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Apically extruded debris in curved root canals using the waveone gold reciprocating system

Baljeet Singh Hora
Professor, Department of Conservative Dentistry and Endodontics, Rama Dental College, Hospital and research centre
Corresponding author email: drbaljeet69@yahoo.com

Asheesh Sawhny
Professor and Head of Department, Department of Conservative Dentistry and Endodontics, Rama Dental College, Hospital and Research Centre
Email: drasheeshmydentist@gmail.com

Pragati Barukial
Postgraduate student, Department of Conservative Dentistry and Endodontics, Rama Dental College, Hospital and Research Centre
Email: pragatibarukial25@gmail.com

Debasmita Ghosh
Postgraduate student, Department of Conservative Dentistry and Endodontics, Rama Dental College, Hospital and Research Centre
Email: debasmita2495ghosh@gmail.com

Pushpendu Roy
BDS, MDS (Department of Conservative Dentistry and Endodontics)
Email: pushpenduroy333@gmail.com

Ankita Shrivastav
Post Graduate, Department of Prosthodontics and Crown and Bridge, New Horizon dental college and research institute, Bilaspur (C.G) 495001
Email: ankbebz_13@yahoo.in

***Abstract*---**Background**:** The purpose of this study was to evaluate apical debris extrusion in curved root canals using a specific file system. Methods:50 human mandibular molars were extracted and chosen for the study, ranging between 20 and 40 degree and curvature radii <10mm were randomly assigned to 2 groups (n=20) according to the kinematics used for root canal preparation (reciprocating motion with waveone gold reciprocating system) and the Manual Technique. The apically extruded debris were collected in

eppendorf tubes. The tubes are stored in an incubator for 5 days. The time recorded for each instrumentation procedure was recorded. Results: The Wave One Gold reciprocating system is associated with less extrusion of debris as compared to Manual technique. Conclusion : Under the conditions of the study both the Wave One Gold Reciprocating system and the Manual instrumentation technique caused apical debris extrusion to some degree. The WaveOne Gold reciprocating system caused less extrusion of debris in curved root canals compared with manual instrumentation technique.

***Keywords*---**root canal therapy, waveone file, debris, curved root.

Introduction

This may be done in order to avoid the chemomechanical preparation of root canals from extruding bacteria into the surrounding tissues by moving dentin chips and pulp tissue debris toward its apex. As a consequence, post-operative discomfort, flare-ups, or even apical healing failure may affect the endodontic treatment's clinical outcomes. Recent advancements in metal heat treatment, alloy kinematics, and Ni-Ti file technology have transformed root canal treatments. While apically extruded debris is produced by all preparation methods, motor-driven devices have been demonstrated to generate less debris extrusion than manual file techniques1. Using fewer stages and files, reciprocating systems were designed to make root canal instrumentation more efficient9

“Using a particular heat treatment, the Densply Tulsa Dental, Tulsa, OK, WaveOne Gold (WOG) reciprocating system is a single-file system that enhances its instruments' physical properties (gold alloy technology). 2 In order to allow for more file flexibility than the prior WaveOne reciprocating system (Dentsply Tulsa Dental), the WOG's tip diameters, tapers, and cross section (a parallelogram with two cutting edges) were changed (7). When compared to the WaveOne Primary file, the WOG Primary file has a 50% stronger resistance to cycle fatigue (8). They have proved to be more resistant to cycle fatigue than the WaveOne instrument and have more torsional stress resistance and flexibility when compared with the Twisted File Adaptive (TFA) instruments, according to Adiguzel and Capar (9).”

One or two studies (13–15) have evaluated the expulsion of debris at the end of circular channels with varying flow rates. Another factor that might affect instrumentation problems is apical garbage ejection, a characteristic that is usually associated with teeth that have deep root pits. It was determined how much apically ejected trash and instrumentation time were produced by instrumenting mandibular molars with bended root trenches using the WOG responsive single-record framework and hand documentation, respectively.

Materials and Methods

Sample Selection

The Federal University of Rio Grande do Sul's Institutional Research Ethics Committee (registration number 1.413.530) authorized the study's protocol in Porto Alegre, Rio Grande do Sul, Brazil. For future use, 50 human mandibular molars were extracted and placed in physiological saline solution. Apical patency and mature apices were required for participation in this study, as was the absence of prior endodontic treatment. The dental radiographs' arch points were measured using picture inspection software, and then the selected root examples were selected (Adobe Photoshop CS3; Adobe Systems Inc, San Jose, CA). The examination comprised locations ranging from 20 to 40 degrees and bend radii smaller than 10 mm, following the technique of Sch€afer et al.

Root Canal Preparation

With air-water cooling, round jewel pods (#1014 KG Sorensen in Brazil) were used to construct standard access trenches at fast speeds. A low-speed contra-point handpiece and a LA Axxess case # 35.06 (SybronEndo) were used to expand the cervical third of the channel after a water framework with refined water. K-records confirmed the apical patency of each of the root canals (Dentsply Tulsa Dental). Figured tomographic frameworks were used to examine the samples at 90kV, 112mA and 12.8-mm voxel size boundaries in the instances (SkyScan 1174v.2; Bruker-microCT, Kontich, Belgium). The images were re-created using CT and programming in three different ways (form 1.4.32, Bruker-microCT).

