

## Original Research

### Comparative evaluation of debris extrusion by three file systems with different crosssectional design- An in-vitro study

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#### ABSTRACT:

**Background:** To compare and evaluate debris extrusion by three file systems. **Materials & methods:** A 30 mandibular first premolars were randomly assigned to 3 groups (n = 10 teeth/group). The root canals were instrumented according to the manufacturers' instructions using the Reciprocating single-file system WaveOne™ and full-sequence rotary Hyflex CM™ and ProTaper™ instruments. The debris extrusion was compared and statistically analyzed using analysis of variance and SPSS software. **Results:** A total of 30 teeth were enrolled. The mean extruded debris weight of the three groups were included. The mean apically extruded weight of debris in WaveOne (0.0079 g) was more when compared with the Hyflex (0.0016 g). WaveOne™ and ProTaper™ (0.0068 g) was significantly more when compared to Hyflex™ (P < 0.05). **Conclusion:** The WaveOne™ and ProTaper™ rotary instruments produced significantly more debris compared with Hyflex CM™ rotary instruments (P < 0.05).

**Keywords:** debris, rotary file, waveone.

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#### INTRODUCTION

During the root canal preparation procedures, dentin chips, pulp tissue, microorganisms and/or irrigants may get extruded into the periradicular tissues. Though a thorough control of the working length (WL) may decrease the risk, but nevertheless extrusion of any debris may potentially cause post-operative complications such as flare-ups, <sup>1</sup> which are characterized by pain, swelling causing unscheduled visits of the patients resulting in interappointment emergency. <sup>2,3</sup>

ProTaper™ (DentsplyMaillefer, Ballaigues, Switzerland) system exhibits progressively variable tapers of each instrument that develop a "progressive preparation" in both the vertical and horizontal directions. The ProTaper™ cross-sectional design mimics that of a reamer, with three machined cutting edges and convex core. <sup>4</sup>Hyflex™ CM nickel-titanium (NiTi) Files (Coltene-Whaledent, Allstetten, Switzerland) is produced by an innovative methodology (patent pending) which uses a unique process that controls the material's memory (a

complex heating and cooling treatment). The cross-sectional design of Hyflex™ files is very much similar to EndoSequence. <sup>5</sup>WaveOne™ (DentsplyMaillefer, Ballaigues, Switzerland), the recently introduced single-file NiTi system is claimed to complete root canal preparation with only one instrument in reciprocating motion with adequate size and taper. These files are made of a special NiTi alloy called M-Wire that is created by an innovative thermal treatment process. <sup>6</sup> It is available in sizes of 21.06, 25.08 and 40.08 and these are used in a reciprocal motion that requires a special automated devices. Hence, this study was conducted to compare and evaluate debris extrusion by three file systems.

#### MATERIALS & METHODS

A 30 mandibular first premolars were randomly assigned to 3 groups (n = 10 teeth/group). The root canals were instrumented according to the manufacturers' instructions using the Reciprocating single-file system WaveOne™ (DentsplyMaillefer, Ballaigues, Switzerland) and full-sequence rotary

Hyflex CM™ (ColteneWhaledent, Allstetten, Switzerland) and ProTaper™ (DentsplyMaillefer, Ballaigues, Switzerland) instruments. The canals were then irrigated using bidistilled water. The debris that was extruded apically was collected in preweighed Eppendorf tubes and assessed with an electronic balance and compared. The debris extrusion was compared and statistically analyzed using analysis of variance and SPSS software.

