Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 14s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Comparative Evaluation of Apical Debris Extrusion During Root Canal Preparation Using Two Different Rotary File Systems: "A Wave One Gold and Hyflex EDM Rotary File Comparison

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Cite this paper as: Dr. Arun Rahar, Dr. Jitender, Dr. Vandana, Dr. Nivedita, Dr. Ankita, Dr. Radhika, (2025) Comparative Evaluation of Apical Debris Extrusion During Root Canal Preparation Using Two Different Rotary File Systems: "A Wave One Gold and Hyflex EDM Rotary File Comparison. *Journal of Neonatal Surgery*, 14 (14s), 513-515.

ABSTRACT

Background: This study was conducted for Comparative Evaluation of Apical Debris Extrusion During Root Canal Preparation Using Two Different Rotary File Systems: A Wave One Gold and Hyflex EDM Rotary File.

Material and methods: The working length was determined with number 10 K file up to root canal terminus and subtracting 1 mm from it and confirmed radiographically. An endodontic motor with both continuous and reciprocating motion settings (X-smart plus, Dentsply) was used with 6:1 gear reduction handpiece. A disposable side vented 30-gauge navi tip needle was used for irrigation in all groups, was passively inserted 2 mm from the apex and delivered 8 mL of distilled water as the total volume, 4 mL during instrumentation, and 3 mL as a final flush. Eppendorf tube was used to collect the extruded debris and irrigant during the preparation and were incubated at 37°C for 15 days to allow moisture to evaporate, before weighing the dry debris. On an electronic microbalance, three successive measurements of each eppendorf tube were made, and the mean of these readings was taken to determine the weight of each tube. By deducting the tube's pre-experiment weight from the weight of the tube containing dried debris, the weight of the extruded debris in each tube was estimated. For each group, the mean weight of the extruded debris was computed.

Results: The mean apically extruded weight of debris in WaveOne Gold (0.0084 g) was observed to be higher than Hyflex EDM (0.0023 g)

Conclusion: Based on the findings of the study, it was discovered that the mean apically extruded weight of debris in WaveOne Gold was higher than Hyflex EDM.

Keywords: *Apical Debris, RCT, Rotary Files, Hyflex EDM, Wave One Gold.*

1. INTRODUCTION

The potential outcomes of cleaning and shaping procedures include inflammation in the periapical region, which may arise from the creation of a wound due to pulp extirpation or from the displacement of debris into the periapical area.[1]

It is recognized that both contaminated and uncontaminated dentin and pulp tissues can trigger an inflammatory response.[2]

Historically, stainless steel hand files were the primary tools employed for cleaning and shaping. However, due to iatrogenic complications such as ledging, zipping, canal transportation, apical extrusion, and blockage associated with these files, there has been a significant shift towards exploring new materials, instruments, and techniques aimed at achieving a clean, disinfected, and debris-free canal while minimizing or preventing apical extrusion. Each system presents its own set of benefits and drawbacks.[3]

This study was conducted for Comparative Evaluation of Apical Debris Extrusion During Root Canal Preparation Using Two Different Rotary File Systems: A Wave One Gold and Hyflex EDM Rotary File.

2. MATERIAL AND METHODS

The study included, 30 mandibular premolars with a single straight canal that were extracted from individuals between the ages of 20 and 30 for orthodontic reasons. The study excluded any malformed teeth as well as those that had under-gone internal or exterior resorption. A digital calliper was used to measure the length of the teeth, and the crown was then marked with a marker pen to show that just 15 mm would be left after the teeth were decorated with a diamond disc and plenty of water cooling.

Two groups were made, 15 teeth were kept in each group.

Group I (Hyflex EDM): Glide path was established using size #15 K-File. The HyFlex EDM file with the size of 25.08 was used in a gentle in-and-out motion operated at 500 rpm rotary motion and 2.5 Ncm torque.

Group II (Waveone Gold): Countering motion back and forth was used with a reciprocating WaveOne Gold file. 0.07 tapered reciprocating WaveOne Gold file (Dentsply Maillefer, Ballaigues, Switzerland) was used slowly with an in-andout pecking motion as suggested by the manufacturer. The instrument flutes were cleaned after every three pecks.

