Assessment of Antibacterial Activity, Cytotoxicity and Penetration Ability of Novel Nanobased Endodontic Irrigating Solutions (An In-vitro Study)

Thesis
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By

Heba Sohail Abd Ellateef Badra

B.D.S (2003)
Faculty of Dentistry, (Cairo University)
M.S.C (2010)
Faculty of Oral and Dental Medicine, Cairo University

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بسم الله الرحمن الرحيم

قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا ۖ إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ

صدق الله العظيم

سورة البقرة ايه (٣٢)

Supervisors

Prof. Dr. Ehab Elsayed Hassanein

Professor of Endodontics

Faculty of Dentistry

Ain Shams University

Prof. Dr. Kariem Mostaf Elbatouty

Professor of Endodontics

Faculty of Dentistry

Ain Shams University

Prof. Dr. Somaia Abdel Latif Eissa

Professor of Medical Microbiology and Immunology

Cairo University

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Dedication

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INTRODUCTION

Elimination of microorganisms from the root canal system plays an important role in achieving a long term success in endodontic treatment [(1)]. Despite the advances in the tools and techniques that are used in endodontic treatment, the success rate of the treatment is still a problem. Colonization of various kinds of bacteria in biofilm, formation of smear layer during instrumentation, complex anatomy of root canal system and the remaining microorganisms in dentinal tubules are the main causes of failure and reinfection in endodontic treatment[(2)].

Many irrigation solutions have been developed to improve and complement the mechanical debridement procedure. Canal irrigation solutions should possess characteristics such as low toxicity, low surface tension, lubrication, long-lasting antimicrobial effect, easy availability, tolerable odor, and reasonable cost. Chlorhexidine, sodium hypochlorite, EDTA, MTAD or tetracycline isomer, phenol and alcohol derivatives, iodide potassium iodine and formocresol are among the commonly used root canal irrigation solutions [(3)].

Sodium hypochlorite has a wide range of antimicrobial activity and is able to kill various bacteria. It also has disadvantages such as toxicity and risk of tissue destruction, bad taste, inability to eliminate all the microorganisms present in infectious canals and risk of physically changing the structure of dentinal canal walls[(4)].

Introduction of nanobased materials has brought new abilities into different scientific fields. An important group of nanomaterials for biological applications are nanobased antimicrobial agents. This group of nanobased materials benefits from new mechanisms for efficient disinfection and microbial control.

Various nanoparticles have gained popularity as antimicrobial agents as a result of their broad spectrum of activity and biocompatibility. Nanoparticles exhibit higher antibacterial activity as a result of their polycationic/ polyanionic nature with higher surface area and charge density, resulting in greater degree of interaction with bacterial cell.

Silver nanoparticles along with antibacterial effect, also exhibit novel physicochemical and biological activities [(5)].Zinc oxide nanoparticles have also been shown to possess good antibacterial property. They have bacterial effects on both gram-positive and gram-negative bacteria. They even have antibacterial activity against spores which are resistant to high temperature and pressure.

Based on that it was thought that evaluation and comparing a new irrigation solution containing nanosilver and nanozinc-oxide particles with sodium hypochlorite was of great value.

REVIEW OF LITERATURE