

## ORIGINAL RESEARCH

### Comparison of hand files and rotary system for extrusion of debris and irrigants from the apical foramen while performing biomechanical preparation of root canals: An *in-vitro* study

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#### ABSTRACT:

**Background:** Complete preparation of the root canal space is one of the most important stages in endodontic treatment. **Aim of the study:** To compare hand files and rotary system for extrusion of debris and irrigants from the apical foramen while performing biomechanical preparation of root canals. **Materials and methods:** The present study was conducted in the Department of Endodontics of the Dental institution. For the study, authors selected a total of 100 freshly extracted human mandibular premolars with complete root formation and having a single root canal. For the study, we grouped the sample equally into 4 groups for instrumentation with different techniques. Group 1- The teeth in this group were instrumented with a Hand K files. Group 2- The instrumentation of teeth in this group was carried out with a Rotary Protaper instrument. For irrigation of the canal, 1 ml of distilled water was used after every change of instrument. For all instrumentation techniques, the apex was prepared with #40 file. **Results:** In the present study, we observed that more debris and irrigant was extruded from the apex with hand K files as compared to Rotary files. In all the techniques, same amount and type of irrigant was used and the preparation was done by same operator on all patients. The extrusion of debris and irrigant was observed to be highest in Group 1. It was observed that significantly smaller amounts of irrigant and debris were extruded from the apex in Group 2. **Conclusion:** Within the limitations of the present study, it can be concluded that apical extrusion of debris and irrigant is seen with both, hand instruments and rotary instruments; however, the apical debris extrusion is significantly decreased with rotary instruments.

**Keywords:** Root canal treatment, apical debris, irrigant extrusion, K files

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#### Introduction:

Complete preparation of the root canal space is one of the most important stages in endodontic treatment. During preparation, irrigant and debris such as bacteria, dentin fillings, and necrotic tissue may be extruded into the periradicular region leading to periapical inflammation and postoperative flare-ups.<sup>1</sup> Tissue reactions following instrumentation short of the apex are milder than those reactions that follow instrumentation beyond the apex.<sup>2</sup> It is also known that

inflammatory reactions can cause bone resorption, edema, and pain.<sup>3</sup> Debris extrusion from apical foramen is a sequel for all instrumentation techniques, but some methods provide less. In contrast, hand instrumentation has been shown to extrude more debris. Besides, coronal canal preparation before apical cleaning may reduce this side-effect. Following NiTi rotary system introduction various studies have been accomplished to calculate the amount of extruded debris from apical foramen in comparison to Stainless Steel (SS) hand

files.<sup>4-6</sup> Hence, the present study was conducted to compare hand files and rotary system for extrusion of debris and irrigants from the apical foramen while performing biomechanical preparation of root canals.

**Materials and methods:**

The present study was conducted in the Department of Endodontics of the Dental institution. Ethical approval for the study was obtained from the ethical committee of the institute. For the study, authors selected a total of 100 freshly extracted human mandibular premolars with complete root formation and having a single root canal. Preparation of the standard access cavity was done using #10 K-file and working length was determined. The apparatus for collection of irrigant and debris was prepared similar to that described by Meyers and Montgomery.

For the study, we grouped the sample equally into 4 groups for instrumentation with different techniques.

- Group 1- The teeth in this group were instrumented with a Hand K files.
- Group 2- The instrumentation of teeth in this group was carried out with a Rotary Protaper instrument.

For irrigation of the canal, 1 ml of distilled water was used after every change of instrument. For all instrumentation techniques, the apex was prepared with #40 file. After completion of canal instrumentation, the volume of irrigant extruded from apex was measured

following the method given by Meyers and Montgomery. For the measurement of dry debris, the debris adhering to root surface after canal preparation was collected by washing off the apical area of tooth with 1 ml of distilled water and stored in an incubator at 68°C for 5 days for moisture to evaporate and dry weight of debris was measured.

The statistical analysis of the data was done using SPSS version 11.0 for windows. Chi-square and Student’s t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistically significant.

