Efficacy of laser and ultrasonic activated irrigation on eradicating a mixed species biofilm grown in the mesial roots of human mandibular molars

A thesis submitted to The University of Adelaide in partial fulfilment of the requirements for the Degree of Doctor of Clinical Dentistry (Endodontics)

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Abstract

Aim

To compare the efficacy of Er,Cr:YSGG laser and ultrasonic activated irrigation on eradicating a biofilm grown in the mesial roots of human mandibular molars.

Methods

A biofilm containing *Enterococcus faecalis*, *Streptococcus sanguinis* and *Fusobacterium nucleatum* was grown over 4 weeks in the mesial root canals of decoronated human mandibular molar teeth. Following removal from the flow cell, control roots (n=5) received no further treatment. The remaining tooth roots were chemomechanically prepared using different irrigating protocols: saline standard irrigation (Saline SI; n=15); 4% NaOCl and 15% EDTAC with ultrasonic activated irrigation (UAI; n=18); 4% NaOCl and 15% EDTAC with laser activated irrigation using power settings 0.5 W (LAI 0.5 W; n=18) or 0.75 W (LAI 0.75 W; n=10). Following treatment and crushing, bacteria were quantified by culturing (CFU/mL) and quantitative real-time PCR (qPCR). One tooth from each group was subjected to SEM analysis.

Results

Quantification by culturing revealed significant differences between controls and all other treatment groups. Significant differences were found between Saline SI and UAI, Saline SI and LAI 0.5 W and also between LAI 0.5 W and LAI 0.75 W. No significant differences were found between Saline SI and LAI 0.75 W or between UAI and LAI 0.5 W or LAI 0.75 W.

From qPCR results, significant differences were found between controls and all other treatment groups. No statistically significant differences were found between Saline SI and UAI, LAI 0.5 W or LAI 0.75 W.

Conclusions

Both culture and molecular techniques showed that mechanical preparation significantly reduces bacteria from the root canals of lower molar mesial roots. Further reductions were achieved by irrigating with 4% NaOCl and 15% EDTAC UAI or 4% NaOCl and 15% EDTAC LAI. No significant reductions in bacterial number were found between UAI and LAI protocols.

Declaration

I, Jonathan Race, certify that this work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission for any other degree or diploma in any university or other tertiary institution without the prior approval of The University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

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Declared by: Jonathan Race Date:……03/03/2015…..

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