

Comparison of sodium hypochlorite, propolis and saline as root canal irrigants: A pilot study

Hind Al-Qathami, BDS, Msc and Ebtissam Al-Madi, BDS, MSc

هيبوكلوريت الصوديوم كغسول في علاج الجذور يملك العديد من السلبيات التي تتضمن كونه مادة سامة ، كريه الرائحة ، ويسبب تغير في لون محتويات العيادة . وجود مطهر له نفس الفاعلية ولكنه آمن ، هو شئ مرغوب فيه. الهدف من هذه الدراسة هو إجراء مقارنة للنشاط المضاد للعفونة لمادة البروبوليس وهيبوكلوريت الصوديوم في المختبر على الأوعية الجذرية لـ ٤٩ سنا بشرية مقلوعة ومصابة بالنخر النافذ. وتم تحضير أقينتها بإستخدام طريقة الدرجة الراحعة، وأستخدم ككلام من مادة البروبوليس وهيبوكلوريت الصوديوم (كلوركس) والسالين كغسول . وقد تم أخذ عينات جراثومية من الأسنان مباشرة بعد الوصول إلى قناة السن وبعد إتمام تحضير الأوعية الجذرية وإستخدام الغسول . أوضحت النتائج أن مادة البروبوليس لها نفس التأثير المضاد للعفونة لمادة هيبوكلوريت الصوديوم.

Sodium hypochlorite as an endodontic irrigant, poses problems of toxicity, odor and discoloration of operatory items. An equally effective, but safe irrigant is desirable. The purpose of this study was to compare the anti-microbial activity of propolis with that of sodium hypochlorite in an *in vitro* root canal system. Forty-nine extracted human teeth with large carious lesions reaching the pulp were instrumented using step-back technique. Propolis, sodium hypochlorite and saline were used as irrigants. Microbiological samples were taken from the teeth immediately after accessing the canal, and after instrumentation and irrigation. The results of this study indicated that the propolis has antimicrobial activity equal to that of sodium hypochlorite.

Introduction

The pulp chambers and root canals of untreated teeth that need endodontic treatment are filled with gelatinous masses of necrotic pulp remnants and tissue fluid. Bacteria are usually present as well. Instruments thrust into these canals are likely to force such noxious materials through the apical foramen, with resulting periradicular inflammation and/or infection. Therefore, the canals are irrigated with a solution capable of disinfecting them and dissolving organic matter before and at frequent intervals during instrumentation. In addition to the debriding action, irrigation serves the purpose of facilitating instrumentation by lubricating canal walls and by floating out dentinal fillings.¹

Several irrigating solutions are being used in today's modern practices such as sodium hypochlorite alone or sodium hypochlorite in combination with other irrigating or chelating agents such as Rc-prep and EDTA (Ethylene diamine tetraacetic acid). In addition, irrigating solutions include saline, water, anesthetic solutions, hydrogen peroxide and others are also being used. However none of them is as effective as sodium hypochlorite.¹⁻³

Sodium hypochlorite (NaOCl) is manufactured by the reaction of molecular chlorine with sodium hydroxide and water. A small excess of sodium hydroxide is required to maintain the pH between

11 and 13 to minimize decomposition.⁴ Sodium hypochlorite is very biocidal against bacterial vegetative forms, *Candida albicans*, viruses, and some spore forms. Unfortunately hypochlorite is corrosive to metals, irritating to skin and eyes, has a strong odor, tends to be unstable, causes tissue irritation and can discolor operatory items.⁵⁻⁸ Consequently, another irrigant with less adverse effect is desirable.

Propolis is a sticky, resinous material gathered by bees from bud scales of plants and trees. The bees take the resin back to their hives and work on it, producing a glue-like substance with which they fill cracks and seal up their hives. Propolis is derived from the Greek word "pro" before, polis "city" or defender of the city. It is composed of resin (55%), essential oils and wax (30%) mixed with bee glue "the salivary secretions of bees" and pollen (5%) and other constituents (10%) which are amino acids, minerals, ethanol (alcohol), vitamins A, β complex, E and the highly active bio-chemical substance known as bioflavonoid.⁹

Some physicians use propolis as a medication because it extracts stings, reduces swelling, softens indurations, soothes pain of sinews and heels sores. It has been proven to have antibacterial, antiviral, antifungal, anti-inflammatory activities and an anesthetic action.¹⁰ In dentistry, propolis has been used for surgical wound repair,¹¹ direct and indirect pulp capping,¹²

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Lecturer

Department of Restorative Dental Sciences

College of Dentistry, King Saud University, Riyadh, KSA

Address reprint requests to:

Dr. Hind Al-Qathami

Department of Restorative Dental Sciences

College of Dentistry, King Saud University

P.O. Box 60169, Riyadh 11545, KSA

reduction of dentin hypersensitivity,¹³ and in treatment of infected root canals and periodontitis.¹⁴

In this study, a comparison of the anti-microbial activity of propolis and sodium hypochlorite in an *in vitro* root canal system of pathologically exposed pulps was investigated.

