Research Article

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# Evaluation of Difference between Efficiency of Smear Layer Removal by Reciprocating Wave One Gold and Continuous Rotation One Shape File Systems Through SEM

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## ABSTRACT

**Background**: A Successful endodontic therapy depends on many factors, one of the most important factor in any root canal treatment is root canal preparation. Maintaining the original shape of the canal is very important otherwise, canal aberrations will be created. The present study was conducted to evaluate the difference between efficiency of smear layer removal by reciprocating wave one gold and continuous rotation one shape file systems through SEM (scanning electron microscope).

**Material and methods:** In the present study a total of 80 single-rooted human teeth freshly extracted for periodontal reasons were selected for this study. In teeth with intact root apices, patency of apical foramina was standardized using size 10 stainless steel K-Files. Teeth were randomly numbered and divided into two groups: group A (wave one gold) (n=40): and group B(one shape) (n=40):. Root canals were irrigated with 1 mL of 5.25% NaOCl followed by 1 mL of 17% ethylene diaminetetraacetic acid after each change of instrument. Each sample were dipped in liquid nitrogen immediately after canal preparation and split longitudinally into 2 halves (24) with a stainless-steel chisel. The sections were then prepared for scanning electron microscopy (SEM) analysis. The debris score of all the samples was analysed using Mann–Whitney U-test.

**Results:** In present study total sample size was 80, which were divided into two groups. Our study shows that group B shows greater efficiency in reducing smear layer than group A.

**Conclusion:** Our study concluded that one shape file system is better than wave one gold system in removing smear layer.

**Keywords:** Wave one gold, one shape, smear layer.

## INTRODUCTION

Root canal therapy is one of the standard treatment modalities for pulpally involved teeth. Successful endodontic therapy depends on many factors. One of the most important step in any root canal treatment is root canal preparation.[1] The major aim of the endodontic treatment is to remove infected and necrotic tissue and debris, shape the root canals and provide an adequate seal of the root canals system.[2] Smear layer is always formed due to dentin cutting no matter what type of instrument is used .[3] The smear layer consists of dentin, remnants of odontoblastic processes, pulp tissue, and bacteria. Packing of smear debris in the tubules may reach a depth of 40 µm.[4] To meet this challenge, Nickel – titanium (NiTi) rotary technique have been developed to improve root canal preparation

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because of the unique properties of the alloy. These instruments are able to improve both the morphological characteristics and safety of canal shaping.[5] It was reported that they can maintain the original shape of the canal with minimal transportation.[6] Single files which worked in continuous rotation motion include One Shape (Micro-Mega, France), KOMET F 360 (Komet, USA) and NeoNiTi files (Neolix SAS, France). Single reciprocating file systems include WaveOne (Dentsply Maileffer, Switzerland), Reciproc (VDW, Munich, Germany) and Unicone files (Medin, Czech Republic).[7] The present study was conducted to evaluate the difference between efficiency of smear layer removal by reciprocating wave one gold and continuous rotation one shape file systems through SEM (scanning electron microscope).

## MATERIAL AND METHODS

In the present study a total of 80 single-rooted human teeth freshly extracted for periodontal reasons were selected for this study. Before the commencement of the study ethical approval was taken from the Ethical Committee. The extracted tooth was placed in saline at room temperature immediately after extraction. The teeth which were morphological similar, single-canal roots, straight roots, absence of root decay and absence of previous endodontic treatment were included in the study. In teeth with intact root apices, patency of apical foramina was standardized using size 10 stainless steel K-Files. Teeth with apical diameters larger than size 15 or with an altered apex were not included in the study. Teeth were randomly numbered and divided into two groups: group A (n=40): Wave onegold ; and group B (n=40): one shape. Root canals were irrigated with 1 mL of 5.25% NaOCl followed by 1 mL of 17% ethylenediaminetetraacetic acid after each change of instrument for group A and after 3 in-and-out movements for group B. After canal preparation, a final 1-mL aliquotof 17% EDTA was left in situ for 2 minutes and replaced by 1 mL of 5.25% NaOCl for 3 minutes. A final flush with ethanol for 30 seconds concluded the preparation. Each canal was dried with calibrated paper points.All irrigation procedures were delivered with a 27-gauge needle. Samples were prepared with two different instruments: In Group B One Shape files with 6% taper (tip diameter of 0.25mm) was used for instrumentation of canal in rotating motion in endomotors at 400rpm and 2.5Ncm torque. Instrumentation of canals was completed in three consecutive steps using in and out pecking motion up to WL.

In Group A Wave One gold files with 7% taper (tip diameter of 0.25mm) was used for instrumentation canals in reciprocating motion in endomotor. Instrumentation was completed in three consecutive steps.

