

COMPARISON BETWEEN ULTRASONIC AND ROTATING INSTRUMENTS IN PROSTHODONTIC MARGIN REPOSITIONING AND FINISHING: IN VITRO EVALUATION OF TEMPERATURE INCREASE IN THE PULP CHAMBER

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PURPOSE The purpose of this study was to analyze pulpal temperature increase generated by prosthodontic margin repositioning and finishing with ultrasonic and rotating instruments. The temperature changes recorded were also correlated with the residual dentin thickness.

MATERIAL AND METHODS A sample of 32 human molars (extracted for periodontal reasons) was selected. The teeth were endodontically treated and prepared with prosthetic round chamfer preparation. Then, they were inserted in plaster cubes up to the cement-enamel junction, leaving the apical portion pervious for inserting the thermocouple probe. The conventional technique, which involves the use of a high-speed contra-angle handpiece, was compared with an ultrasonic method: the innovative piezoelectric technology developed by Mectron S.p.a. For margin repositioning and finishing, two walls were randomly selected for each tooth: one was included in the test group and cut with the piezoelectric instrument (Multipiezo Touch with TipHolder DB2, Mectron) the other one was inserted in the control group and cut with the high speed contra-angle handpiece (Kavo). To standardize the operator-dependent parameters, it was used a mechanical arm controlled by a computer and to which both instruments were set. These parameters were the pressure exerted on the dental wall, the cutting length and the time required for margin repositioning and finishing. For both the test and the control group the test phase consisted in a first stage of margin repositioning using an ultrasound tip or a diamond bur with a greater granulometry (120 μm for the ultrasound tip and 125 μm for the diamond bur), followed by a second finishing step conducted by an ultrasound tip or a diamond bur with smaller granulometry (60 μm for the ultrasound tip and 30 μm for the diamond bur). Each test had a duration of 60 seconds: this was the time that the mechanical arm needed to accomplish 32 rides. During these stages the intrapulpal temperature was recorded thanks to a thermocouple. Before and after these steps, the thickness of the remaining dental walls was measured with a caliber.

RESULTS The average pulpal temperature increase was 5,03° C with a standard deviation of 0,98 for the ultrasonic preparation (test group) and 3,55° C with a standard deviation of 0,95 for the conventional technique (control group). The difference was statistically significant (p value < 0,001). However, neither of the instruments reached the critical level of 5.5° C reported in the literature. There were no statistically significant differences using tips with different granulometries within each group.

The mean initial dentin thicknesses was 1,82 mm (S.D. 0,47) for the control group and 1,59 mm (S.D. 0,54) for the test group but the analysis of the residual dentin thicknesses revealed a greater reduction of the walls worked up with high speed contra-angle handpiece (mean 0,9 mm, S.D. 0,5), which was therefore more aggressive than the ultrasonic instrument (mean 1,1 mm, S.D 0,5). A very weak negative correlation was present between the thickness of the wall at baseline and the increment of temperature.

CONCLUSIONS Within the limitations of this in vitro study, it was concluded that the piezoelectric device represents a useful and safe instrument for the repositioning and finishing of the prosthodontic finish line. The advantages are margin precision, preservation of soft tissues and reduction of operating times. Furthermore, it is considered safe for pulp vitality because the increase in pulpal temperature is similar to traditional instruments and it doesn't exceed the critical level of 5,5° C.



