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The antimicrobial effect of water extraction of *Salvadora persica* (Miswak) as a root canal irrigant

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ABSTRACT

The aim of this study was to evaluate the antimicrobial effect of 10% water extraction of *Salvadora persica* (Miswak) when used clinically as an endodontic irrigant.

Twenty four uniradicular teeth with necrotic pulps were chosen. The patients were divided randomly into 2 groups: Experimental group, in which water extract of *Salvadora persica* (10%) was used as a root canal irrigant; and control group, in which distilled water was used as a root canal irrigant.

Bacteriological samples were obtained from the canal at the step of working length determination (before the canal was subjected to instrumentation and irrigation procedures), and at the end of the biomechanical instrumentation procedures by using a sterile K–file. The file was separated from the handle using a sterile wire cutter, and the severed portion was placed in a sterile screw–capped vial containing 5 ml of thioglycollate broth as a transport media. A 0.1 ml of thioglycollate broth was inoculated on each of two brain–heart infusion agar plates: One plate was incubated under aerobic conditions, and the other was incubated under anaerobic conditions using anaerobic jar and gas pack anaerobic system. Both plates were incubated at 37 ºC for 24 hours; then, the number of bacterial colonies was counted.

The results revealed that 10% water extraction of *Salvadora persica* is an effective antimicrobial agent when utilized clinically as an irrigant in the endodontic treatment of teeth with necrotic pulps.

Key Words: Miswak, antimicrobial effect, root canal irrigant.

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INTRODUCTION

The aim of root canal therapy is to alter the balance of the microbial environment in order to allow the periapical tissues to heal.(1)

Irrigating solutions used in endodontic treatment not only present antimicrobial action, but they also clean the pulp chamber. When endodontic treatment is performed under aseptic conditions and according to accepted clinical principles, the success rate is generally high.(2, 3)

The irrigating solution must combine maximum antimicrobial action with minimum toxicity, physical and chemical prop-

erties associated with a feasible cost to the professional.[4]

Antimicrobial agent must suppress or destroy microbial growth; thus susceptibility of the microorganisms, penetration of antimicrobial agent to the infected site, adequate concentration of the agent, low toxicity of the host cell, lack of microorganism development of resistance to the agent are necessary.[5]

Miswak is mainly used to describe the stick, which is used for cleansing the teeth. Arak is the plant from which Miswak is derived (*Salvadora persica*).[6]

Many studies have been carried out on different types of chewing sticks focused mainly on antimicrobial activity of these sticks. Akpata and Akinrimisi[7] found that alcoholic and water extracts of *Salvadora persica* inhibited the growth of *Streptococcus pyogenes*, *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa*.

Al–Lafi and Ababneh[8] found that benzyl thiocyanate present in *Salvadora persica* inhibited the growth of *Streptococcus mutans*, and suggested that *Salvadora persica* decreases the incidence of dental caries.

Wolinsky and Sote,[9] by isolation of the active ingredient from *Salvadora persica*, found that the limonoid had a great antimicrobial activity against various Gram positive and Gram negative microorganisms.

Sote and Wolinsky[10] showed that *Salvadora persica* had a growth–inhibitory effect compatible to chlorhexidine.

Homer *et al*.[11] tested the inhibitory action of aqueous extract of *Salvadora persica*. They found that this extract inhibited the growth of different types of bacteria by interfering with extrapolysaccharides and glycosidase enzymes produced by these microorganisms.

The aim of this study was to evaluate the antimicrobial effect of 10% water extraction of *Salvadora persica* (Miswak) when used clinically as an irrigant for infected root canal system.

MATERIALS AND METHODS

The experimental subjects for this study were selected from referrals to the Department of Conservative Dentistry, University of Mosul, College of Dentistry. Primary criterion for inclusion of subjects in the study was the presence of a radiographically demonstrable apical periodontitis on a single–rooted tooth with a necrotic pulp. Patients were excluded from the study if they were on antibiotics for the 2 weeks prior to treatment, the root canal in question had been entered or medicated before the inclusion stage, or there was a sinus tract. A total of 24 teeth were treated. The age of the patients ranged from 18–60 years.

The patients were divided randomly into 2 groups:

- ***Experimental Group:*** In this group, water extract of *Salvadora persica* 10% was used as a root canal irrigant.
- ***Control Group:*** In this group, sterile distilled water was used as a root canal irrigant.

After rubber dam isolation, the operative field was disinfected with 2% iodine. An access opening was made with sterile burs. The working length was established by placing a sterile K–file that fits snuggly in the root canal within the average working length. A radiograph was taken and the file length was adjusted to within 1 mm short of the radiographic apex. Then the file was rotated with an effort to contact all canal walls in an attempt to engage as many bacteria as possible. The file was withdrawn from the canal, and its cutting edge was separated from the handle using a sterile wire cutter. The separated portion was placed in a screw–capped vial containing 5 ml of thioglycollate broth as a transport media. The canal was then instrumented with K–files at least three sizes larger than the first file that fit snuggly within one millimeter of the apex. Circumferential filing action was used for instrumentation. The canal was irrigated after each file size with 5 ml of the irrigant related to the group of patients. Canal instrumentation was continued until a clean white dentin was obtained in the flutes of the file. The canal was then dried with sterile paper points, and a sample of its contents was taken again. The samples were then transferred for culturing and incubation. A 0.1 ml of thioglycollate broth was inoculated on each of two brain–heart infusion

agar plates. One plate was incubated under aerobic condition, and the other was incubated under anaerobic condition using ana-erobic jar and gas pack anaerobic system. Both plates were incubated at 37 ºC for 24 hours; then, the number of bacterial colo-nies was counted.

