract is rich in minerals and low in fluoride content.⁽⁶⁾ It also comprise a diversity of polar and non-polar compounds that has been approved to possess high medicinal values.⁽⁹⁾ Therefore, our study targeted to assess the effect of Miswak as a natural toothbrush and fluoride containing mouth rinse on salivary PH changes.

Null hypothesis: is Miswak has an effect on the saliva PH as fluoride containing mouthwash.

MATERIALS AND METHODS

Sample size calculation: To study the effect of 2 different interventions (Miswak and Fluoride) on salivary pH, a non-parametric test was used for comparison. The effect size of 0.63 was calculated upon a prior study by (Prihastari L, et al, 2019).⁽¹⁰⁾ The sample size 20 patients (10 patients in every group) was assigned to determine the effect size of 0.63, with a power (1- β error) of 0.8 and a significance level (α error) 0.05 for data. Sample size estimation was carried out using G*power Program (University of Düsseldorf, Düsseldorf, Germany). G*Power Version 3.1.9.4.

Ethical approval, and funding sources: Application form for biological samples of the Research Ethics Committee (REC) Faculty of Dentistry, Cairo University was fulfilled to conduct the trial, this is to prevent any unethical management or harms during the study. Analysis of the proposal, patients' data as well as the whole procedures were done and accepted by the Research Ethical Committee (REC), Faculty of Dentistry, Cairo University, Cairo, Egypt. The registration number be in use was REC 50-7-23

This study was financially funded by the primary investigator.

Study design and Patient's enlisting: This is a single blind random study. A total of 50 patients were picked from the out clinic of the faculty of Dentistry, Cairo University. A group of 20 Patients were allocated according to the inclusion and exclusion criteria. Clinical examination was done on clean dry teeth using simple visual examination and tactile method with ball tipped dental probe (Medentra instruments, UK). According to American Dental Association (ADA) caries risk assessment from (Ages >6) high caries risk category patients were selected. We included in this study patients with age group from 20-50 years. And we excluded patients with chronic illness, using antibiotic, any other medical condition that may affect the salivary

gland function either oral cavity PH, smokers, or mouth rinse at least in the previous month.

Informed consent: Patients were informed about all possible drawbacks, profits, as well as the study design. Upon which they signed a written informed consent. The inspector clarified that participation in the trial is optional and they are free to discontinue at any time.

Randomization & blinding: In this study random sequence of both interventions and participants was performed by *Microsoft Excel Program*. An index with a numerical order was established where every participant in this list had a sequential number (1, 2, 3). Participants were given an arbitrarily letter (M1, M2, M3) to settle each participant with a corresponding intervention. This is a blind study, where the inspector and the participants were unblind, while the assessor was blind to the settlement of the interventions.

Clinical Procedures: Each patient was given a serial number (ID) on list from 1-20. Data for every patient (ID, age, telephone number and address) was recorded in a chart. Patients were allocated into two groups of 10 patients each (n=10). Group I; used (Miswak, Macca Al Mokarama). Group II; used fluoride mouth rinse (0.05% sodium fluoride, FluoriGard, Colgate). The investigator (H.A.) explained the directions of the intervention use for all participants. Regarding the mouth rinse, half of the drug measuring cup was filled with the mouth rinse and used for 2 minutes and spit out twice daily for a month. Avoid swallowing or exceeding the prescribed dose. Meanwhile, miswak group participants used 15 cm of Miswak twigs. First trim the top of the twig and remove the outer part for 1 cm. Chew that part slowly to expose and separate the whiskers of the Miswak twig.⁽¹¹⁾ They used the twigs twice daily in a coronal direction. Both interventions were used for a month.

Saliva samples collection: Resting Saliva represents the basal salivary functions. Samples

were gathered from the patients at baseline (before any use of Miswak or Fluoride) and after 1 month. They were collected by spitting technique. Since they are affected by the body posture, head position as well as some drugs.^(12,13) Patients represented to the dental out clinic 2 hours after the main meal. The ideal position for collecting saliva samples was a comfortable upright sitting position with head slightly leaning forward. The samples were collected in a disposable plastic measure until the mark of 2 ml. saliva samples should be clear with no contamination neither blood nor diet remnants.

Salivary pH assessment: Immediately after collection, saliva assessment was done by (Digital Pocket pH meter). The pH bulb glass membrane is a hydrogen sensitive bulb. It was rinsed under distilled water for 5 seconds then the meter was turned on and left for 2 seconds for the meter to start. The pH bulb was immersed in the saliva sample for 5-10 seconds, until the reading is stable. Readings were taken for all samples.⁽¹⁴⁾

RESULTS

Statistical analysis

Data management and statistical analysis were performed using the Statistical Package for Social Sciences (SPSS) version 20. Numerical data were summarized using means and standard deviations. Data were explored for normality by checking the data distribution and using Kolmogorov-Smirnov and Shapiro-Wilk tests. Comparisons between groups with respect to normally distributed numeric variables was performed by independent t test, while non-parametric variables (percent change) were compared by Mann-Whitney U test. Comparisons between pre & post were performed using paired t test.

