

# Effectiveness of Sodium Hypochlorite and Etidronic Acid in Combination as a Root Canal Irrigant with Varying Apical Preparation Sizes- An *in vitro* Analysis

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## Abstract

Sodium hypochlorite is a proteolytic and antimicrobial agent and most commonly used during root canal therapy due to its tissue dissolving ability, as it helps in removing the necrotic tissue debris from the root canal. A hypochlorite- chelator combination can reduce the hard tissue debris accumulation during rotary root canal instrumentation. Hence etidronic acid was selected as the chelator in this study. Etidronic acid is a soft chelating agent and a potential alternative to EDTA which is used to remove the inorganic debris namely, the smear layer, from the root canal which is produced during instrumentation of the root canal. The study included varying apical preparation sizes using rotary system, to know whether a conservative approach in root canal preparation could be attained by the combination of these two irrigants. The results concluded that larger apical preparations showed better debridement with these agents. However, the combination of these irrigants may prove to be effective with smaller preparation sizes when used with other mechanical irrigating techniques.

**Keywords:** Hypochlorite, Etidronate, Proteolysis, Smear Layer

## INTRODUCTION

Endodontic therapy is aimed at achieving long-term retention and function of the tooth. The integrity of the tooth structure after root canal preparation greatly impacts the endodontic outcome. Hence an alternative approach is taken to minimize structural changes during root canal therapy with minimally invasive endodontic therapy maintaining the strength of the teeth. Minimally invasive endodontics aims at less removal of tooth structure from the root canal walls and help in reinforcing the tooth, maintaining form and function for longevity.

During endodontic therapy, chemical solutions are used to assist the action of endodontic instruments in the process of cleaning and shaping the root canal system. The lubrication of dentinal walls by these solutions would lower mechanical stress on rotary root canal instruments preventing instrument separation<sup>[1]</sup>.

Bacteria have long been recognized as the primary etiologic factor in the development of pulp and periapical lesions<sup>[2]</sup>. Successful root canal therapy depends on thorough chemo mechanical debridement of pulpal tissue, dentin debris, and infective microorganisms. Irrigants can augment mechanical debridement by flushing out debris, dissolving tissue, and disinfecting the root canal system. Chemical debridement is especially needed for teeth with complex internal anatomy such as fins or other irregularities that might be missed by instrumentation<sup>[3]</sup>.

### Ideal Requirements Of Root Canal Irrigants<sup>[1]</sup>

In irrigant should have a broad antimicrobial spectrum. With a high efficacy against anaerobic and facultative microorganisms organized in biofilms. It should also have

an ability to dissolve necrotic pulp tissue remnants and inactivate endotoxins. It should also prevent the formation of a smear layer during instrumentation or to dissolve the latter once it has formed. Finally it should be systemically nontoxic when in contact with vital tissues, noncaustic to periodontal tissues, and with little potential to cause an anaphylactic reaction.

NaOCl is one of the most popular and widely used endodontic irrigants since 1920 as for its antibacterial activity as for its capacity of dissolving organic tissue<sup>[4]</sup>. The antimicrobial effect of NaOCl results from the formation of hypochlorous acid (HOCl), when reacts with organic debris. HOCl exerts its effect by oxidation of sulphhydryl groups within bacterial enzyme systems disrupting the microbial metabolism<sup>[5]</sup>.

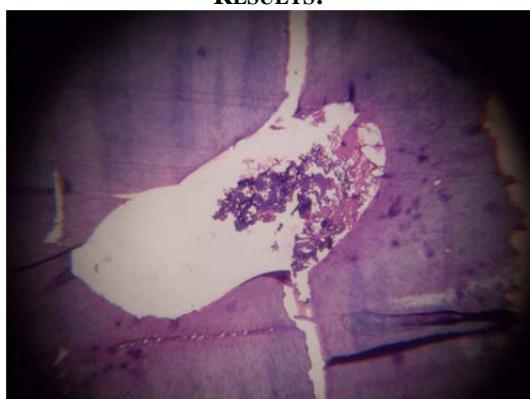
HEBP (1-hydroxyethylidene-1, 1-bisphosphonate): It is also known as etidronic acid or etidronate, has been proposed as a potential alternative to EDTA or citric acid<sup>[6]</sup>. HEBP is non-toxic and has been systematically applied to treat bone diseases. The demineralization kinetics promoted by both 9% HEBP and 18% HEBP were significantly slower than those of 17% EDTA [7].