Fig. 1

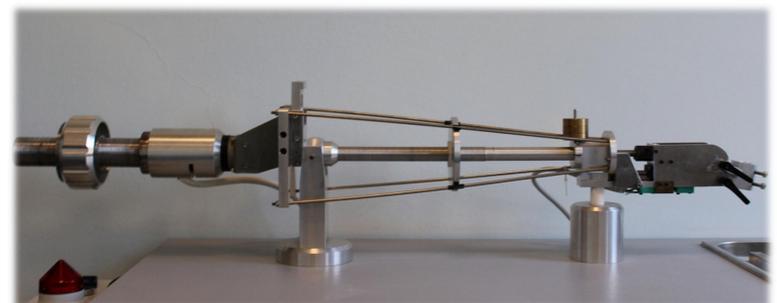


Fig. 2

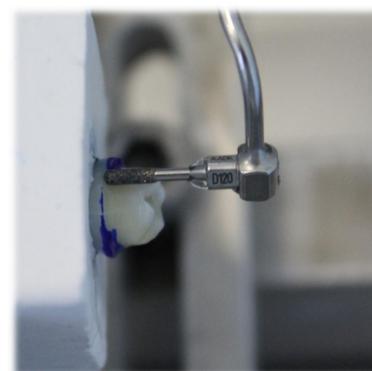


Fig. 3

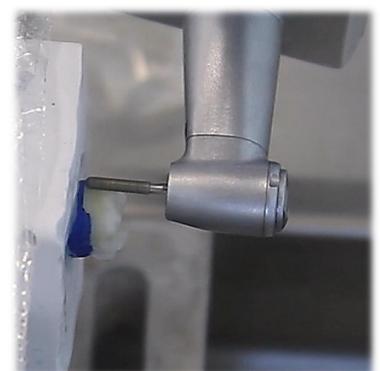


Fig. 4

| | GROUP 1 Piezoelectric handpiece + Ultrasound Tip (120 μm) | GROUP 2 Piezoelectric handpiece + Ultrasound Tip (60 μm) | GROUP 3 High-speed contra- angle handpiece + diamond bur (125 μm) | GROUP 4 High-speed contra- angle handpiece + diamond bur (30 μm) |
|--------------------|---|--|---|--|
| Mean | 4.65 | 5.40 | 3.39 | 3.72 |
| Standard Deviation | 0.99 | 0.84 | 0.96 | 0.93 |
| Median | 4.97 | 5.23 | 3.40 | 3.58 |
| Minimum | 2.05 | 4.35 | 1.35 | 1.50 |
| Maximum | 5.70 | 8.65 | 6.00 | 6.90 |

| P VALUE Overall: <0.001 | Instruments | | p value | |
|-----------------------------|--------------------|-------|---------|---------|
| | 1 + 2 | 3 + 4 | | |
| GROUP 1 vs GROUP 2 = 0.013 | Mean | 5.03 | 3.55 | <0.001* |
| GROUP 1 vs GROUP 3 < 0.001* | Standard Deviation | 0.98 | 0.95 | |
| GROUP 1 vs GROUP 4 < 0.001* | Median | 5.20 | 3.53 | |
| GROUP 2 vs GROUP 3 < 0.001* | Minimum | 2.05 | 1.35 | |
| GROUP 2 vs GROUP 4 = 0.21 | Maximum | 8.65 | 6.90 | |

Table 1

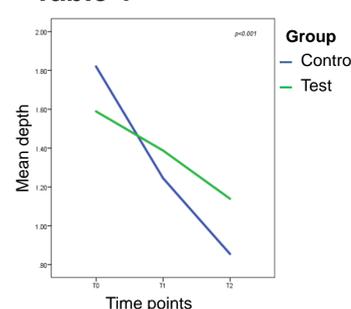


Fig. 5

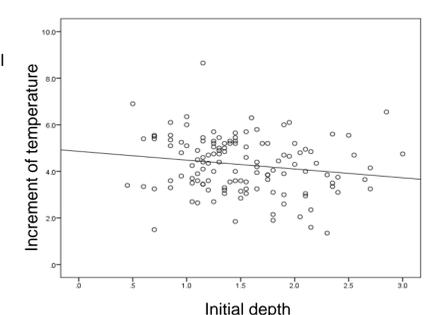


Fig. 6

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FIGURE LEGENDS

Fig. 1 Sample of 32 human molars that were endodontically treated and prepared with prosthetic round chamfer preparation. **Fig. 2** The mechanical arm controlled by a computer. **Fig. 3** Margin repositioning using an ultrasound tip conducted by Multipiezo Touch with TipHolder DB2. **Fig. 4** Margin repositioning using a diamond bur conducted by an high-speed contra-angle handpiece. **Table 1** Comparison of the increment of temperatures using the different techniques. **Fig. 5** Analysis of the residual dentin thicknesses. **Fig. 6** Correlation between dentin thickness at baseline and the increment of temperature.