

Republic of Iraq
Ministry of Higher Education
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Formulation and characterization of a new root canal irrigant solution by adding Poloxamer surfactant to NaOH and NaOCl (*In-Vitro* Study).

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 Restorative and Aesthetic Dentistry

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Abstract

Objective: formulation of a new irrigant solution of sodium hydroxide (NaOH) compared with the sodium hypochlorite (NaOCl), and study the effect of adding Poloxamer surfactant on their properties.

Specimens preparation: roots of maxillary and mandibular premolar with single root (15mm) were used to study the cleaning efficiency, and penetration of irrigant solutions inside dentinal tubules. The instrumentation of samples was done with ProTaper Gold to reach size F4. During instrumentation each group was irrigated with the following nine solutions: three concentrations of NaOH [A1 (5%), A2 (2.5%), A3 (0.5%)], three concentrations of NaOH with Poloxamer [B1 (5%), B2 (2.5%), B3 (0.5%)], NaOCl 5.25% (group C1), NaOCl 5.25% plus Poloxamer (group C2), and normal saline (group D).

Materials and Methods: The tests used in the present study were

1-Surface tension test: this test was done with Du-Nay ring method.

Results: NaOH significantly showed lower surface tension compared with NaOCl, the addition of poloxamer surfactant had reduced the surface tension significantly for NaOCl and NaOH.

2-Viscosity test: this test was done by using digital viscometer.

Results: NaOH significantly showed lower viscosity compared with NaOCl, and the addition of poloxamer surfactant had reduced the viscosity significantly for NaOCl and NaOH.

3-Cytotoxicity test: this test was done by using MTT assay.

Results: Normal saline was nontoxic, while other eight irrigation solutions were toxic, and NaOH with all concentrations was more toxic

than that of NaOCl 5.25%. Adding Poloxamer surfactant was significantly decreased the toxicity for both solutions used.

4-Antimicrobial test: it was performed against *E. faecalis* bacteria.

Results: Normal saline, and NaOH at 0.5% concentration (with and without Poloxamer surfactant) revealed zero inhibition zone of antibacterial activity. NaOCl significantly had larger inhibition zone than that of NaOH at concentration 2.5 % and 5%. Addition of a poloxamer surfactant significantly decreased the inhibition zone for NaOCl 5.25% and NaOH (2.5% and 5%).

5-Penetration test: this was done by bleaching of Methylene blue dye.

Results: NaOH showed higher penetration than NaOCl inside dentinal tubules, and the addition of surfactant was increased the penetration of both solutions inside dentinal tubules.

6-Cleaning efficiency: by using Scanning Electron Microscopy (SEM).

Results: There was non-significant difference in smear layer removal between NaOH and NaOCl. The addition of Poloxamer surfactant not significantly increased the smear layer of both solutions used in study.

7-Fourier Transform Infrared Spectroscopy(FTIR)

Results: By FTIR, the addition of a poloxamer surfactant to both solutions showed an interaction not reaction.

Conclusion: from the results of the present study it was concluded that poloxamer was very effective for decreasing surface tension, viscosity, toxicity, and antimicrobial activity. Adding surfactant significantly increased the penetration of irrigant inside dentinal tubules, while significantly not affect the cleaning efficiency of NaOH and NaOCl.



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