American Journal of Engineering Research (AJER)
e-ISSN: 2320-0847 p-ISSN : 2320-0936
Volume-13, Issue-11, pp-46-50
www.ajer.org
Research Paper Open Access

Effect Of Slow Down On Extrusion Of Dentinal Debris In Uniradicular Teeth

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ABSTRACT : *The aim of this study is to compare the amount of extruded dentin debris during instrumentation using a new endodontic engine in two different root canal instrumentation functions. Materials and methods. 24 extracted premolars were divided into two groups, chamber access was performed using a #4 carbide ball cutter, all samples were decorated to standardize the working length to 17 mm. The samples were instrumented with rotary Nickel-Titanium Vortex Blue apical gauge #40 taper files .06 (Dentsply Maillefer, Ballaigues, Switzerland) with an E-Connect S. endodontic motor in two of its functions: 1) Slow down or 2) rotary. For the collection of extruded debris, Eppendorf tubes were used, which were weighed individually. After instrumentation, the samples were stored in an incubator at 70°C for 5 days to evaporate the distilled water, product of irrigation, and then the tubes were weighed again by the same scale to obtain the final weight of the tubes with the extruded debris. Results. When comparing the weight in grams of the amount of extruded debris during instrumentation with two different functions of the endodontic motor E connect S, using rotary instruments of Ni Ti Vortex Blue, it was observed that the slow down function produces a lower amount of debris, however there were no statistically significant differences between both groups (p>.05). Conclusion. Both functions of the endodontic motor E connect S produce dentinal debris, however, it was observed that in the slow down function, the production of dentin debris is slightly lower.*

KEYWORDS: *Dentin debris, apical debris extrusion, eppendorf, slow down.*

Date of Submission: 06-11-2024 Date of acceptance: 18-11-2024

I. INTRODUCTION

In the last twenty-five years there has been a significant development and improvement in the procedures and techniques of root canal treatment, this has allowed us to obtain better results with greater control and speed in the procedure. Positive changes have occurred hand in hand with the appearance of new techniques, equipment, materials and instruments, among which the rotary endodontic system stands out (1).

For many years after this, root canal preparation was completed using a sequence of stainless steel files or reamers in a serial or incremental step-back technique. This technique consisted of initially negotiating the canal to the working length followed by widening of the apical portion, completing the shaping of the canal body by using successively larger instruments at progressively shorter lengths in a coronal direction. This proved to be a difficult procedure, often using instruments with sharp ends in a thrusting and pulling motion. Disadvantages of this approach included considerable difficulty in achieving initial canal negotiation, premature blockage of the canals with debris, inadequate penetration of irrigation solution, and a higher incidence of canal stepping, transportation, or perforation(1-2).

Although the instruments cannot completely clean the root canal system due to the complex anatomy that the canal sometimes presents, the different instrument options for cleaning and shaping it play a fundamental role in achieving the objective of obturation, avoiding errors or accidents, such as transportation of the canal or fracture of rotating instruments (3). Since the discovery of nickel-titanium (NiTi) shape memory alloy in the early 1960s, there have been an increasing number of medical applications due to its superelasticity, shape memory effect and excellent biocompatibility. After the first evaluation in 1988 by Walia et al(4), endodontic files made of superelastic NiTi materials have been successfully introduced for root canal treatment (5-6). Subsequently, the development of NiTi instruments as motor-driven rotary devices has further improved the efficiency and quality of root canal treatments.

Technological advances have imposed an improvement in root canal treatment. The introduction of Nickel-Titanium (NiTi) rotary instruments has reduced the prevalence of errors during instrumentation in pulp therapy. When preparing root canals with stainless steel instruments, there is a risk of producing deviations during preparation, as well as excessive treatment time. To avoid these limitations, nickel titanium instruments have been introduced into endodontic practice due to their effectiveness and efficiency compared to manual instruments (7).

The Vortex Blue Rotary System (Dentsply Tulsa Dental USA) features M-Wire NiTi, a proprietary processing of NiTi wire, which the manufacturer claims offers optimal performance in terms of efficiency, flexibility and fatigue resistance cyclic, produces a distinctive surface layer of "blue-colored" titanium oxide. These instruments, produced by complex heating and cooling procedures, show greater fatigue resistance and greater flexibility with controlled shape memory (8). The proprietary processing of Vortex Blue rotary instruments is claimed to reduce shape memory relative to standard NiTi instruments, which attempt to return to their original straight shape due to shape memory characteristics (8,9).

They have variable helical angle cutting blades with triangular cross section. The lower helical angle, which has fewer flutes in the coronal portion of the file, facilitates efficient removal of debris and the higher helical angle, which has more flutes in the apical portion, facilitates increased force with minimal probability. formation of dentinal cracks (10).

There are certain factors that contribute to the amount of debris extrusion during cleaning and shaping of root canals, such as the type and design of instrument, the technique used, the number of instruments, the apical size, and the degree of rotation of the instruments. instruments. All endodontic instrumentation systems tested to date cause apical extrusion of debris. Some systems extrude less and others more (11). In an attempt to achieve complete disinfection and shaping of the root canals, there is a risk of extruding dentin remains, necrotic pulp tissue, bacteria and irrigants into the periapical tissues, causing postoperative pain. The accumulation of hard tissue debris during the cleaning and shaping process is a well-accepted phenomenon. This three-dimensional smear layer can represent 6% of the total volume of the mesial root of a lower molar after instrumentation, and only 50% of these particles are removed by strong chelating agents such as EDTA used with NaOCl or techniques conventional positive apical pressure (12-13).

