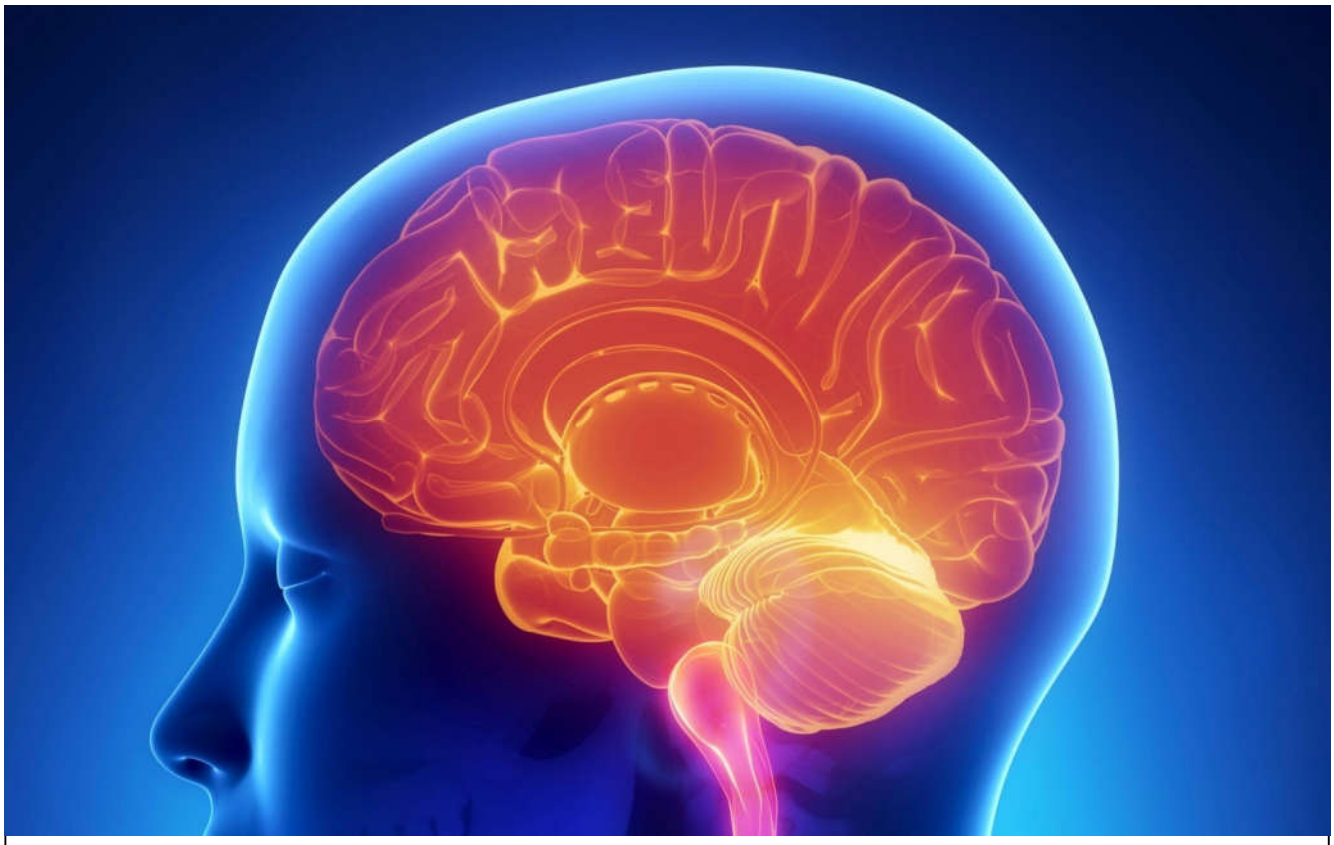

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APICAL EXTRUSION OF DEBRIS AND IRRIGANT USING NEOLIX AND ONE-SHAPE ROTARY SYSTEMS: A COMPARATIVE STUDY

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ABSTRACT

Extrusion of any debris during endodontic treatment may potentially cause post-operative complications such as flare-ups. The purpose of this in vitro study was to assess the amount of apically extruded debris during the root canal preparation using Neolix and One-Shape rotary systems.

Materials and Method: In this study, 20 extracted human mandibular first premolars were randomly assigned to 2 groups (n = 10 teeth/group). The root canals were instrumented according to the manufacturers instructions using the Neolix (Orikam) and One Shape (Micro-Mega) rotary instruments. The canals were then irrigated using normal saline. The debris and irrigant collection apparatus prepared was similar to that described by Meyers and Montgomery. The debris that was extruded apically was collected in preweighed eppendorf tubes and assessed with an electronic balance and compared.

