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Canal and isthmus cleanliness of mesial roots of mandibular molars after laser activated irrigation: a micro-computed tomography study

Aim To investigate the effectiveness of different irrigant agitation techniques on removal of accumulated hard tissue debris (AHTD) in mesial roots of human mandibular molars.

Methodology Thirty extracted human mandibular molars with joining mesial root canals and an isthmus between them were selected based on micro-CT (μ CT) scans. The canals were instrumented to an apical diameter of size 30 using the ProTaper rotary system. NaOCl (2.5%) irrigation was used throughout instrumentation, followed by a final flush with 2 mL EDTA (17%) and 2 mL NaOCl. Teeth were then randomly assigned to three irrigant activation groups ($n = 10$): (i) ultrasonically activated irrigation (UAI) using the size 20 Irrisafe (Satelec Acteon Group, Merignac, France) for 3×20 s, (ii) laser activated irrigation (LAI) with an Er:YAG-laser and plain 300 μ m fibre tip inside the canal (20 mJ, 20 Hz, 3×20 s) and (iii) LAI with the same laser and parameters but with the 400 μ m PIPS tip held at the canal entrance. All teeth were scanned in a μ CT system (Triumph-II, TriFoil Imaging, Paris, France) at 30 μ m resolution before and after instrumentation and after irrigant activation. After reconstruction and image processing the percent of total canal system volume filled with hard tissue debris before and after irrigant activation was calculated. Data were compared using one-way ANOVA and a paired samples *t*-test.

Results The volume% AHTD after irrigant activation was significantly lower than before activation in all groups. Although the lowest AHTD values were observed in the laser groups, no significant differences in volume% AHTD after activation were observed between groups.

Conclusions All activation groups were associated with a significant reduction of AHTD; UAI, and both LAI protocols performed equally well in this respect. No method was capable of removing all AHTD.