

1556 Air-turbine handpiece force vector measurement in clinical procedures

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Data on duty cycles employed by clinicians during normal clinical cutting procedures are lacking yet these are needed for the development of more clinically-relevant laboratory cutting tests. **Objectives:** To develop and validate a system to measure the magnitude and direction of forces applied by operators during simulated clinical dental cutting procedures using air-turbine handpieces (ATH). **Method:** Two diametrically-opposed pairs of temperature-compensating two-element strain gauges (FCA-1-17-1LT, Tokyo Sokki Kenkyujo, Japan) were bonded to the neck of each of two ATHs (GENTLEforce LUX 7000B [ATH-A], Bella-Torque Mini LUX3 637B [ATH-B]; KaVo, Germany) to measure paraxial strain in vertical and horizontal planes. Calibrated output signals from a strain meter (SDA-62B, Tokyo Sokki Kenkyujo, Japan) were logged and processed in software for force magnitude and direction for five operators performing a standardized labial reduction procedure on phantom-head maxillary central incisors using both diamond (542 Hi-Di, Dentsply, UK) and tungsten carbide (170 006 010, Midwest, Canada) rotary cutting instruments (RCI) for each handpiece. **Results:** Maximum force varied between operators using diamond RCIs in the range 1.5 - 2.7 N (ATH-A) and 1.2 - 2.9 N (ATH-B); using tungsten carbide RCIs: 0.8 - 1.9 N (ATH-A) and 1.0 - 1.9 N (ATH-B). Vector distributions reflected cutting rate and individual cutting style. **Conclusions:** The set-up was stable, reproducible and satisfactory for purpose. Qualitative differences between data sets suggest that detailed quantitative analysis will be informative in understanding the system. Detailed studies of operator characteristics in relation to the ATH and RCIs used for various procedures will lead to better understanding of operator behaviour, allowing the development of both improved dental cutting tests and better guidelines for effective handpiece use, and potentially improvements in both ATHs and RCIs.

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