Etidronic acid (also known as 1-hydroxyethylidene-1,1-bisphosphonate or HEBP) is a biocompatible chelator that can be used in combination with sodium hypochlorite and have adequate calcium chelating capacity<sup>[8]</sup>. Bisphosphonates are highly biocompatible chelators systemically administered in patients suffering from osteoporosis or neoplastic diseases involving osteolytic bone destruction<sup>[9]</sup>.

**MATERIALS AND METHODS:**

(n = 12) freshly extracted human mandibular premolar teeth with single oval canals were collected and divided into two groups A and B, i.e., six teeth per group. The canals were prepared in a crown down fashion using the rotary system and copiously irrigated with 10ml NaOH+HEBP in 3 minutes using a 26-gauge needle and syringe. Group A was prepared to a size 20/0.06% while group B was prepared to size 40/0.06%. Once the canals were prepared, they were subjected to irrigation in the following manner. First the canals were flushed with 30ml of NaOCl+HEBP for 10 minutes, at the rate of 3ml/min. once this step was completed, the canals were further flushed with 12 ml of irrigant for 3 minutes at the rate of 4ml/min. On completion of irrigation protocol, the specimens were subjected to histological examination.

**RESULTS:**



Group A



Group B

Group A	Group B
41.2 ± 3.12 <sup>a,A</sup>	4.1 ± 20.8 ± 3.23 <sup>a,A</sup>

**Table 1.** Means and standard deviations (SD) for remaining pulp tissue in the oval canals of mandibular premolars (%) following application of the experimental groups for each group (n=10), 3mm from the apex

Mean values that share a lower case superscript letter were not significantly different at the 5% level along the columns and mean values that share an upper case superscript letter

were not significantly different at the 5% level along the rows.

Statistics used: Two way ANOVA using apical size and irrigation methods as variables and percentage of remaining pulp tissue as outcome measure.

There was significant difference between Group A and B. When canals were irrigated using a syringe and needle, there was a significant difference in the amount of remaining tissue between the two apical preparation sizes i.e., larger apical preparations result in significantly better cleaning than preparations with smaller apical sizes.

**DISCUSSION:**

Successful root canal therapy relies on the combination of proper instrumentation, irrigation, and obturation of the root canal. Of these three essential steps of root canal therapy, irrigation of the root canal is the most important determinant in the healing of the periapical tissues [10]. Sodium hypochlorite is a proteolytic and antimicrobial agent and most commonly used during root canal therapy due to its tissue dissolving ability, as it helps in removing the necrotic tissue debris from the root canal [11]. A hypochlorite- chelator combination can reduce the hard tissue debris accumulation during rotary root canal instrumentation [12]. Hence etidronic acid was selected as the chelator in this study. Etidronic acid is a soft chelating agent and a potential alternative to EDTA which is used to remove the inorganic debris namely, the smear layer, from the root canal which is produced during instrumentation of the root canal [5]. The rotary instrument used in this study is V-taper rotary files which is a performance-enhanced system that is easier, safer, more efficient, and less expensive other NiTi rotary file system [13].

The study included varying apical preparation sizes using rotary system, to know whether a conservative approach in root canal preparation could be attained by the combination of these two irrigants. But the results concluded that larger apical preparations showed better debridement with these agents. However, the combination of these irrigants may prove to be effective with smaller preparation sizes when used with other mechanical irrigating techniques. Further studies are required on this study to attain a conservative approach.

**CONCLUSION:**

Within the parameters of volume of irrigant used in this study, when only syringe irrigation is employed, larger apical preparations showed significant debridement of oval root canals.

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