Effect of Two Natural Irrigations on Canal Cleanliness and Microhardness of Root Canal Dentin

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Dedication

I dedicate my Master thesis to my family the source of encouragement and inspiration throughout my life.

I dedicate it also to my friends for their great support and help at all times.

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INTRODUCTION

Microorganisms and their by-products are considered to be the primary etiologic agents in endodontic diseases. The objective of endodontic treatment is to prevent or eliminate infection within the root canal. In every root canal system there are spaces that cannot be cleaned mechanically and where cleaning is dependent on thorough chemo mechanical debridement of pulpal tissue, dentin debris, and infective microorganisms. Infection control is critical for the success of nonsurgical endodontic treatment.

Irrigation is complementary to instrumentation in facilitating the removal of pulp tissue and/or microorganisms. There are a number of ideal requirements of a root canal irrigant. It should: a) have a broad antimicrobial spectrum and high efficacy against anaerobic and facultative microorganisms, b) dissolve necrotic pulp tissue remnants, c) inactivate endotoxin, d) prevent the formation of a smear layer during instrumentation or dissolve it, e) be systemically nontoxic, f) be non caustic to periodontal tissues and g) be little potential to cause an anaphylactic reaction.[(1)]

Sodium hypochlorite has remained a popular root canal irrigant because of its antimicrobial potential and its ability to dissolve organic matter. But it possesses certain disadvantages such as: a) high toxicity, b) unpleasant taste, c) inability to remove the smear layer, d) reduction in elastic modulus and flexural strength of dentin,[(2)] e) corrosive to instruments,[(3)] f) staining of instruments and g) burning of surrounding tissues.[(4)]

Owing to the potential side effects, safety concerns and ineffectiveness of conventional allopathic formulations all of these have prompted researchers to look for natural alternatives. Herbal or natural products have become more popular today due to their high antimicrobial activity, biocompatibility, anti-inflammatory and anti-oxidant properties.
From these natural plant extracts are Curcumin (Cu) and Propolis. Curcumin (Cu) is a diferuloyl methane present in extracts of the plant (turmeric or rhizome). Curcuminoids are responsible for the yellow color of turmeric. They are derived from turmeric by ethanol extraction. Cu longa contains three major curcuminoids (approximately 77% Cu, 17% demethoxycurcumin and 3% bis demethoxycurcunin). Various studies showed that Cu has antioxidant, anti-inflammatory, antifungal and antibacterial activities.

Propolis (bee glue) is a resinous hive substance produced by honeybees from products collected from plants. In general, it is composed of 50% balsams and resins, 30% wax, 10% essential oils, 5% pollen and 5% of various other substances like sugars, vitamins, etc. Bees modify propolis by β-glucodiases, enzymes from hypopharyngeal glands, during collection and processing. It is known to possess valuable antimicrobial, antiviral, antifungal, local anesthetic, antiulcer, immunostimulating, hypotensive and cytostatic properties. The effect of these materials on microhardness and canal cleanliness is still unclear and needs to be investigated.

REVIEW OF LITERATURE

• Herbal irrigants:

Al-Qathami and Al-Madi [5] compared the anti-microbial activity of propolis with that of sodium hypochlorite in a root canal system. Forty-nine extracted human teeth with large carious lesions reaching the pulp were instrumented using step-back technique. They used Propolis, sodium hypochlorite and saline as irrigants. Microbiological samples were taken from the teeth immediately after accessing the canal and after instrumentation and irrigation. They concluded that propolis has antimicrobial activity equal to that of sodium hypochlorite.

Murray et al [6] compared in vitro the effectiveness of Morinda citrifolia juice (MCJ) with sodium hypochlorite (NaOCl) and chlorhexidine gluconate (CHX) to remove the smear layer from the canals of endodontically instrumented teeth. Sixty extracted, single-rooted, permanent premolar teeth with a single canal were inoculated with Enterococcus faecalis at 37°C in a CO_2 atmosphere for 30 days. Irrigation was provided by MCJ, NaOCl, CHX, MCJ/CHX, followed by a final flush of 17% ethylenediaminetetraacetic acid (EDTA). The teeth were then examined by scanning electron microscopy for the removal of smear layer. They found that the most removal of smear layer occurred with MCJ and NaOCl, both with a rinse of 17% EDTA where both completely remove up to 80% of the smear layer from some aspects of the root canal. They concluded that MCJ was more effective than CHX for removing smear layer. MCJ appears to be the first fruit juice to be alternative to NaOCl as an intracanal irrigant.

