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Comparison of antifungal efficacy of chitosan nanoparticles with a conventional root canal irrigant

Abstract

Background: The use of chitosan nanoparticles [CNPs] in endodontics has attracted increasing attention from researchers. *Candida albicans* is the dominant fungal species in endodontic infections. The purpose of this study was to assess the antifungal property of high, medium, and low molecular weights of chitosan against *C. albicans* biofilms when used as an endodontic irrigant and to compare their efficacy to that of the gold standard endodontic irrigant, NaOCl (sodium hypochlorite).

Materials and methods: *C. albicans* (SC5314) biofilms were grown for 24 h on microtiter plates and treated for 5 minutes with either 3% NaOCl or chitosan nanoparticles of high, medium and low molecular weights, in two different concentrations (0.05% or 0.1%). Biofilms were then washed and reincubated with fresh media for additional 72 h. Biofilm metabolic activity and biomass were assessed using XTT and crystal violet, respectively, at o h and also at 72 h to assess biofilm regrowth. In addition, the viability of biofilms treated for 5 mintes with 0.1% chitosan was assessed at 0 h using live/dead cell viability assay with microscopic fluorescent imaging.

Results: NaOCl caused significant reduction in metabolic activity, as revealed by readings at 0 h and 72 h (**** $p < 0.0001$). The biofilm biomass was also reduced by ˜99% and ˜98% at 0 h and 72 h, respectively, compared to the controls. In addition, significant reduction in viability was observed with all different molecular weights of chitosan nanoparticles, at 0 h. The highest reduction in XTT readings was seen with 0.1% low molecular weight chitosan [˜97%]. However, CNPs were not able to reduce the *C. albicans* biofilm biomass. On the contrary, significant regrowth of *C. albicans* biofilms were observed after 72 h of chitosan treatment.

Conclusion: The results indicate that CNPs reduced *C. albicans* biofilms viability, initially, when used as an irrigant for 5 minutes. However, CNPs were not effective in preventing biofilm regrowth following 72 h re-incubation. The antimicrobial activity of chitosan was far less than that of the gold standard irrigant. Therefore, chitosan may not be useful as an alternative irrigant to NaOCL. However, chitosan could be used as an intracanal medicament or an adjunct to conventional irrigant.