

**Republic of Iraq  
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# **Incorporation of nano-sized bioactive fillers into gutta-percha based silicon Endodontic sealer**

A Thesis

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# 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 sealers incorporating nano-sized bioactive glass (BG) and nano-sized hydroxyapatite (HA) separately into Guttaflow 2 (GF2).

A pilot study was conducted to find the most appropriate percentage of nano-sized bioactive powder to be added and mixed mechanically into Guttaflow 2 to obtain clinically applicable newly developed material. 1%, 3%, 5%, and 10% were used, 1% and 3% were chosen to be utilized in this study because they showed continuous flow on raising via spatula over the cement slab that making them clinically applicable. These materials were undergone several testing include: solubility assessment of filler distribution, chemical analysis (FTIR), testing the bioactivity, testing the biocompatibility, testing antibacterial activity, assessment of optical density, assessment of flowability.

All samples of GF2 and newly developed sealers showed no solubility in water at all time periods.

All samples of newly developed sealers showed good nano-sized particles distribution into GF2 matrix.

Chemical analysis showed that GF2 group revealed no calcium compounds while BG 3% showed larger amount of calcium compounds followed by AH 3%, BG 1%, AH 1% respectively.

Bioactivity test showed that GF2 revealed no development of carbonated hydroxyapatite layer (CHA) while BG 3% showed larger amount of CAH at all time periods followed by AH 3%, BG 1%, AH 1% respectively. All newly developed sealer groups showed their maximum amounts of CHA at the last time period.

Histopathological study of biocompatibility test showed that BG 3% was more biocompatible than HA 3% followed by BG 1%, HA 1%, and GF2 sequentially at all time periods.

Antibacterial study revealed that *S.mutans* was more susceptible to BG 3% than HA 3%, BG 1%, HA 1%, and GF2 sequentially, while *E.feacalis* showed no susceptibility to any of samples.

Radio-opacity and flowability tests showed no difference in radio-opacity and flowability between GF2 and all groups of newly developed sealers.

The newly introduced sealers showed promising characteristics as they showed excellent biocompatibility and potent antimicrobial activity compared to GF2 sealer, Further more, it exhibited the same solubility, radio-opacity and flow characteristics as those of original gutta flow sealer.