



## Comparison of different rotary files and dentinal damage during root canal treatment seen in stereomicroscope.

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### Abstract

**Background:** This study was done to compare the dentinal damage caused by several rotary files and how it appeared under a stereomicroscope during root canal treatment.

**Material and methods:** 100 newly extracted mandibular premolars were divided into 5 groups, each with 20 teeth, and each group underwent biomechanical preparation. Group 1 included teeth that had not been prepped; Group 2 included hand files; Group 3 included ProTaper rotary instruments; Group 4 included K3 rotary instruments; and Group 5 included Easy RaCe rotary instruments. Then, roots were cut horizontally at 3, 6, and 9 mm intervals from the apex, and they were viewed under a stereomicroscope. The dentin had flaws, it was found. Groups were investigated using chi-square analysis.

**Results:** The groups differed significantly from one another. Group 1 didn't exhibit any damaged roots. ( $P = 0.006$ ) In the Hand K-file, ProTaper, K3 SybronEndo, and Easy RaCe rotary groups, dentinal flaws were discovered. But across all of the rotational systems

employed in this investigation, the difference was not statistically significant. Results indicated that there were non-significant differences for dentinal abnormalities.

**Conclusion:** When compared to hand instrumentation, the use of rotary devices may increase the risk of developing dentinal abnormalities.

**Keywords:** rotary nickel-titanium files, dentinal damage

## **Introduction**

The aim of root canal treatment (RCT) is to eliminate inflamed and infected pulpal tissue, thus providing an environment that promotes healing, and arrests the progression of periapical pathology. Periapical healing encourages the long-term retention of functional, endodontically treated teeth.<sup>1-4</sup>

Root canal preparation is performed with files, reamers, burs, sonic instruments or mechanical apparatus, and with nickel-titanium (Ni-Ti) rotary file systems. Since most hand preparation techniques are time consuming and may lead to iatrogenic errors (i.e. ledging, zipping, canal transportation and apical blockage), much attention has been directed toward root canal preparation techniques with Ni-Ti rotary instruments. Numerous studies have reported that they could efficiently create smooth, predetermined funnel-form shapes, with minimal risk of ledging and transportation.<sup>5-8</sup>

Rotary instrumentation in curved molar root canals of permanent teeth has been shown to be time efficient, with increased patient comfort lower risk of flare-up.<sup>9,10</sup>

Ni-Ti files do not need precurvature due to their elastic memory; they are motor-activated and can prepare the root canal with high speed. The probability of root canal deformation is reduced due to its elastic memory and radial land that keeps the file in the center of the root canal via wall support and inactive tips.<sup>11,12</sup>

Hence, this study was conducted to assess the Comparison of different rotary files and dentinal damage during root canal treatment seen in stereomicroscope.

## **Material and methods**

100 recently extracted mandibular premolars were chosen, cleaned with a periodontal scaler, and kept in filtered water that had been cleansed. All teeth had their coronal parts removed using a diamond disc, leaving roots that were 16 mm long.

Group 1: Left unprepared

Group 2: Prepared using stainless steel K-files up to apical size 25 at the working length and step-back technique was used till file no. 60.

In the remaining three groups, canal patency was established with a #10 K-file. Then, a size 15 K-file was introduced into the canal until it was visible at the apical foramen. The working length was determined by subtracting 1 mm from this measurement.

Group 3: Prepared using ProTaper rotary system sequentially at the speed of 300 rpm using a crown-down technique. Canal preparation was finished with F2 (25/.08) till working length.

Group 4: K3 rotary system sequentially at the speed of 300 rpm using a crown-down technique. Canal preparation was done with file 25/.06 till working length.

Group 5: Easy RaCe rotary system (FKG Dentaire, La Chaux-de-Fonds, Switzerland) sequentially at the speed of 300 rpm. Canal preparation was done with file 25/.06 till working length.

Each canal in each group received 3% sodium hypochlorite irrigation in between each instrument used to prepare the canal. Dolo Endogel was utilized in groups using a rotational preparation mechanism in between each successive instrument. In order to thoroughly clean the canals in all groups, the EndoActivator was utilized for 30 s with a no. 25 tip. Throughout the experiment, purified filtered water was used to maintain the moisture of all the roots.

SPSS 17.0 statistical software was used to examine the data. To establish whether there was a statistically significant difference in the appearance of defective roots between the experimental groups, a Chi-square test was used. A chi-square test was also run to identify the flaws in each group's various horizontal parts. The significance threshold was established at P 0.05.

## Results

**Table 1: Comparison of number and percentage of teeth showing defects**

Defect	Control group	Hand K-file	ProTaper-rotary	K3-rotary	Easy RaCe rotary	Total
Absent	02	13	15	16	29	75

Present	00	05	09	08	03	25
Total	02	18	24	24	32	100

The difference between the groups was statistically significant ( $P = 0.006$ ). There were no damaged roots in Group 1. In the Hand K-file, ProTaper, K3 SybronEndo, and Easy RaCe rotary groups, dentinal flaws were discovered. But across all of the rotational systems employed in this investigation, the difference was not statistically significant. Results indicated that there were non-significant differences for dentinal abnormalities.

## Discussion

Root canal preparation with different rotary NiTi endodontic instruments may cause stress and strain, which can lead to micro cracks or craze line formation in root dentin.<sup>13</sup> The current study aimed to investigate and compare the effect of endodontic files using different kinematic motions (rotary, reciprocating, and vibratory) on the formation of dentinal microcracks. The total volume of dentin removed from root canals is significantly greater with NiTi engine driven systems may contribute for the formation of the defects. A reciprocal motion has shown various advantages like; extended durability, resistance to cyclic fatigue, and centered root canal preparation.<sup>14</sup>

The groups in this study significantly differed from one another ( $P = 0.006$ ). There were no damaged roots in Group 1. In the Hand K-file, ProTaper, K3 SybronEndo, and Easy RaCe rotary groups, dentinal flaws were discovered. But across all of the rotational systems employed in this investigation, the difference was not statistically significant. Results indicated that there were non-significant differences for dentinal abnormalities.

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Wilcox et al.<sup>15</sup> claimed that the amount of tooth structure removed was associated with vertical root fractures. A previous study<sup>16</sup> reported that the ProTaper Next X2 instrument removed similar amounts of dentin compared with other instruments with larger taper sizes. The design features of the ProTaper Next might be related with the greater crack formation at the 3- and 9-mm levels than with the K3XF and RECIPROC. Furthermore, Bier et al.<sup>17</sup> stated that the instrument taper affected the incidence of microcracks in root dentine. In this study, the apical preparation size was standardized to the size of #25 instrument. Nevertheless, for the final apical taper there were two different sets: 0.06 for K3XF and ProTaper Next and

0.08 for RECIPROC and TF Adaptive system. The larger apical taper in the TF Adaptive group may have contributed to the greater crack formation at the 3-mm level.

## Conclusion

Ni-Ti rotary instruments have several advantages over hand instruments, but they can also damage dentin to variable degrees during root canal preparation. The causes could include the higher taper, more rotations, and forceful cutting since they can raise stresses on the dentin wall and promote the emergence of anomalies in the dentin. This study found that compared to other rotary systems (K3, Easy RaCe), the ProTaper rotary system causes higher dentin damage.

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