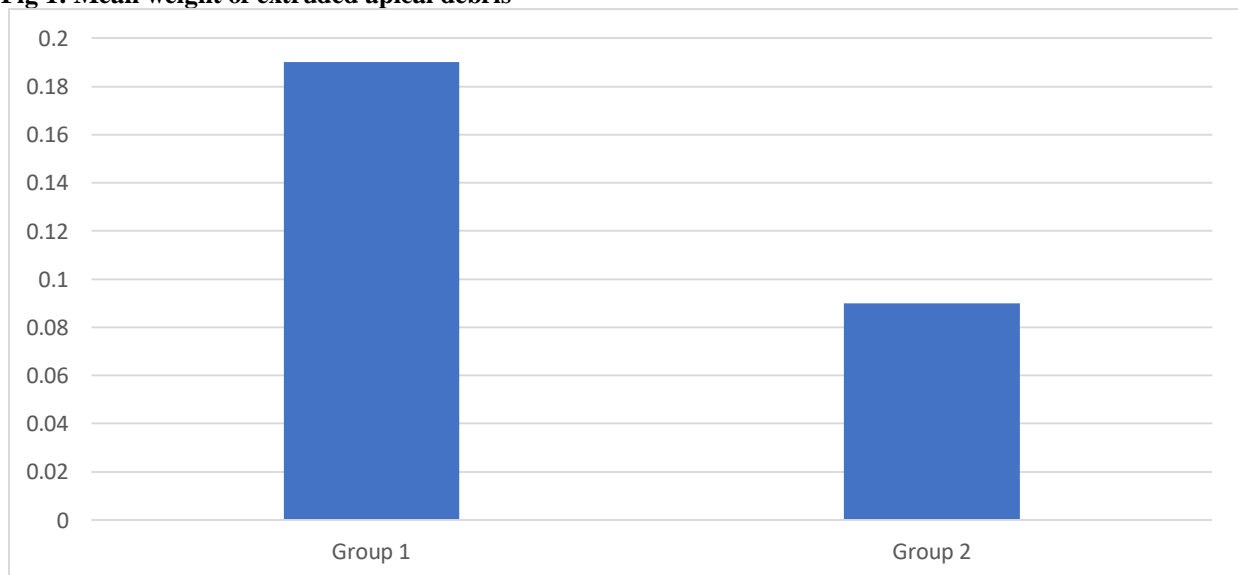
**Results:**

In the present study, we observed that more debris and irrigant was extruded from the apex with hand K files as compared to Rotary files. In all the techniques, same amount and type of irrigant was used and the preparation was done by same operator on all patients. The extrusion of debris and irrigant was observed to be highest in Group 1. It was observed that significantly smaller amounts of irrigant and debris were extruded from the apex in Group 2. (Table 1 and 2; Fig 1 and 2) Statistically significant difference (P<0.05) was observed between group 1 and Group 2 for mean weight of excluded apical debris, however, the mean volume of excluded apical debris was statistically non-significant. (p>0.05)

**Table 1: Mean weight of dry debris extruded by different instrumentation techniques**

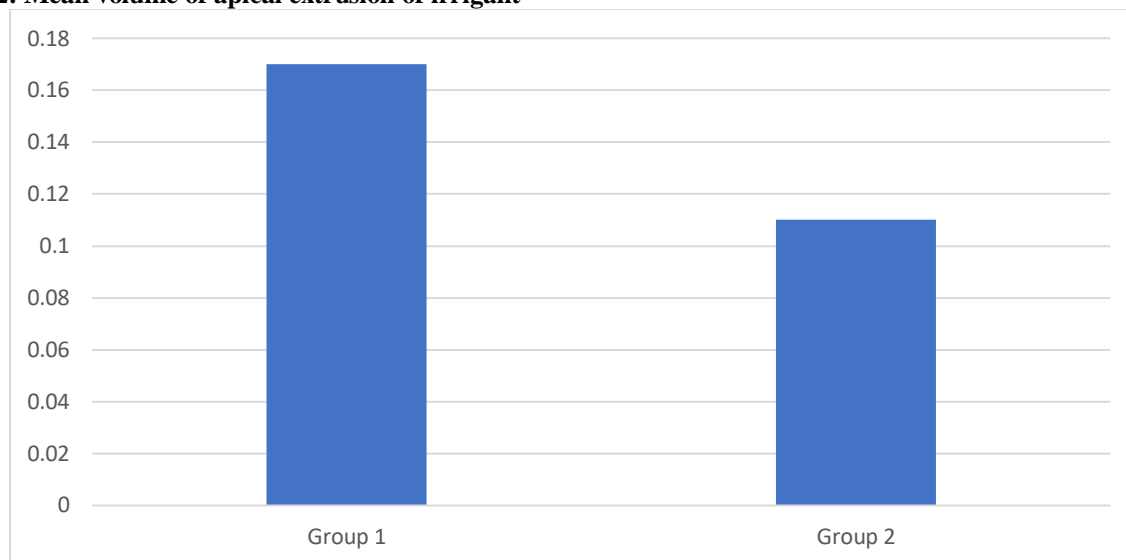
Groups	N	Mean (mg)	p-value
Group 1	50	0.19	0.002
Group 2	50	0.09	