Statistical Analysis Used: The debris extrusion was compared and statistically analyzed using Mann-Whitney U test.

Results: The One Shape rotary instruments produced significantly more debris compared with Neolix rotary instruments ($P < 0.05$).

Conclusions: Under the conditions of this study, all systems that were used resulted in extrusion of apical debris. One Shape rotary instruments produced significantly more debris compared with Neolix rotary instruments

INTRODUCTION

The main objective of the root canal treatment is thorough debridement and complete shaping of the root canal system**.** A thorough control of the working length (WL) is necessary to minimize the risk of extrusion of any debris into the periradicular region. Extrusion of any debris during endodontic treatment may potentially cause post-operative complications such as flare-ups and periapical inflammation.[1] Several instrument designs & instrumentation techniques have been developed to prevent this.

Studies examining an apical extrusion of debris have stated that procedures using the push–pull motion tend to produce more debris than those involving some sort of rotational movement. This has led to the hypothesis that engine-driven instruments produce less debris than hand filing techniques, as they have a tendency to pull debris in the flutes of the instrument.[2]

Traditionally the shaping of root canals was achieved by the use of stainless steel hand files. However, using stainless steel hand files have several drawbacks. They require the use of numerous hand files and drills to adequately prepare the canals (Schilder 1947). Hand instrumentation with stainless steel files is time consuming. (Ferraz *et al* 2001). Therefore, nickel titanium single file systems were introduced.[3]

Nickel titanium being super elastic, allows preparation of curved root canals with minimal procedural errors especially in the apical area of the curved canal. Single file NiTi rotary systems were preferred as they are time saving, 2-3 times more elastic than stainless steel files, have an added advantage of minimum or no glide path and reduce instrument fatigue &

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reduces possible cross contamination as compared to multiple file systems.[4] Some of the examples of single file systems are WaveOne, Reciproc, Neolix, One Shape and F360.

Neolix rotary files have a progressive flexibility to better negotiate the curves and respect the canal anatomy. The built-in abrasive properties of the flutes and edges associate a greater and cutting action, avoiding smear layer risk. One shape rotary files are resistant to cyclic fatigue and twisting and are particularly useful for canals difficult of access and highly mineralized canals with strong curvatures. They have asymmetrical cross-section along the entire blade, variable cross-section and a longer pitch.

The main objective of this study was to compare the apical extrusion of dentine debris as a result of canal shaping with Neolix and One Shape rotary systems.

MATERIALS AND METHOD

Twenty freshly extracted intact, untreated human Mandibular premolars with single root canal and apical foramen having root curvature between 0° and 10° were used in the study. The teeth were stored in normal saline after cleaning the root surface with ultrasonic scaler. The standard access cavity was prepared in each tooth. To maintain similar tooth lengths all the teeth were decoronated using a diamond disc at 15mm from the apex of the tooth and all external tooth surfaces were covered with 2 layers of nail polish except for 1 mm around the apical foramen. The teeth in which the #10 K-file can just be seen through the apex and # 15 K-file that fitted snugly at the working length were selected for the study. The debris and irrigant collection apparatus prepared was similar to that described by Meyers and Montgomery.

A bent 19-gauge needle was forced alongside the rubber stopper to use as a drainage cannula and balance between the air pressure inside and outside the vials. (Fig 1)

Fig1 Irrigant collection apparatus similar to that of Meyers and Montgomery

Before starting the experiment, the initial weights of empty Eppendorf tubes were measured with a 10^{-6} g precision electronic balance (Fig 2).Three consecutive measurements were taken, and the average measurement for each tube was considered to be its initial weight. The tooth was forced through a rubber stopper of the vial after standard access cavity preparation.

All instruments were set into permanent rotation with a 6:1 reduction using X-SMART endo motor (Dentsply, Maillefer). For each file, the individual torque limit and rotational speed programmed in the file library of the motor were used. All the preparations were made by a single operator. During the entire cleaning and shaping procedure with both Neolix and One Shape files irrigation was performed after every instrument with normal saline, followed by a final rinse of root apex externally so as to remove the debris adhering the root surface. The total volume of irrigant in each group was the same and it was 2 mL for every tooth. The tooth were detached from the apparatus and the tubes were incubated at 70 degree Celsius for 5 days to evaporate the solution. The tube was again measured on an electronic weighing scale. The difference between the pre-instrumentation and post-instrumentation weight of the Eppendorf tube was calculated for the amount of extruded debris.