An average of 0.09-0.05 mm was determined for the foramina's apical width, which was chosen, described, and quantified using Adobe Photoshop (Adobe Systems Incorporated) software. As a result of their foramen breadth and point of arch, the instances were randomly allocated to two experimental groupings (n = 20):

1. The WOG group: VDW Silver endodontic engine was connected to the WOG Primary record (#25.07) and the "WaveOne All" mode had been activated. According to its creator's instructions, a slow, in-and-out pecking action was used for this record.
   The WOG # 25 record was reworked till it reached the working length (WL). The instrument's woodwinds were cleaned after three pecks.
2. The manual technique group: Hand files made using FlexoFile were used in the crown-down method (Dentsply Maillefer, Ballaigues, Switzerland). The coronal portion of each canal was prepared with a LA Axxess bur #35.06. In the beginning, manual instruments were made in sizes ranging from 50 to 45, and then 35, 30 and 25 up to the WL. Preparations for the apical stop were done using file #25.02.
   Using a #10 K-file, DentsplyTulsa Dental figured out the principal diameter of the canal and deducted 1 millimeter from that figure. This resulted in the WL.

Checking the canal's integrity using a #10 K-file was done at the WL A NaviTip irrigation needle and a syringe were used to irrigate 10 milliliters of distilled water during canal preparation (Ultradent, South Jordan, UT).For each surgery, a single operator utilized just one equipment to prepare one canal.[15]

Debris Assessment

Chemo mechanical planning was influenced by a previous project's method for collecting apically ejected waste (20). They removed the plugs from the Eppendorf tubes and found that they were all within the acceptable range (Sartorius, Göttingen). Three progressively increasing loads were obtained for each cylinder, and the mean was not predetermined. All teeth were put into Eppendorf tube plugs until they reached the concrete polish junction. A 27-G needle was placed just beyond the fitting when it was time to establish the strain both inside and out.

The fitting, needle, and teeth were removed from the Eppendorf tube when the instrumentation was completed. In order to recover the root's surface detritus, 1 mL of purged water was used to wash the root while it was still within. Five days of incubation at 70°C were required to completely eliminate the purged water. In order to collect the final piles of chamber rubbish, the Eppendorf tubes carrying the shot out garbage were weighed once again. After gauging each chamber a few times, the chamber's normal load was determined. 20 The gravity of the vacant Eppendorf tube was taken into account when determining how much rubbish was blasted out.

Preparation Time

A digital timer was used to maintain track of the total number of active instruments, instrument changes, and irrigation activities throughout canal preparation (SportLine, Elmsford, NY).

Statistical Analyses

With SPSS, statistical analysis was performed on the quantity of debris that was expelled and the preparation time periods (IBM SPSS, Chicago, IL). Tukey post hoc tests were also used in the analysis of variance. There was a 5 percent threshold for significance.

Results

Disposable material was less likely to be expelled from the WOG reciprocating single-file system as compared to hand files. (P = .036)

Group	Mean	Standard deviation
WOG	9.52[A]	0.62
MT	10.00[B]	0.80

Table 1: For each research group, the mean and standard deviation of apically extruded debris. (in milligrams)”

Discussion

In chemomechanical systems, the quantity of debris extruded has been observed. However, various variables impact this amount, including the preparation process and kinematics as well as the number of instruments used in each system as well as their design and size. Postoperative discomfort after root canal therapy may be decreased if debris ejection is minimized. Research using single-established teeth and very straight root trenches has been done in the majority of published research. Many NiTi engine-driven devices, however, have been shown to be significantly affected by anatomical variability and variations in root canal curvature, reducing their efficacy. This study's usage of mandibular molar mesial roots simulates the difficulties that doctors face in the real world.

Findings from testing showed that all of the equipment analyzed exhibited apical material ejection. When compared to hand files, the WOG reciprocating single-file approach generated less debris extrusion. According to these results, reciprocating systems have an advantage over stationary systems because of the balanced force and pressureless mechanics that they provide.20 It is possible that the root trench's design and arch might affect the record's differential pressure during measurement. Reduced garbage ejection in the WOG instrument may be linked to features like a cross segment with a parallelogram shape, an optional 1-point contact, and an unmatched compound (M-Wire Gold).

Alternatively, multiple studies tend to confirm the hypothesis that quicker mechanical arrangements with fewer instruments typically force more garbage over the top. To reduce the amount of debris that ejected from a single record frame, B€urklein and Sch€afer (25) used rotating movement. Further procedures were used to provide a fair and objective evaluation of the review groups, including limiting the root trench bend range during example selection. The apical width was adjusted to ISO #25 in order to eliminate any differences in the quantity of material that was removed. This is because sodium hypochlorite, when employed as a flooding arrangement to separate sodium gems from detritus and so alter the findings, is ineffective; hence, bidi-stilled water was used.

To further reduce inclination, the apical foramen regions were surveyed. It is possible that the mistakes in apical garbage expulsion findings might be explained by previous exams failing to standardize the size of the apical foramen. Normalizing the apical foramen's size should be a top priority for future research, say Tanalp and Gungor. More time was saved by using single record response and flexible motion frameworks than by using manual documents for root trench design. A reduction in the number of instruments and a move toward elective kinematics are suggested here to benefit solitary record planning in clinical practice. Since a single improvement in strategy, instrument layout, or instrument quality may not have as significant an effect on clinical outcomes as one would expect, the harmony between microbial forcefulness and host defences may be the most essential perspective.

GROUP	MEAN	SD
SWOG	65^{A}	13
MT	150^{A}	10

Table 2- The average and standard deviation of the time spent preparing for each research were calculated (in seconds)

Conclusions

There was some apical debris extrusion with all of the techniques studied in this research In curved root canals, the WOG reciprocating method resulted in less debris ejection than the manual technique.

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