The percent change was calculated by the formula: **(Value after-value before) / value before X100**

All p-values are two-sided. P-values ≤ 0.05 were considered significant

Comparison between groups

Baseline: a higher mean value was recorded in Miswak group (7.43 ± 0.39) in comparison to Fluoride group (6.93 ± 0.43). The difference between groups was statistically significant ($p=0.014$), (Table 1, Fig. 2)

One month: a higher mean value was recorded in Miswak group (7.52 ± 0.8) in comparison to Fluoride group (7.23 ± 0.62). The difference between groups was not statistically significant ($p=0.377$), (Table 1, Fig. 2)

Percent change: a higher mean percent increase was recorded in Fluoride group ($4.42 \pm 7.72\%$;

median 5.34%); in comparison to Miswak group ($1.15 \pm 8.52\%$, median 1.27%). The difference between groups was not statistically significant ($p=0.545$), (Table 1, Fig. 2)

Comparison within the same group

Miswak: A higher mean value was recorded after one month (7.52 ± 0.8), in comparison to baseline (7.43 ± 0.39). The difference between baseline and after one month was not statistically significant ($p=0.671$), (Table2, Fig.1)

Fluoride: A higher mean value was recorded after one month (7.23 ± 0.62), in comparison to baseline (6.93 ± 0.43). The difference between baseline and after one month was not statistically significant ($p=0.117$), (Table2, Fig.1)

TABLE (1) Descriptive statistics and comparison between groups regarding baseline and one month values (independent t test) and percent change of pH (Mann Whitney U test)

	Groups	Mean	Std. Dev	Median	Difference				P value
					Mean	Std. Dev	C.I. upper	C.I. lower	
Baseline	Miswak	7.43	.39	7.55	.500	.183	.116	.884	.014*
	Fluoride	6.93	.43	7.00					
One month	Miswak	7.52	.80	7.65	.290	.320	-.382	.962	.377 ns
	Fluoride	7.23	.62	7.20					
Percent change	Miswak	1.15	8.52	1.27	-3.27	3.63	-10.91	4.37	.545 ns
	Fluoride	4.42	7.72	5.34					

Significance level $p \leq 0.05$, *significant, ns=non-significant

C.I. =95% confidence interval

TABLE (2) Comparison of baseline and one month values of pH within the same group (Paired t test)

Groups		Mean	Std. Dev	Paired difference				P value
				Mean	Std. Dev	C.I. upper	C.I. lower	
Miswak	Baseline	7.43	.39	-.090	.649	-.554	.374	.671 ns
	One month	7.52	.80					
Fluoride	Baseline	6.93	.43	-.300	.548	-.692	.092	.117 ns
	One month	7.23	.62					

