ABSTRACT

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Variation in power output of Piezon-Master 400 ultrasound generators and analytic handpieces

Aim To evaluate the variability in power output between Piezon-Master 400 generators (EMS) with different Analytic handpieces (Analytic). The displacement amplitude of an unloaded KiS 2D (Obtura Spartan) root end preparation tip was measured using a Scanning Laser Vibrometer (SLV; Polytec) over a range of generator power settings.

Methodology Four Piezon-Master 400 ultrasound generators were each used in conjunction with four analytic handpieces. A graduated scale was positioned over the power dial of each of the ultrasound generators to enable incremental power settings to be selected (six settings were used between the minimum and the 9 o'clock position). The handpiece with a KiS 2D tip was fixed in position so that the anterior surface of the tip was vertical and perpendicular to the scanner head of an SLV. Previous investigation showed that the maximum displacement amplitude of the oscillating tip occurred at the unconstrained end. The laser from the SLV was therefore scanned over this point to assess the maximum displacement amplitude. Scans were repeated 10 times for each power setting. The whole process was then repeated for all generator/handpiece combinations. Throughout the investigation, irrigation was used at a constant flow rate of 20 mL min^{-1}.

Results Linear trend lines fitted to all tip data showed that none of the generator/handpiece combinations produced a linear increase in tip displacement amplitude with increasing power setting. A univariate analysis of variance (general linear model) showed that generator, handpiece and power were all significant variables ($P < 0.0001$). Multiple post hoc comparisons (Tukey's test) at a significance level of $P < 0.05$ (dependent variable being displacement amplitude) showed that all generators were significantly different from each other ($P < 0.0001$), except generators 1 and 3 that showed no significant differences ($P > 0.66$). No significant differences were found between handpieces 1 and 4 ($P > 0.98$) and handpieces 2 and 3 ($P > 0.82$). All other handpieces were significantly different from each other ($P < 0.0001$).

Conclusions This study demonstrated that, for all Piezon-Master 400 generators and handpieces tested, there was no linear increase in tip displacement amplitude with increasing generator power setting. It was also shown that there is considerable variability in power output between commercially available Piezon-Master 400 ultrasound generators and different analytic handpieces. Users should be aware of this variability, which may influence clinical practice. Further investigation using tips under load is required.