**Fig 1: Mean weight of extruded apical debris**



**Table 2: Mean volume of irrigant extrusion by different instrumentation techniques**

Groups	N	Mean (ml)	p-value
Group 1	50	0.17	0.21
Group 2	50	0.11	

**Fig 2: Mean volume of apical extrusion of irrigant****Discussion:**

In the present study, a total of 100 mandibular premolars were included. Two groups with equal number of teeth were formed. Group 1 teeth were instrumented with hand K files and Group 2 were instrumented with rotary files. Kuştarci A et al compared in vitro the amount of debris and irrigant extruded apically from extracted teeth, using manual technique and crown down pressureless technique by K3, RaCe, and Flex Master instruments. Sixty human single-rooted mandibular premolar teeth were randomly assigned to 4 groups, 15 teeth each. The teeth in 4 groups were instrumented until the working length with RaCe, K3, FlexMaster, and K-type stainless steel instruments respectively. No statistically significant difference was observed among the groups in terms of debris extrusion. On the other hand, a statistically significant difference was observed between K3 and manual technique groups in terms of irrigant extrusion. The difference between other groups was not statistically significant. They concluded that all instrumentation techniques produced extruded debris and irrigant; however, the engine-driven nickel-titanium systems were associated with less apical extrusion and irrigant. <sup>7</sup> Kalra P et al compared the K-file, ProTaper hand and ProTaper rotary instrumentation systems for the amount of apically extruded debris, irrigant solution and intracanal bacteria. Experimental single blinded randomized type of in vitro study with sample of 30

single rooted teeth. Canals were prepared using K files, Hand protapers and Protaper rotary files. Tests revealed statistically significant difference between the amount of debris and number of bacteria extruded by the ProTaper hand and the K-files. No statistically significant difference was observed between the amounts of irrigant extruded by the ProTaper hand and the K-file system. They concluded that amount of apical extrusion of irrigant solution, bacteria and debris are significantly greater with K File instruments and least with Protaper rotary instruments. <sup>8</sup>In our study, mean weight of excluded apical debris and mean volume of excluded irrigant from apical foramen was more with hand K files as compared to rotary files. Thus, exclusion of apical debris and irrigant is seen with both types of instrumentation but the exclusion is significantly reduced with rotary instruments. The results are consistent with previous studies from the literature.

Ghivari SB et al compared the amount of debris and irrigant extruded quantitatively by using two hand and rotary nickel-titanium (Ni-Ti) instrumentation techniques. Eighty freshly extracted mandibular premolars having similar canal length and curvature were selected and mounted in a debris collection apparatus. The step-back technique extruded a greater quantity of debris and irrigant in comparison to other hand and rotary Ni-Ti systems. They concluded that all instrumentation techniques extrude debris and irrigant,

it is prudent on the part of the clinician to select the instrumentation technique that extrudes the least amount of debris and irrigant, to prevent a flare-up phenomena.<sup>9</sup> Singh A et al compared the weight of debris and volume of irrigant extruded apically from teeth using different preparation techniques. Thirty extracted human mandibular premolars with single canals and similar lengths were instrumented using hand ProTaper F2, M-two and WaveOne Primary. There were no statistically significant differences among the groups. The WaveOne reciprocating system showed the maximum amount of apical extrusion of debris and irrigant among all the groups. The least amount of debris and irrigant was observed in ProTaper hand instrument. They also concluded that all instrumentation techniques were associated with debris and irrigant extrusion.<sup>10</sup> Dincer AN et al evaluated the amount of apically extruded debris following root canal preparation with three different instrumentation systems. Sixty mandibular incisor teeth were selected and randomly divided into three groups (n = 20/group) according to the instrumentation system used: the ProTaper Next, the Twisted File Adaptive, and the WaveOne Gold. The mean weights of apically extruded debris were  $0.00035 \pm 0.00014$  g (PTN);  $0.00023 \pm 0.0001$  g (TFA); and  $0.00019 \pm 0.0001$  g (WOG). They concluded that the PTN system extruded more debris than the TFA and WOG systems.<sup>11</sup>

### Conclusion:

Within the limitations of the present study, it can be concluded that apical extrusion of debris and irrigant is seen with both, hand instruments and rotary instruments; however, the apical debris extrusion is significantly decreased with rotary instruments.

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