Republic of Iraq
Ministry of Higher education
& Scientific Research
University of Baghdad
College of Dentistry

Modification and Characterization of Gutta Percha Incorporated with Bioactive Glass and Chitosan Nano-Fillers for Endodontic Use

A Thesis

A Thesis Submitted to the Council of the College of Dentistry, University of Baghdad, in Partial Fulfillment of the Requirements for the degree of Doctor of Philosophy in Conservative Dentistry

By

Ahmed Ibrahim Khalaf Al-Jobory

B.D.S., M.Sc. PhD. student

Restorative and Aesthetic Department

Supervisor

Professor Dr.

Raghad Abdulrazzaq Al-Hashimi

B.D.S., M.Sc., PhD. (London, UK)

Restorative and Aesthetic Department

2021 A.D. **1442 A.H.**

Abstract

The success of endodontic therapy is relied on radicular system cleaning, shaping, elimination of micro-organisms, and three-dimensional filling of the radicular complex most commonly using trans-isomer of isoprene, called gutta percha. This study was conducted to develop and assess new root canal obturation material incorporating bioactive glass and nano-sized chitosan into gutta percha.

A pilot study was conducted to find the most appropriate percentage of bioactive powder and chitosan to be added and incorporating into gutta percha to obtain clinically applicable newly developed material. 1%, 5%, and 10% were used, and 1% was chosen depending on the MTT assay that showed the best biocompatible results in comparison to other concentrations. The concentration of the filler did not exhibit any significant influence on the mixing gutta percha with fillers 1%. Cell exposed to eluants from the test materials showed a non-significant drop-in metabolic activity at 24 hrs. following 24 hrs. and 72 hrs.

These materials were undergone several testings as follow:

Chemical analysis (FTIR and XRD), Assessment of filler distribution inside gutta percha by scanning electron microscope (SEM), testing the bioactivity, testing the biocompatibility, testing antibacterial activity, assessment of optical density.

All samples of newly developed gutta percha showed good particles distribution of fillers into gutta percha matrix.

Chemical analysis and scanning electron microscope showed chemical interaction and well distribution of the incorporated fillers with gutta percha.

Cytotoxicity study showed that fillers incorporating into gutta percha was not affecting the biocompatible during all tested periods.

Carbonated hydroxyapatite layer was detected on the surface of experimental gutta percha after immersion in simulated body fluid indicating the bioactivity behavior of the developed materials.

The developed gutta percha also revealed antimicrobial activities against *E. faecalis* in comparison to control gutta percha.

Although the incorporated bioactive glass and chitosan fillers reduced the radio-opacity of the experimental gutta percha, this modified material still has higher radio-opacity than dentine.

In conclusion, the incorporation of 1% bioactive glass and chitosan fillers into gutta percha improved the antimicrobial and bioactivity of the resulted material with minimal alteration in cytotoxicity and radioactivity. This modification can improve the function and decreased the drawbacks of conventional gutta percha.

جمهورية العراق
وزاره التعليم العالي والبحث العلمي
جامعة بغداد
كلية طب الاسنان

تعديل وتوصيف الحشوات الجديدة النشطة بيولوجيًا ودمجها في جوتا بيرشا للاستخدامات اللبية

رسالة مقدمة الى مجلس كلية طب الاسنان/جامعة بغداد
كجزء من متطلبات نيل شهادة الدكتوراه
في معالجة الاسنان

من قبل
أحمد إبراهيم خلف الجبوري
بكالوريوس في طب وجراحة الفم والاسنان
ماجستير في معالجة الاسنان

باشراف
الاستاذ الدكتور رغد عبد الرزاق الهاشمي
بكالوريوس في طب وجراحة الفم والاسنان
ماجستير في معالجة الاسنان
دكتوراه حشوات الجذور(بريطانيا)

2021م **1442هـ**