Materials and Methods

Forty-nine extracted human teeth were collected from the emergency and students clinic of the College of Dentistry of King Saud University. All teeth had obvious pulpal pathosis such as a carious lesion extending into the pulp chamber (18 teeth) or periradicular radiolucency (31 teeth) on their radiographs. All teeth exhibited negative response (necrotic pulps) to electrical and thermal pulp tests. The teeth were stored in sterile saline and used within two weeks of extraction. The canals of single rooted teeth (maxillary and mandibular premolars and canines), distal canals of 1st and 2nd mandibular molars, and palatal canals of maxillary 1st and 2nd molars were used. Teeth were assigned randomly to the following three irrigants: (1) a 2.5% solution of sodium hypochlorite,* (2) sterile physiological saline,** (3) a 1:120 solution of propolis.*** A 500 mg tablet of propolis was dissolved in 120 ml warm sterile distilled water.

To access the root canal system, each tooth was disinfected by wiping the surface with iodophor.[†] The iodophor was removed with 70% ethanol and an access was made with a high-speed handpiece and sterile saline. The handpiece was disinfected after each tooth with iodophor and 70% ethanol. The pulp was removed with a sterile barbed broach or file held with sterile hemostats. The broach or the file with pulp tissue were dropped into 10 ml of thioglycollate broth. This constituted the "pre-irrigant culture" specimen.[‡]

Working length was determined by advancing a #10 K-type file![§] apically into each canal until the file tip was flush with apical foramen. The distance from that point to a coronal reference point was determined and 1 mm was subtracted to establish working length. Instrumentation was accomplished by widening the coronal part with Gates Glidden![¶] from size 2 to size 4 operated in

low-speed handpiece and then the apical portion was prepared by a conventional step-back technique[¶] using K-type files until size 50 was reached. The canals were irrigated with 1 ml of irrigant between each file size and with 3 ml of irrigant after reaching the master apical file (#50). The canals were then dried with sterile paper points.^{¶¶} The microbial status of the canal was evaluated by filling it with thioglycollate broth delivered with a sterile tuberculin syringe with a 26-gauge needle. A size 25 K-file was used to agitate the broth inside the canal. The broth was then removed with a sterile syringe and placed in a sterile bottle containing 10 ml of thioglycollate broth. This constituted the "post-irrigant culture" specimen. All disinfection procedures and instrumentation of the canals were done by one operator, while the pre- and post-irrigant culture samples were taken by the other operator. The pre and the post specimens were incubated at 37° for 72 hours in an anaerobic chamber. Growth in thioglycollate broth was recorded as positive (presence of turbidity in thioglycollate broth) or negative (clear thioglycollate broth).

Non-Parametric Kruskal-Wallis one-way ANOVA and Tukey HSD tests were used to evaluate the difference between the anti-microbial activities of the different irrigants.

Results

A total of 49 teeth studied randomly included 18 irrigated with sodium hypochlorite, 18 with propolis and 13 with saline. All pre-irrigant cultures obtained prior to biomechanical preparation of all teeth were positive which confirmed the presence of microorganisms in all the teeth. Irrigation with propolis or sodium hypochlorite significantly ($P < 0.05$) reduced the number of post-irrigant positive growth compared with the post-irrigant positive growth obtained from saline-treated teeth (control).

The number of post-irrigant positive growth obtained from propolis-treated teeth was higher than the number obtained from sodium hypochlorite-treated teeth, but this difference was not significant ($P > 0.05$).

Discussion

The results of this study indicated that propolis is as equally effective as sodium hypochlorite when used as an anti-microbial endodontic irrigant. There was a similar significant reduction in the number of positive growths in both groups

* Clorox, Oakland, CA, USA

** Baxter, Deerfield, IL, USA

*** CC Pollen Co., 3627E, USA

† Wescodyne, AMSCO, Erie, PA, USA

‡ Union Broach Health, Chem Co., Emitts Ville, PA, USA

§ Kerr, Romulus, MI, USA

of treated teeth when compared with the saline-treated control. Propolis irrigation resulted in slightly higher positive post-irrigant growth than did sodium hypochlorite irrigation, but the difference was not significant.

This study could very well be the first research which compared the anti-microbial activity of propolis with that of sodium hypochlorite in endodontic treatment. However, propolis had been previously used as filler for root-canal obturation and as an irrigant for treatment of acute, exacerbated and chronic forms of periodontitis.¹⁴

The anti-microbial effects of propolis in this study are similar to those obtained by others who have evaluated the inhibitory effect of propolis solution on bacterial growth. Grang and Davey¹⁶ used a propolis dilution of 1:20 in nutrient agar and they found that it had an inhibitory effect on gram-positive cocci and rods. Koo *et al.*¹⁷ found that propolis had an antibacterial effect on *S. mutans*, *S. Sanguis* and *A. naeslundii*. Antibacterial characteristic of propolis had been explained in a number of ways. One study reported that it prevented bacterial cell division and also broke down bacterial walls and cytoplasm similar to the action of some antibiotics.¹⁸ In another study, Kujumgiev *et al.*¹⁹ reported the antibacterial, antifungal and the antiviral activities of propolis to be due to flavonoids and esters of phenolic acids. The antimicrobial activity of sodium hypochlorite, however, is known to be due to free chlorine ions which inactivate sulfhydryl enzymes and nucleic acids and denature proteins of the microorganisms.⁵

If anti-microbial activity was the only requirement of an endodontic irrigant, the results of this study would indicate that propolis is as good as sodium hypochlorite. However, sodium hypochlorite possesses other significant attributes that propolis is not known to possess. Many investigators have reported that sodium hypochlorite can dissolve pulp tissues as well as necrotic tissue.^{20,21} Further investigation is currently being conducted by the authors to evaluate the effectiveness of propolis in pulp and necrotic tissues debridement. Until then, sodium hypochlorite still remains the irrigant of choice in endodontic therapy.

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