



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم



MONA MAGHRABY



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جامعة عين شمس التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغييرات



يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار



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**Faculty of Dentistry
Endodontic Department**

**Evaluation of Chemical Stability, Tissue
Dissolution Capacity and Ability to Remove the
Smear Layer of Calcium Hypochlorite Solution
When Used As an Endodontic Irrigant
(An in vitro study)**

Thesis

Submitted to department of Endodontics, Faculty of Dentistry,
Ain Shams University, in partial fulfillment of the requirements
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*First and foremost, I feel always indebted to **ALLAH**, the Most Kind and Most Merciful.*

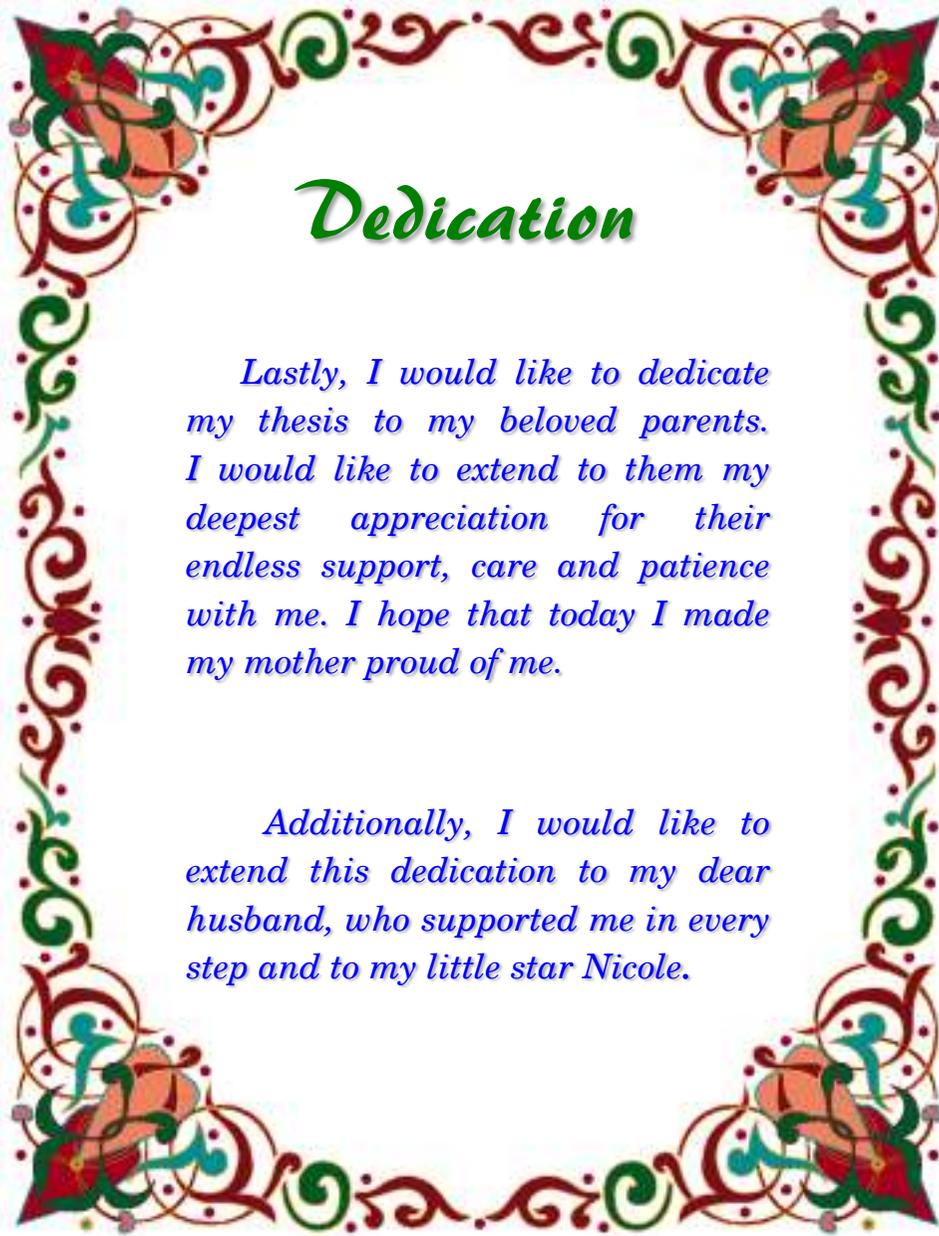
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A decorative border with intricate floral and scrollwork patterns in shades of red, green, and orange, framing the central text.

Dedication

Lastly, I would like to dedicate my thesis to my beloved parents. I would like to extend to them my deepest appreciation for their endless support, care and patience with me. I hope that today I made my mother proud of me.

Additionally, I would like to extend this dedication to my dear husband, who supported me in every step and to my little star Nicole.

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INTRODUCTION

The main purpose of endodontics is the reduction of bacteria and their products by chemical-mechanical preparation followed by obturation in order to maintain or to restore the health of periradicular tissues. Endodontic treatment aims to eliminate inflamed pulpal tissue, to clean and to obturate the canals.

During the mechanical preparation, large areas of the root-canal wall remain untouched by the instruments explaining the importance of chemical means of cleaning and disinfecting all areas of the root canal.