Kandaswamy et al [7] investigated the antimicrobial activity of 2% chlorhexidine gel, propolis, Morinda citrifolia juice (MCJ), 2% povidone

Iodine (POV-I), and calcium hydroxide on Enterococcus faecalis-infected root canal dentine at two depths (200 um and 400 um) and three time intervals (day 1, 3 & 5). 180 extracted human teeth were infected for 21 days with E. faecalis. Samples were divided as: Group I (Saline), Group II (Propolis), Group III (MCJ), Group IV (2% povidone Iodine), Group V (2% Chlorhexidine Gel), Group VI (Calcium hydroxide). Dentine shavings were collected at depths (200 um and 400 um), and numbers of colony forming units were determined. They found that colony-forming units number was statistically significant in all groups compared to Saline group. Group V (chlorhexidine gluconate) (100%) produced better antimicrobial efficacy followed by 2% POV-I (87%), Propolis (71%), MCJ (69%) and Calcium hydroxide (55%). There was no significant difference between Propolis and MCJ. They concluded that Propolis and MCJ were effective against E. faecalis in dentine of extracted teeth.

Costa et al [8] evaluated the antimicrobial activity and the root canal cleaning ability of plant extracts used in irrigation solutions. They examined Aroeira-da-praia and the Quixabeira hydroalcoholic extracts,of 2.5% Sodium hypochlorite (NaOCl) and of 0.12% Chlorhexidine against Enterococcus faecalis. Root canal cleanliness was examined by Scanning Electron Microscopy (SEM). Twenty one single-rooted human teeth were divided into three groups: 1) 50% Aroeira-da-praia; 2) 50% Quixabeira and 3) a combination of 2.5% Sodium hypochlorite + 17% EDTA. They found that all solutions showed antimicrobial activity against Enterococcus faecalis. The SEM analysis revealed that higher and lower degrees of surface cleaning were in the three groups, respectively for the coronal and apical thirds, where Quixabeira has the greatest efficiency in removing the smear layer in the apical third. They found that all agents presented antimicrobial activity against E. faecalis. None, was able to

completely remove the smear layer in the different thirds of the canal.

Kulkarni et al [9] evaluated extraction method of turmeric using Soxhlet extractor. Isolation and purification of curcuminoids was carried out by column chromatography. The quantification of curcumin in maximum resultant extract (by methanol) was performed by pre validated HPLC methodology. Percentage of curcumin by HPLC was 12.39%. Extracted curcuminoids were subjected to spectrophotometer to check it's percentage amount in extracted sample. Different solvent were used for extraction, among them methanol showed maximum yield of each curcuminoids. Separation of curcuminoids were tested in TLC chloroform: methanol at 95:5 showed RF value at 0.67, 0.6, 0.506 as curcumin, dimethoxycurcumin,bis demethoxycurcumin respectively. The methanol extract was subjected to silica gel column chromatography with chloroform: methanol at increasing polarity followed by TLC to check purity of extracted curcumin.

Silva et al [10] evaluated the efficacy of chitosan compared with different chelating agents, and quantified, by atomic absorption spectrophotometry with flame (AASF), the concentration of calcium ions in these solutions after irrigation. 25 canines prepared by crown-down technique. The teeth were divided into 5 groups (n = 5): 15% EDTA, 0.2% chitosan, 10% citric acid, 1% acetic acid and control. Roots were split longitudinally and examined by SEM for evaluation of smear layer removal. They found that 15% EDTA, 0.2% chitosan and 10% citric acid had similar smear layer removal with a significant difference from 1% acetic acid and the control group. There was no significant difference between the remaining smear layer in the middle and apical thirds. The highest calcium ion concentration was with 15% EDTA and 0.2% chitosan, with no significant difference. The lowest calcium ion