The flutes of the instrument were cleaned after 3 in-and-out movements and working length was reached with slow in-and-out pecking motion. Each sample were dipped in liquid nitrogen immediately after canal preparation and split longitudinally into 2 halves (24) with a stainless-steel chisel. The sections were then prepared for scanning electron microscopy (SEM) analysis. The samples were dehydrated in graded concentration ethanol solutions and then gold (Au=99.99) sputtered and observed with SEM. After a general survey of the canal wall from the apex to the most coronal part, 6 SEM photomicrographs were obtained at a standard magnification of ×5,000 at each third (coronal, middle and apical). Each root segment was approximately 12 mm in length: 4 mm for coronal, 4 mm for middle and 4 mm for apical third. The images were saved digitally with specific magnifying software and scored by 3 trained operators blinded to the preparation procedures.

Score system for smear layer (dentine particles, remnants of vital or necrotic pulp tissue, bacterial components and retained irrigant):

- Score 1: no smear layer, with orifices of dentinal tubules open.
- Score 2: small amount of smear layer, and some dentinal tubules open.
- Score 3: homogenous smear layer covering the root canal wall, only a few dentinal tubules open.
- Score 4: complete root canal wall covered by a homogenous smear layer, with no open dentinal tubules.
- Score 5: heavy, homogenous smear layer covering the entire root canal wall.

The debris score of all the samples was analyzed using Mann–Whitney U-test.

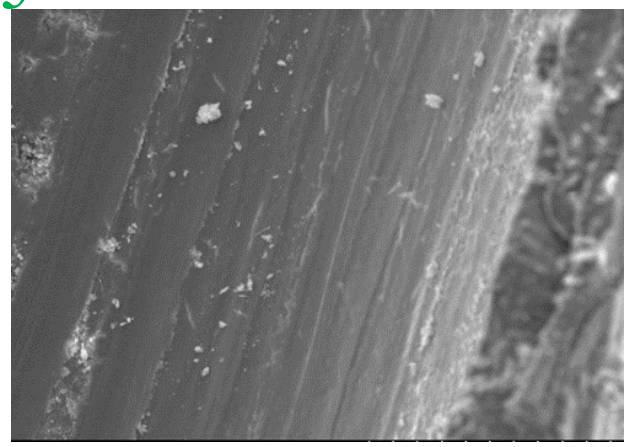

Fig 1: Photomicrograph of root canal shaping with reciprocating waveone coronal third).

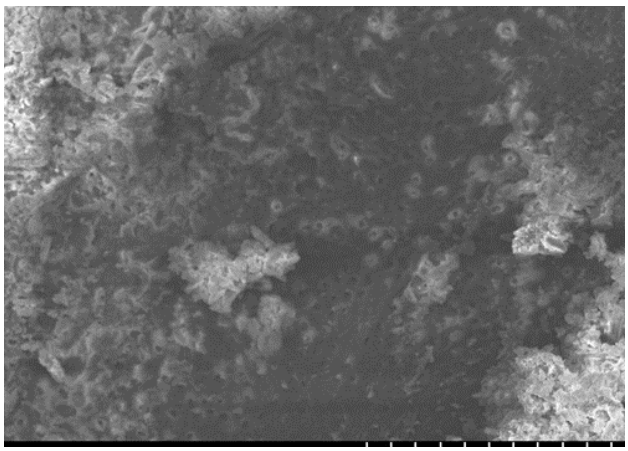

Fig 2: Photomicrograph of root canal shaping with reciprocating waveone (middle third).

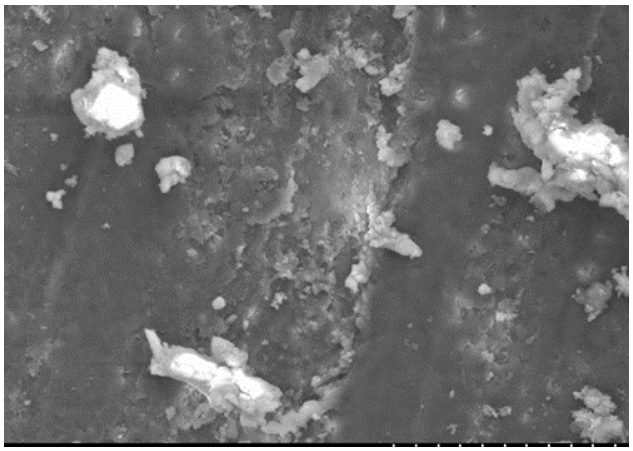

Fig 3: Photomicrograph of root canal shaping with reciprocating waveone (apical third).