**Table: amount of apically extruded debris.**

Debris extrusion (g)	ProTaper	Hyflex	WaveOne
Mean	0.0068	0.0016	0.0079
Standard deviation	0.0021	0.0009	0.0018

## DISCUSSION

The clinical success of pulpectomy lies in various factors such as chemomechanical preparation, apical and coronal seal, restorative material, number of visits, and obturating material.<sup>7</sup> Optimal quality of obturation is achieved when a good chemomechanical preparation is executed so as to obtain uniform and tapered canals.<sup>8</sup> Conventional endodontic treatment for primary teeth is carried out with K-files and H-files. H-files are favored in primary teeth since they enter canals readily with minimum resistance. H-files remove hard tissue on withdrawal, thus preventing infected material from being pushed out of the apex.<sup>9</sup> Although hand instrumentation is considered to be the most satisfactory method for canal shaping and debridement, it can sometimes result in iatrogenic errors such as perforation and ledge formation and is generally time-consuming.<sup>10</sup> Hence, this study was conducted to compare and evaluate debris extrusion by three file systems.

In the present study, a total of 30 teeth were enrolled. The mean extruded debris weight of the three groups were included. The mean apically extruded weight of debris in WaveOne (0.0079 g) was more when compared with the Hyflex (0.0016 g). A study by Surakanti JR et al studied 60 human mandibular first premolars were randomly assigned to 3 groups (n = 20 teeth/group). The root canals were instrumented according to the manufacturers' instructions using the Reciprocating single-file system WaveOne™ (DentsplyMaillefer, Ballaigues, Switzerland) and full-sequence rotary Hyflex CM™ and ProTaper™ instruments. The canals were then irrigated using bidistilled water. The debris that was extruded apically was collected in preweighed Eppendorf tubes and assessed with an electronic balance and compared. All systems that were used resulted in extrusion of apical debris. Full-sequence rotary instrumentation was associated with less debris extrusion compared with the use of reciprocating single-file systems.<sup>11</sup>

In the present study, WaveOne™ and ProTaper™ (0.0068 g) was significantly more when compared to Hyflex™ (P < 0.05). However, no statistical significant difference was obtained between

## RESULTS

A total of 30 teeth were enrolled. The mean extruded debris weight of the three groups were included. The mean apically extruded weight of debris in WaveOne (0.0079 g) was more when compared with the Hyflex (0.0016 g). WaveOne™ and ProTaper™ (0.0068 g) was significantly more when compared to Hyflex™ (P < 0.05). However, no statistical significant difference was obtained between WaveOne™ and ProTaper™ (P > 0.05).

WaveOne™ and ProTaper™ (P > 0.05). Another study by Nabavizadeh M et al studied In this in vitro study, sixty mandibular premolars with single canal were randomly assigned to three groups (n=20). The root canals were prepared with Medin, ProTaper, and RaCe rotary instruments based on their manufacturers' instructions. The debris were collected into pre-weighted Eppendorf tubes. The weight of the extruded debris was calculated by subtracting the pretreatment weight of the vials. Data were analyzed using the Kruskal-Wallis test at a 5% significance level. Medin instrument caused significantly less debris extrusion in comparison with ProTaper and RaCe (p< 0.05). The differences between the ProTaper and RaCe rotary systems were not statistically significant (p= 0.752).<sup>12</sup> Medin (MEDIN Co., Czech Republic) rotary files with inactive tips and a three-bladed profile are designed to shape curved canals using the crown-down technique. The manufacturers claim that the resistance of files to cyclic fatigue increases by special heat treatment processing. Several Studies have compared this rotary system with popular rotary systems in terms of shaping abilities. Bidar et al. microscopically compared the cleaning efficiency of this rotary system with RaCe and Mtwo instruments and did not find any differences between the groups.<sup>13</sup> In another study, Moradi et al. compared the dentin removal and centering ability of these three rotary file systems in curved canals and found that Mtwo is more conservative for root canal preparation.<sup>14</sup> Talati et al. also found the superiority of Mtwo over RaCe and Medin rotary systems regarding the avoidance of apical transportation.<sup>15</sup> Several studies have considered the apical debris extrusion of popular rotary systems such as ProTaper (DentsplyMaillefer, Switzerland) and RaCe (FKG Dentaire, La Chaux-de-Fonds, Switzerland) rotary systems.<sup>16,17</sup>

## CONCLUSION

The WaveOne™ and ProTaper™ rotary instruments produced significantly more debris compared with Hyflex CM™ rotary instruments (P < 0.05).

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