﴿وقَالَ رَبِّ أَوْزِعْنِي أَنْ أَشْكُرَ نِعْمَتَكَ الَّتِي أَنْعَمْتَ عَلَيَّ وَعَلَى وَالِدَيَّ وَأَنْ أَعْمَلَ صَالِحًا تَرْضَاهُ وَأَدْخِلْنِي بِرَحْمَتِكَ فِي عِبَادِكَ الصَّالِحِينَ﴾

[النمل:19]

Evaluation of the Sealing Ability of Three Root End Filling Materials in Different Ph Levels. In Vitro Study.

A Thesis

Submitted to Faculty of Oral & Dental Medicine

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for Masters Degree in Endodontics

By

Reema Adel Shaaban Sadik

D.D.S. Ajman University for Science and Technology

Faculty of Oral and Dental Medicine

Cairo University

2010

SUPERVISORS

Dr.Alaa Diab

Professor of Endodontics
Faculty of Oral and Dental Medicine
Cairo University

Dr.Nehal Ezzat

Associated Professor of Endodontics
Faculty of Oral and Dental Medicine
Cairo University

Dedication,

To my family who always give me endless love and support…

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Introduction

The goal of endodontic is to retain natural teeth with maximum function and pleasing esthetics.

Non surgical endodontic treatment gives good results in most cases, however, surgery may be indicated for teeth with persistence periradicular pathoses that did not responded to nonsurgical approaches.

An adequate apical seal is a major factor for improving endodontic success. Therefore, the most important criteria for an ideal endodontic material are sealing ability and marginal adaptation.

At the same time, the objective of placing a root- end filling material is to produce a tight seal that prevents residual irritants contamination. Many materials have been used as root end filling. Zinc oxide eugenol cement (IRM and Super EBA), glass ionomer cement, Diaket, composite resin, amalgam, geriostore and mineral trioxide aggregates.

The ideal root end filling materials should adhere and adapt to the wall of root end preparation preventing egress of any bacteria, bacteria by products, or toxic material into the surrounding periradicular tissues.

An evaluation for the sealing ability of root end filling materials has been assessed in terms of the penetration of radioisotopes, dyes and bacteria. Each technique has significant limitation that can result in errors.

Periradicular area is a vital tissue with a normal physiological environmental pH of 7.4. This critical area could be affected by internal or external factors that will tend to alter tissue pH value into more acidic or alkaline environment. Such change will expose retrograde filling material to non favorable conditions that might adversely cause physical changes in the materials, which might directly or indirectly affected the retrograde sealing ability.

In a trial to reach an answer to this question whether the different pH value affected the sealing ability of different root end material or not this study was conducted.

REVIEW OF LITERATURE

Periapical lesions of endodontic origin have been associated with presence of bacteria and their by products in infected root canals and the egress of bacteria to the periapical tissues. The Removal of these irritants and total obturation of the root canal system in three dimensions is the main goal of nonsurgical root canal therapy. However, because of the complexity of the root canal system and inability to complete cleaning using present techniques and instruments, root canals cannot always be adequately treated by using a nonsurgical orthograde approach. So retreatment of unsuccessful cases is the preferred treatment of choice and usually results in a successful outcome. But when nonsurgical attempts prove unsuccessful or contraindicated, surgical endodontic or apeceoctomy therapy is needed to save the tooth.

Sealing ability of retrograde filling materials:

The aim of placing retrograde filling material is to develop an apical seal which is the most important factor in achieving success in surgical endodontics, because it inhibits the leakage of residual irritants from the root canal into the periapical tissues. An ideal root end filling material should adhere and adapt to the dentinal walls of the root end preparation, prevent leakage of microorganisms and their by-products into the periradicular tissues, and be biocompatible. In addition, it should be insoluble in tissue fluids, dimensionally stable, and unsusceptible to the presence of moisture.

A variety of testing procedures were introduced to evaluate the sealing ability and microleakage of retrograde filling material. Such as Radioisotopes,

electrochemical method, Dye leakage, fluid filtration, capillary flow prometery, bacterial leakage and marginal adaptaion.

Radioisotopes:

Tronstad et al 1983[(1)] Compared the sealing ability of different types of dental amalgam (Zn containing, Zn free amalgam, dispersed phase 19% Cu, spherical alloy 27% Cu) when used as a retrograde filling material in combined vivo-vitro study. Two hundred seventy human extracted teeth had 2 mm apical resection and received root end fillings with various types of amalgam. Then were sterilized by means of γ-radiation and implanted subcutaneously in rabbits to expose the materials to vital tissue and tissue fluids. After 7, 30 and 90 days, animals were sacrified, roots were recovered and dipped for 5 minutes in radioactive isotopes then sectioned longitudinal through the filling materials and placed on dental x-ray films for 2 hours. The leakage in the filling-tooth interface was recorded and scored. Leakage was observed in all experimental groups, copper-containing spherical amalgam gave the best results. However, zinc free amalgam had the lowest sealing ability scores with no significant differences with other materials.

Danin et al 1992 [(2)] Compared the retrograde sealing properties of amalgam, Glass Ionomer Cement GIC, composite resin and root canal calcium hydroxide- based sealer (Sealapex). Forty teeth with 2 mm cavities received root end fillings of the suggested materials. Prepared roots were mounted through lid of sterile sampling vials containing sterile sampling liquid (11.5 ml of 1% human serum albumin, with 0.5% Triton X-100 and 0.005% Merthiolate). Apical 3 mm of the root was immersed in solution, thin paper point impregnated with isotopes solution was placed within root canals. Vials stored in humidor at 37 °C. Of each

sampling 0.5 mm liquid was taken from extraradicular area then added to 10 ml Aqueous Counting Scintillat (ACS) in scintillation vials. The radioactivity was measured in a liquid scintillation counter. Samples were taken from the fluid at 0, 3, 7, 28, 56, 105, 210, 285 and 376 days to determine the radioactivity. Results showed leakage in all fillings with the highest degree in GIC then amalgam more than composite resin and sealapex.

Electrochemical Method:

Mattison et al 1985 [(3)] Assessed and compared the apical microleakage of teeth with different thickness and compositions of amalgam as retrograde filling material. That was two part study, the first part root end cavities were prepared in twenty human extracted teeth then filled with zinc-containing amalgam to a depth of 1 mm or 3 mm. Second part of the study consisted of the root end filling with zinc-containing amalgam following varnish application, zinc-free amalgam, or zinc free amalgam with varnish, all thirty teeth were retrofilled to a depth of 3 mm. Leakage was measured in each sample through electrochemical method which was based on building galvanic cell that contain two metal wires. One inserted in the specimens which immersed in electrolyte solution (potassium chloride KCL) will act as anode, and the other metal wire in the solution which will penetrate the apical microleakage gaps to reach the metal wire (the cathode) to create an electrical current. Time elapsed between immersion and current flow accurately denoted the rate of the electrolyte solution penetration and the magnitude of the current indicated the leakage degree. Measurements were obtained in 24 hours intervals for 30 days. The current flow measurement recorded as voltage drop. All tested samples showed low initial leakage that increased through the testing period. However, that 3 mm thickness of amalgam