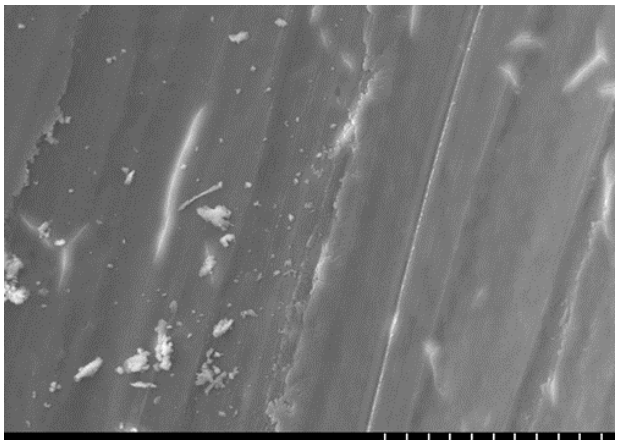

Fig 4: Photomicrograph of root canal shaping with continuous motion one shape (coronal third).

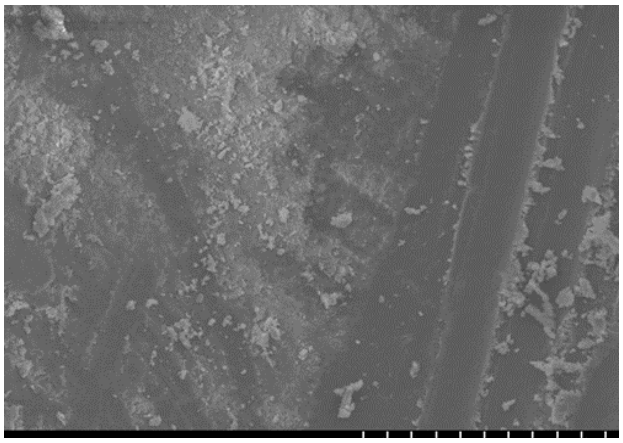

Fig 5: Photomicrograph of root canal shaping with continuous motion one shape (middle third).

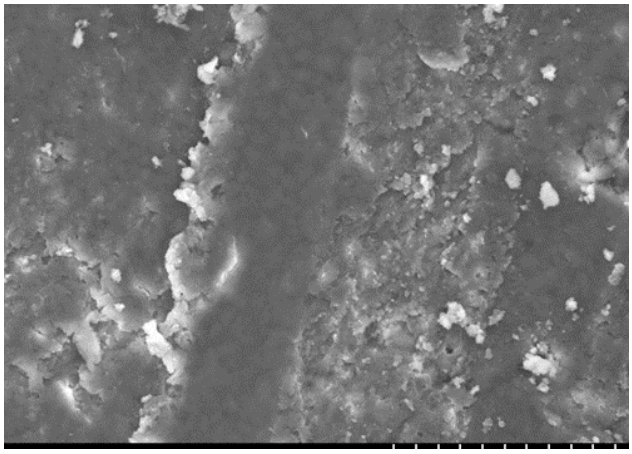

Fig 6: Photomicrograph of root canal shaping with continuous motion one shape (apical third).

## RESULTS

In present study total sample size was 80, which were divided into two groups. Our study shows that group Bshows greater efficiency in reducing smear layer than group A.

Table 1: Mean and standard deviation of samples according to Mann–Whitney U-test.

| | Group B | Group A |
|---|---|---|
| Mean | 1.566 | 1.786 |
| Median | 1.342 | 2.564 |
| SD | 0.465 | 0.833 |

## DISCUSSION

Preparation of the root canal determines the success of all succeeding steps. Adequate instrumentation(shaping) combined with effective irrigation is required to achieve adequate disinfection and for achieving the biological and mechanical purpose of the root canal treatment.[8-10]

Our study shows that one shape file system is better than wave one gold system in removing smear layer. Nabeshima *et al.* who reported 96.5% bacterial reduction for OneShape.[11]

One shape instrument is made up of NiTi alloy and has a tip size of 25mm with constant taper of 0.06mm such that it has different cross sectional design over its entire working length and variable pitch length. This asymmetrical design is alleged to eliminate threading and binding of the instrument in continuous rotation.[12]

Waveone Gold WOG 25 (0.07 taper) has a parallelogram cross-section with 2 cutting edges. It also features the off-center design of protaper next (Dentsply Malleifer) files and is manufactured with advanced gold with heat treatment technique. This newer manufacturing technique improves the elasticity and cutting efficacy of the file.[13]

The results of the study by Tewari et al.[14] and Machado et al.[15], who observed a better performance of a parallelogram-shaped cross-section instrument compared to other systems.

## CONCLUSION

Our study concluded that one shape file system is better than wave one gold system in removing smear layer.

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