Fig 2 Eppendorf tubes measured with a electronic balance

RESULTS

The mean apical extrusion of debris weight is shown in Table

1. The results showed that all instrumentation techniques produced a significant amount of extruded debris. The mean apically extruded weight of debris in Neolix (6.70 g) was less when compared with the One Shape (14.30g).

However, statistical significant difference was obtained between Neolix and One Shape ($P < 0.05$).

	Mean Rank	Mann Whitney U	P Value
NEOLIX	6.70	12.00	0.004 *
ONE SHAPE	14.30		

Results were statistically analysed by Mann-Whitney U test

DISCUSSION

Apical extrusion of debris and irrigant is an inherent limitation associated with cleaning and shaping of root canals. The extruded material referred to as the 'worm of necrotic debris' has been related to periapical inflammation and postoperative flare-ups. [2] The immunological aspects of postoperative flare-ups demonstrated that antigens originating from root canal resulted in the formation of an antigen-antibody complex when forced beyond the apical foramen, which could lead to a severe inflammatory response.[5]

Many factors play an important role in affecting the amount of debris and irrigant extrusion such as instrument size, instrument type (cross-sectional design),canal preparation technique, apical stop, irrigation solution, and irrigation delivery system.[7] In this study the variations recorded in terms of weight of debris and irrigant extruded is a function attributed entirely to the different types of instruments and its cross-sectional design while keeping the irrigation protocol and volume constant**.** Vande Visse JE and Brilliant have shown that in the absence of an irrigant, no significant extrusion of

debris was observed, while a thick worm of debris extruded when an irrigant was used.[2]

In the current study, the type and quantity of the irrigants used were the same. The amount of irrigation solution was kept constant in all of the groups, to decrease variables during the irrigation process. 30-gauge side-port opening needle was selected for use because this method would minimize forcing the irrigant out of the canal.[6]

Earlier studies have shown that manual instrumentation produced significantly more debris than the rotary NiTi techniques and the balanced-force technique. In case of engine driven instruments early flaring of the coronal part of the preparation may improve instrument control during preparation of the apical third of the canal. The rotary motion tends to direct debris toward the orifice, avoiding its compaction in the root canal.[1]

Single file endo concept is said to require a minimum or no glide path and only a single file for complete instrumentation for majority of root canals. The recommendation for single use has added advantage of reducing instrument fatigue. This concept reduce the working time, cost and lower cross contamination between patients, a common problem associated with the use of multiple files.

The One Shape system consists of only one instrument & has three variable cross-sections along the length of the blade:-

- At the apical part there are three symmetrical cutting edges.
- In the middle the number decreases to two cutting edges; this part is asymmetrical.
- In the coronal part there are two S shaped cutting edges.

Elmsallati Ea *et al*, reported that the file with short pitch design extruded less debris than the medium and long ones. [2] However One Shape files have a longer pitch as compared to Neolix.

NeoNiti file system (Neolix, France) is an efficient file system to shape the root canal completely to a continuously tapering funnel shape. It has non-homothetic rectangular cross section. To prevent the instrument fracture of roatry nickel titanium instruments a new technology EDM (Electric Discharge Machining) is introduced. The NeoNiTi file system is made up by the EDM (Electric Discharge Machining) process which is responsible for the unique behavior of the file. Neolix file has superior cutting edges, a built-in abrasive surface and a progressive flexibility, resulting in an unmatched Cutting Efficiency and Resistance to Fatigue. The appropriated heat treatment can dramatically increase the flexibility and the resistance to fatigue.[7]

Limitations of This Study

1. It must be emphasized that the results of this study should not be directly extrapolated to the clinical situation. No attempt has been made to simulate the presence of vital pulp or periapical tissues, an in vivo model may give different result, as the periapical tissues may serve as a natural barrier, inhibiting debris extrusion.
2. Results may also differ because of positive and negative pressure at the apex and with normal or pathological periapical tissues.
3. Salt precipitation that occurs after desiccation of the NaCl solution might increase the weight of apically extruded debris.

CONCLUSION

All of the instrumentation systems used in the present study produced apical extrusion of intracanal debris and irrigation solution. Under the conditions of this study, One Shape rotary was associated with more debris extrusion as compared to Neolix.

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