Significance level $p \leq 0.05$, *significant, ns=non-significant

C.I. =95% confidence interval

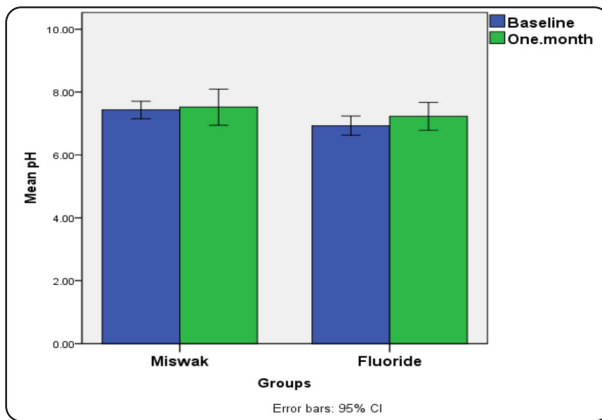


Fig. (1) Bar chart illustrating mean value of pH at baseline and after one month

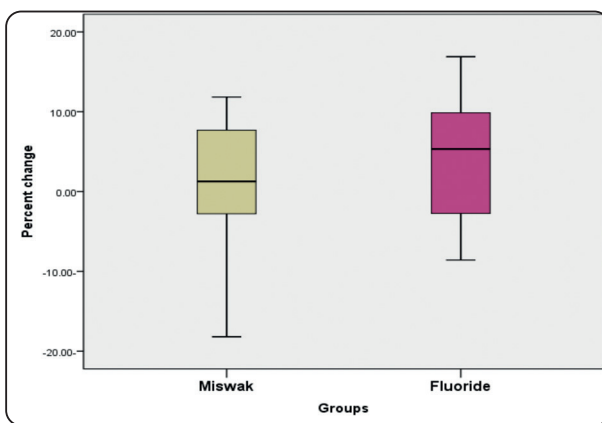


Fig. (2a) Box plot illustrating median value of percent change in p

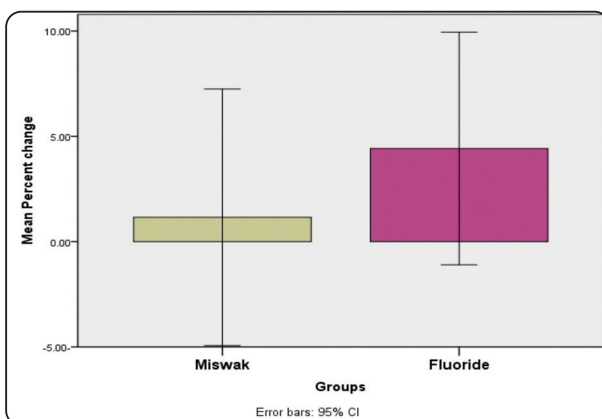


Fig. (2b) Bar chart illustrating mean value of percent change in pH

DISCUSSION

Poor oral health has been linked with many chronic and systemic disease.⁽¹⁵⁾ Tooth brushing with /without dentifrices is considered the most common way of teeth cleaning.⁽¹⁶⁾ Many research and studies have confirmed that the tooth brushing technique only with /or without using toothpastes was sufficient for disturbance or removing the biofilm and preventing caries initiation.^(16, 17, 18) By coming the era that dedicate the idea of “ back to nature” dentists trying to shift from using chemical products to natural products to take their benefits without the harmful side effects conjugated with chemical ones. Therefore, natural chewing sticks are become frequently used for oral and dental care. These sticks are selected and prepared from the twigs, stems or roots of a variety of plant species.⁽¹⁹⁾ Miswak (*Silvadora persica*) is one of the famous natural cleaning chewing sticks due to their low cost and availability simplicity especially in the Middle East.^(17, 19) Thus in this study we chose to use Miswak versus traditional fluoridated mouth rinse to compare their effects on salivary PH which regulates the balance between de-mineralization and re-mineralization process of tooth structure. *Salvadora persica* plant is worldwide known as Miswak tree. Miswak is an Arabic word. means “tooth cleaning stick” becomes a famous name for *Salvadora persica*. They are selected and prepared from the twigs, stems or roots of a variety of plant one end of the Miswak stem is trimmed to form an exposed end, which will then be chewed to form a brush. This brush is used to clean the teeth to remove any food deposits.⁽²⁰⁾ Also sodium fluoride was used as a comopotator in this study as it is considered a gold standard material for caries prevention and to stop caries progression. Sodium fluoride has anti cariogenic effect due to fluoride release and anti-bacterial effect especially against streptococcus mutans. In addition, its own mineralizing power as it releases minerals and enhances re-mineralizing and salivary functions.^(21, 22) Saliva plays a major

role in initiating and facilitating digestion and maintaining oral health. It protects the oral cavity against pathogens and moistens the oral tissues to support swallowing, chewing, speech, and taste.⁽¹²⁾ Saliva maintains the oral cavity clean and keeps it protected against pathogens by its antibacterial characteristics. One of the significant roles of saliva regarding maintaining a good oral condition is inhibiting de-mineralization and promoting re-mineralization which can be achieved by enhancing and maintain the pH. Keeping the oral pH in its normal range ensures suitable oral ecosystem for prevent de-mineralization and enhancing re-mineralization.^(12, 13) According to the results we can notice that there is an increase in the pH level of the saliva (in comparison to the base line) for all groups either for Miswak and fluoride mouthwash. Although there was not a statistically significant difference between both groups. These results revealed that emerging Miswak in the daily oral care routine could help in raising the pH of saliva as the result we obtained when using any fluoridated mouthwashes. Miswak is comprised of many organic contents like, glycoside, saponins, flavonoids, alkaloids, tannins, benzyl derivatives, phenol compounds, organic acids and in-organic anionic contents such as fluoride, chloride, sulphate, thiocyanate and nitrate.⁽²³⁾ Besides, it was reported that Miswak possesses antibacterial, anticariogenic and antiplaque effect.⁽²⁴⁾ Many studies were in agreement with our research results as they agreed on the efficiency of Miswak for decreasing plaque formation. and inhibiting the growth of plaque inducing bacteria.⁽²³⁻²⁶⁾ It was reported from previously mentioned studies that Miswak increase the stimulation of parotid gland salivary secretion, increasing the plaque pH thus it could decrease the acid challenge exerted by pathogenic acidogenic bacteria on hard dental tissues. Therefore, we can say that the effect of Miswak on PH level was very comparable to the effect of fluoride and this initiating the use of Miswak (as a natural material) in our daily

dental routine and replacing the chemical agents as Fluoride. Miswak interests in dental hygiene could be attributed to the brushing mechanical action of the teeth besides with its intrinsic chemical properties or both.⁽²⁵⁾ From the previously mentioned reasons for results we could say that the null hypothesis of this research is accepted as both Miswak and fluoridated mouth wash increase the salivary pH.

CONCLUSION

Under the limitations of this study, the following conclusions can be derived:

- Both Miswak and sodium fluoride mouthwash reported impact positive effect by enhancing and maintaining the salivary pH.
- Using Miswak as a natural extract can provide a satisfied effect when included in daily oral care routine.

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