The working length was determined with number 10 K file up to root canal terminus and subtracting 1 mm from it and confirmed radiographically. An endodontic motor with both continuous and reciprocating motion settings (X-smart plus, Dentsply) was used with 6:1 gear reduction handpiece. A disposable side vented 30-gauge navi tip needle was used for irrigation in all groups, was passively inserted 2 mm from the apex and delivered 8 mL of distilled water as the total volume, 4 mL during instrumentation, and 3 mL as a final flush. Eppendorf tube was used to collect the extruded debris and irrigant during the preparation and were incubated at 37°C for 15 days to allow moisture to evaporate, before weighing the dry debris. On an electronic microbalance, three successive measurements of each eppendorf tube were made, and the mean of these readings was taken to determine the weight of each tube. By deducting the tube's pre-experiment weight from the weight of the tube containing dried debris, the weight of the extruded debris in each tube was estimated. For each group, the mean weight of the extruded debris was computed.

3. RESULTS

Debris extrusion (g)	Hyflex EDM	WaveOne Gold
Mean	0.0023	0.0084
Standard deviation	0.0007	0.0013
Minimum	0.0009	0.0036
Maximum	0.0024	0.0105

The mean apically extruded weight of debris in WaveOne Gold (0.0084 g) was observed to be higher than Hyflex EDM (0.0023 g)

4. DISCUSSION

During the procedures for root canal preparation, there is a possibility that dentin chips, pulp tissue, microorganisms, and/or irrigants may be expelled into the periradicular tissues. While careful management of the working length (WL) can mitigate this risk, the extrusion of any debris may still lead to post-operative complications, such as flare-ups, which manifest as pain and swelling, prompting unscheduled patient visits and resulting in interappointment emergencies. Currently, all preparation methods and instruments are linked to the extrusion of debris, even when the preparation is intentionally kept short of the apical terminus.[4-6]

Notably, manual instrumentation tends to produce more extrusion compared to engine-driven rotary techniques. Research has consistently demonstrated that no existing technique or instrument can effectively clean and shape the root canal system without generating some degree of apically extruded debris (AED). Nevertheless, it has been established that different instrumentation techniques are associated with varying quantities of AED.[7,8]

This study was conducted for Comparative Evaluation of Apical Debris Extrusion During Root Canal Preparation Using Two Different Rotary File Systems: A Wave One Gold and Hyflex EDM Rotary File.

In this study, the mean apically extruded weight of debris in WaveOne Gold (0.0084 g) was observed to be higher than Hyflex EDM (0.0023 g)

Surakanti JR et al.[9] The purpose of this *in vitro* study was to assess the amount of apically extruded debris during the root canal preparation using rotary and reciprocating nickel-titanium instrumentation systems. In this study, 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™ (Dentsply Maillefer, Ballaigues, Switzerland) and full-sequence rotary Hyflex CM™ (Coltene Whaledent, Allstetten, Switzerland) and ProTaper™ (Dentsply Maillefer, 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 the post hoc Student-Newman-Keuls test. The WaveOne™ and ProTaper™ rotary instruments produced significantly more debris compared with Hyflex CM™ rotary instruments ($P < 0.05$). Under the conditions of this study, 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.

Patel AR et al.[10] The objective of this study is to evaluate and compare the amount of apically extruded debris during root canal preparation with three different instrumentation systems. The mesiobuccal canals of ninety mature, human mandibular molars were randomly divided into three groups (n = 30 teeth/group). Each group was instrumented using one of the three different instrumentation systems: WaveOne Gold (WOG), self-adjusting files (SAFs), and Hyflex EDM (HEDM). The canals were irrigated using bidistilled water. Debris extruded was collected in preweighed Eppendorf tubes, and the extruded irrigant was evaporated. The weight of the dry extruded debris was established by comparing the pre- and post-instrumentation weight of Eppendorf tubes for each group. The debris extrusion was compared and statistically analyzed using the analysis of variance and the *post hoc* Tukey test. The WOG and HEDM file systems produced significantly more debris compared with SAF system ($P < 0.05$). All instrumentation systems tested produced apical extrusion of debris. SAFs extruded significantly lesser amount of debris than WOG and HEDM.

5. CONCLUSION

Based on the findings of the study, it was discovered that the mean apically extruded weight of debris in WaveOne Gold was higher than Hyflex EDM.

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