The ideal requirements of irrigation includes, washing action (helps remove debris), reduce instrument friction during preparation (lubricant) Facilitate dentin removal, dissolve inorganic tissue (dentin), penetrate to canal periphery, dissolve organic matter (dentin collagen, pulp tissue, biofilm), kill bacteria and yeasts (also in biofilm), do not irritate or damage vital periapical tissue, no caustic or cytotoxic effects and do not weaken tooth structure. No single irrigating solution that alone covers all of the functions required from an irrigant.

Chemical stability is an important requirement in the endodontic irrigant as it affect its shelf time. Chemical stability can be affected by exposure to heat, light, and air. Disinfecting action of Chlorine-containing solutions depends on pH values as this will influence the available free chlorine forms.

Hypochlorous acid (HOCl) has been suggested to have an antimicrobial effect around 80-100 times stronger than the hypochlorite ion.

Another important property of irrigation is smear layer removal, some authors suggest that leaving the smear layer may block the dentinal tubules and limit bacterial or toxin penetration by altering dentinal permeability. Others believe that the smear layer, being a loosely adherent structure, should be removed from the surface of the root canal wall because smear layer has an unpredictable volume and thickness, smear layer provides a lossely adherent structure that may potentially become a leakage avenue and passage for bacteria contaminants between dentinal walls and the root canal filling.

The organic tissue dissolution properties of irrigating solutions are important for the success of endodontic treatment. Tissue dissolution ability of irrigants depends on its concentration, volume, pH, agitation, temperature and also on the contact time with the pulp tissue. It has been shown that irrigants with higher concentration dissolve more easily vital and necrotic remnants of pulp, but at the same time, increase the risk of damage to the periradicular tissues and oral mucosa.

Calcium hypochlorite is a white powder used for industrial sterilization, bleaching, and purifying water treatment. It is relatively stable. Its incorporation in water can be more accurate than preparations by dilution of a more concentrated solution, which can be an advantage for clinical use.

REVIEW OF LITERATURE

Evaluation of chemical stability, tissue dissolution capacity and ability to remove the smear layer of calcium hypochlorite solution when used as an endodontic irrigant.

1) Chemical stability:

Johnson et al. (1993)¹ studied the stability of sodium hypochlorite after exposure to high temperature, light, air, and the presence of organic and inorganic contaminants. The purpose of this study was to investigate the variables of storage conditions and time on the tissue-dissolving capacity of three different concentrations of sodium hypochlorite. Fresh frozen human umbilical cord was used as the tissue sample for this experiment. Tissue samples were dissolved at time intervals ranging from 1 day to 10 wk in 5.25%, 2.62%, and 1.0% solutions of sodium hypochlorite. It was concluded that the tissue-dissolving ability of 5.25% sodium hypochlorite remains stable for at least 10 wk. The tissue-dissolving ability of 2.62% and 1.0% sodium hypochlorite remains relatively stable for 1 wk after mixing, then exhibits a significant decrease in tissue-dissolving ability at 2 wk and beyond.

Piskin et al (1995)² investigated the effects of storage temperature, concentration, and time on the stability on three different brands of commercial household bleaching agents as a source of NaOCl, and to compare the stability of these brands.

Although the manufacturers use at least a 2-yr expiration date for sealed undiluted NaOCl solutions, chemical stability of NaOCl may be adversely affected by many factors. All solutions showed degradation versus time; however, this degradation occurred very slowly except for the group of solutions containing 5% available chlorine stored at 24 degrees C. Solutions containing 0.5% available chlorine stored at 4 degrees C and 24 degrees C and 5% solutions stored at 4 degrees C showed satisfactory stability at 200 days. It was concluded that No significant difference was found among three brands in respect to their chemical stability.

Gambarini et al (1998)³ investigated the advantage of temperature on tissue-dissolving and antimicrobial properties of sodium hypochlorite. However, it is known that the chemical stability of sodium hypochlorite is adversely affected by exposure to high temperature. The purpose of this study was to investigate the effect of heating sodium hypochlorite to 50 degrees C on the stability of the solution. An iodometric titration test was used to evaluate the decomposition rates of heated and non heated solutions over 30 days. Results showed that all specimens exhibited a minimal, gradual degradation versus time. However, no statistically significant difference ($p < 0.05$) was noted between the two groups. After 30 days, both heated and non-heated solutions maintained high available chlorine content and pH values consistent with excellent tissue-dissolving and antibacterial properties.

Clarkson et al. (1998)⁴ reviewed that sodium hypochlorite has been used as an endodontic irrigant for more than 70 years, and is now one of the most common solutions for this purpose. The chemical properties and production of commercial sodium hypochlorite are reviewed. Domestic bleaches and an infant sanitizer are compared from the point of view of cost and ease of use—Milton being recommended where a 1% solution is required. The cost of syringes and needles for endodontic irrigation is many times greater than the hypochlorite they contain, and total annual practice costs for hypochlorite are low.

Len et al. (2000)⁵ investigated the chlorine loss of electrolyzed oxidizing (EO) water during storage under different light, agitation, and packaging conditions. The chlorine loss of pH-adjusted EO water was also examined. Under open conditions, the chlorine loss through evaporation followed first-order kinetics. The rate of chlorine loss was increased about 5-fold with agitation, but it was not significantly affected by diffused light. Under closed conditions, the chlorine loss did not follow first-order kinetics, because the primary mechanism of chlorine loss may be self-decomposition of chlorine species rather than chlorine evaporation. The effect of diffused light was more significant compared to agitation after two months of storage under closed conditions. It was concluded that the chlorine loss of EO water and commercial chlorinated water decreased dramatically with the increase of pH from the acidic (pH 2.5) to the alkaline (pH 9.0) region.