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Delivery of antibacterial-nanoparticles into dentinal tubules with high intensity focused ultrasound

Siew Wan Fong^a, Annie Shrestha^b, Zhilong Shi^c, Boo Cheong Khoo^d and Anil Kishen^b

^aInstitute of High Performance Computing, 1 Science Park Road, #01-01 The Capricorn, 117528 Singapore, Singapore

^bDepartment of Restorative Dentistry, Faculty of Dentistry, National University of Singapore, 5 Lower Kent Ridge road, 119074 Singapore, Singapore

^cDepartment of Chemical and Biomolecular Engineering, National University of Singapore, 10 Kent Ridge Crescent, 119260 Singapore, Singapore

^dNational University of Singapore, Dept of Mechanical Engineering, 10 Kent Ridge Crescent, 119260 Singapore, Singapore

High-Intensity-Focused-Ultrasound (HIFU) when applied clinically often result in the formation of cavitation bubbles in the nearby fluid or tissue which collapse with high-speed jets and can be utilized for particle delivery. Bacteria residing in anatomical complexities and dentinal tubules resist conventional disinfection procedures during root canal treatment. This study aims is to evaluate the efficacy of jet flow produced by collapsing cavitations to push antibacterial nanoparticles into the areas inaccessible to conventional treatment. Eight dentin blocks of 8x3x1.5mm³ were prepared from the root region of freshly extracted single rooted tooth samples and divided into two groups: (1) Control and (2) Nanoparticles. The samples were placed in sterile deionized water and nanoparticles suspension (1mg/ml) for groups 1 and 2 respectively. HIFU at 27 kHz for two minutes was employed. The samples were then sectioned to expose the dentinal tubules and viewed under field emission scanning electron microscopy and Energy Dispersive X-ray analysis to ascertain the depth of penetration of the nanoparticles. The findings from this study suggested that HIFU treatment resulted in the significant penetration and coating of the dentinal tubules with nanoparticles. HIFU can be used as a potential tool for the delivery of antibacterial nanoparticles to disinfect the root canals.