A Study of the Shaping Ability of Single- and Multi-file Techniques in Simulated Curved Canals

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Abstract

Purpose: The purpose of this study was to clarify the canal shaping abilities of the following three files: Reciproc (RE), which is used in reciprocating rotary motion with a single nickel-titanium rotary (Ni-Ti) file; ProTaper (PT), which is used in continuous forward rotation with different taper Ni-Ti files; and the stainless steel K file (SSK), which is used by hand with multiple files.

Methods: Twenty-seven transparent resin blocks with curved canals were used. The working time and force required for push load and pull-out load during root canal preparation were measured. Superimposed images were used to compare changes in root canal shape both before and after preparation. The size of debris produced during the preparation was calculated using image analysis software. All data were subjected to statistical analysis.

Results: Significant differences were observed between groups in total preparation time. RE required the least amount of time while SSK required six times as much time as that with Ni-Ti files. The push and pull-out loads were significantly smaller in the order of PT, RE and SSK. The force required (mean \pm standard deviation, gf) for both PT and RE were as follows: PT, push 233 \pm 58 gf, pull 127 \pm 36 gf; and RE, push 370 \pm 92 gf, pull 353 \pm 58 gf. The superimposed images revealed the presence of unshaped root canal walls both inside the curvature and outside the orifice in SSK; however, images showing the results of shaping with Ni-Ti files indicated that the curved canals were cut uniformly and circumferentially. Step formation and debris clogging were observed in SSK, but not in PT or RE. The debris in canals shaped by Ni-Ti appeared larger than that in canals shaped by the other types of files.

Conclusion: These results suggest that reciprocating rotary single and multiple Ni-Ti files can enable proper canal preparation with uniform shaping inside and outside the canal walls in a short time.

Key words: Single-file technique, Nickel-titanium rotary file, Shaping ability