

The effect of high-frequency electrical pulses on organic tissue in root canals

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Abstract

Aims To evaluate debris and smear layer scores after application of high-frequency electrical pulses produced by the Endox Endodontic System (Lysis Srl, Nova Milanese, Italy) on intact pulp tissue and organic and inorganic residues after endodontic instrumentation.

Methodology The study comprised 75 teeth planned for extraction. The teeth were randomly divided into two groups (60 teeth) and a control group (15 teeth): group 1 (30 teeth) was not subjected to instrumentation; group 2 (30 teeth) was instrumented by Hero Shaper instruments and apical stops were prepared to size 40. Each group was subdivided into subgroups A and B (15 teeth); two electrical pulses were applied to subgroups 1A and 2A (one in the apical third and one in the middle third, respectively, at 3 and 6 mm from the root apices); four electrical pulses were applied to subgroups 1B and 2B (two in the apical third, two in the middle third). The control group (15 teeth) was prepared with Hero Shapers and irrigated with 5 mL of EDTA (10%) and 5 mL of 5% NaOCl at 50 °C but not subjected to the electrical pulse treatment. Roots were split longitudinally and canal walls were examined at 80 \times , 200 \times , 750 \times , 1500 \times and 15 000 \times magnifications, using a scanning electron microscope. Smear layer and debris scores were recorded at the 3 and 6 mm levels using a five-step scoring scale and a 200- μ m grid. Means were tested for significance using the one-way ANOVA model and the Bonferroni *post-hoc* test. The differences between groups were considered to be statistically significant when $P < 0.05$.

Results The mean value for debris scores for the three groups varied from 1.80 (± 0.77) to 4.50 (± 0.68). The smear layer scores for group 2 and the control specimens varied from 2.00 (± 0.91) to 2.33 (± 0.99). A significant difference was found in mean debris scores at the 3 and 6 mm levels between the three groups ($P < 0.001$). The Bonferroni *post-hoc* test confirmed that the difference was due to group 1. In the two subgroups treated with four high-frequency pulses (1B and 2B) a substantial reduction in mean debris scores was found at the 3 and 6 mm level; subgroup 2B was practically free of organic residue. No significant differences for mean smear layer and debris scores were recorded between group 2 and the control group at the two levels; a significant difference was found only for mean smear layer scores at the 3 mm level between subgroup 2B and the control group ($P < 0.05$).

Conclusions The Endox device used with four electrical pulses had optimal efficacy when used after mechanical instrumentation. Traditional canal shaping and cleaning was essential to ensure an effective use of high-frequency electrical pulses in eliminating residues of pulp tissue and inorganic debris.