Regarding statistical analysis of the data, by using Student's t–test, the significance of difference between the mean bacterial counts before and after irrigation was tested for both groups.

RESULTS AND DISCUSSION

The pulp space of all 24 teeth contained bacteria at the beginning of treatment.

For the experimental group, the reduction of the aerobic and anaerobic bacterial counts at the end of the instrumentation and irrigation procedures was 91.7% and 89.6% respectively (Table 1 and Figure 1). By the use of Student's t–test, it was found that this reduction is statistically highly significant (p<0.001) (Table 1). This result may, therefore, enforce the need for a combination of mechanical instrumentation and antibacterial action of irrigant solution in order to effectively remove most root canal bacteria.

For the control group, the reduction of the bacterial counts (aerobic and anaerobic) at the end of the instrumentation and irrigation procedures was 60.2% and 57.3% respectively (Table 1 and Figure 2). Student's t–test showed that this reduction is statistically significant (p<0.05) (Table 1). This reduction may be attributed to the effect of mechanical root canal instrument-ation coupled with the physical flushing effect of distilled water.

Table (1): The percentage of bacterial reduction (aerobic and anaerobic) before and after instrumentation and irrigation procedures for the experimental and control groups

Group	Type of Bacteria	Mean ± Standard Deviation		Percentage of Reduction	t–test	*p*–value
		Before	After			
Experimental	Aerobic	477 ± 128.0	40 ± 8.2	91.7	11.51*	0.0000
	Anaerobic	459 ± 103.0	48 ± 10.1	89.6	13.70*	0.0000
Control	Aerobic	445 ± 91.5	177 ± 17.7	60.2	9.96*	0.0000
	Anaerobic	469 ± 73.8	200 ± 15.2	57.3	12.34*	0.0000

* Significant difference at $p \leq 0.001$

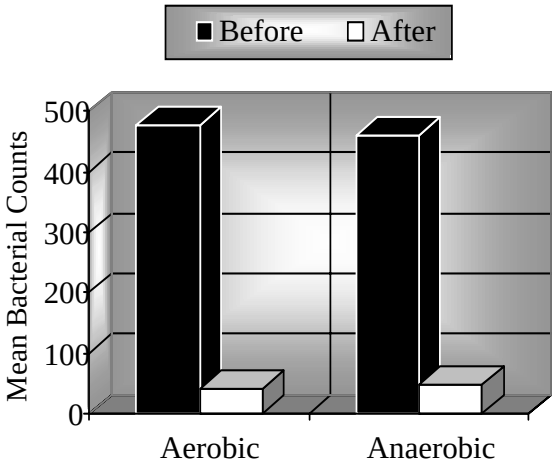

Figure (1): Mean bacterial counts before and after instrumentation and irrigation procedures for the experimental group

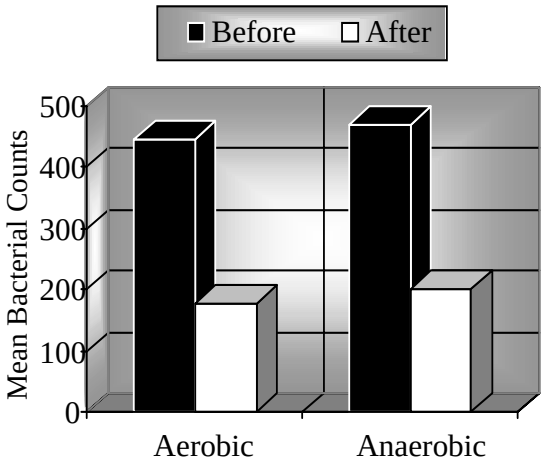

Figure (2): Mean bacterial counts before and after instrumentation and irrigation procedures for the control group

By comparing the results for both groups, it was found that the reduction of the bacterial counts (both aerobic and anaerobic) for the experimental group was significantly higher ($p<0.001$) (Table 2) than that for the control group. These findings indicated that 10% water extraction of *Salvadora persica* could be an effective antibacterial agent when used clinically as an endodontic irrigant for teeth with necrotic pulps.

The results of this study coincide with the results of other stud-ies[7–11] that proved the antimicrobial effect of *Salvadora persica*.

Table (2): Comparison of the bacterial reduction between experimental and control groups

Time of Sampling	Type of Bacteria	Mean ± Standard Deviation		t–test	*p*–value
		Experimental	Control		
Before	Aerobic	477 ± 128.0	445 ± 91.5	0.71**	0.48
	Anaerobic	459 ± 103.0	469 ± 73.8	–0.26 **	0.80
After	Aerobic	40 ± 8.2	177 ± 17.7	–24.30*	0.0000
	Anaerobic	48 ± 10.1	200 ± 15.2	–28.79*	0.0000

* Significant difference at $p \leq 0.001$; ** No significant difference at $p \geq 0.05$.

CONCLUSION

From this study, it could be concluded that 10% water extraction of *Salvadora persica* is an effective antimicrobial agent when utilized clinically as an irrigant in the endodontic treatment of teeth with necrotic pulps.

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