II. MATERIALS AND METHODS

24 lower premolars extracted for periodontal or orthodontic reasons were used. A periapical x-ray was taken from all samples with two different angulations to verify that they were single canals. Remains of soft tissue and calculus adhered to the root surface were removed with the help of an ultrasound (DTE D5). (Figure 1) Cameral access was performed using a #4 carbide ball end mill, all specimens were decorated to standardize the working length to 17 mm. using a flat-end diamond frustocone burr. (Figure 1, 2 and 3). Canal patency was checked with a #15 K file (Dentsply Maillefer, Ballaigues, Switzerland).

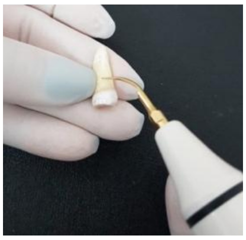

Figure 1. Dental calculus removal

The working length was established for all samples by taking a #15 K file along the root canal until it became visible through the apical foramen and subtracting 1 mm. of the initial length. Instrumentation phase For the instrumentation phase, Vortex Blue Nickel-Titanium rotary files with .06 taper (Dentsply Maillefer, Ballaigues, Switzerland) were used using an E-Connect S endodontic motor. The samples were divided into two groups of 12 teeth each (n= 12). Group I: 12 canals were instrumented with Vortex Blue according to the manufacturer's instructions at the previously established working length until reaching a 40/.06 caliber apically with the help of the E-connect S endodontic motor in its slow down function. Group II: 12 canals were instrumented with Vortex Blue rotary files according to the manufacturer's instructions at the previously established working length until reaching a 40/.06 caliber apically with the help of the E-connect S endodontic motor in its oscillating function. During the instrumentation phase, each canal was irrigated with 6 ml. of distilled water using 1 ml. for each file. Debris collection In this study, the model described by Myers and Montgomery (56) was used; the Eppendorf tubes were weighed on an electronic scale. (Figure 4) Three consecutive measurements were taken for each tube and the average measurement for each tube was considered to be its weight.

Figure 2. Weight of Eppendorf tubes

An opening was made in the lid of the container with a hot instrument and the Eppendorf tube was inserted under pressure. The space between the tube and the opening was sealed with modeling wax using a heated instrument. This last step was repeated by inserting the tooth into the Eppendorf tube and sealing it around with modeling wax to prevent the irrigation solution from escSaping through the space between the tube and the tooth. A hypodermic needle was placed along the eppendorf tube to balance the external and internal air pressure. Aluminum was used to cover the plastic container, avoiding operator bias during the instrumentation procedure. Once the instrumentation phase was completed, the cap of the tube was removed along with the tooth and the needle, the debris adhered to the external surface of the tooth root was collected by washing the apical third of the root with 1 ml. of distilled water in the tube. The samples were stored in an incubator at 70°C for 5 days to evaporate the distilled water and subsequently the tubes were weighed again by the same scale to obtain the final weight of the tubes with the extruded debris. The amount of apically extruded debris was calculated by subtracting the initial weight of the tube from the final weight.

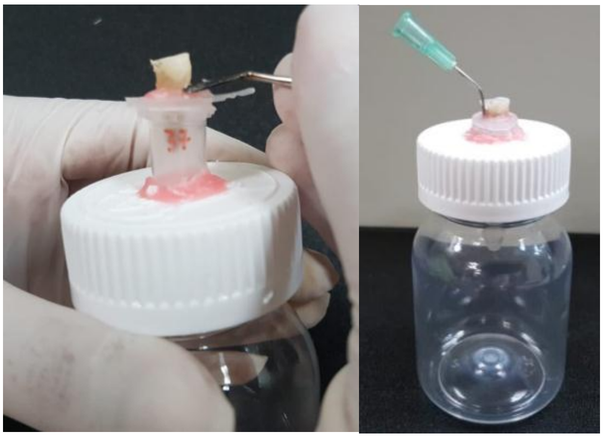

Figure 3. Placing wax on the tube cap.

III. RESULTS

The analysis began by obtaining descriptive statistics of centrality and variation with respect to the dependent variable weight in grams of debris for each of the groups and study times. The initial weight of the oscillatory group reported an average of .621 ± .006 gr and a final weight of .625 ± .005 gr. Likewise, the slow down group presented an average value of .630 ± .016 gr and a final weight of .633 ± .016 gr. Regarding the paired and independent comparisons, it is observed that for both the oscillatory group and the slow down group, a statistically significant difference was observed between their initial weight and final weight ($p < 0.001$).

Regarding the independent comparisons between both groups, no significant differences were observed (p> 0.05), however, it is important to emphasize that despite the differences in means seen in the independent contrasts, applying the student's t test, no significant differences were observed as in paired contrasts due to its mathematical methodology that composes it.

Table 1. Oscillatory Group. Relationship between the initial and final weight of the samples

GROUP 1	**OSCILLATORY**	**C**
# SAMPLE	INITIAL WEIGHT	FIN WEIGHT
14	0.624	0.625
16	0.63	0.633
10	0.618	0.621
18	0.617	0.623
31	0.618	0.623
24	0.617	0.621
33	0.627	0.632
11	0.632	0.633
6	0.615	0.618
3	0.62	0.625
7	0.617	0.623
20	0.613	0.619

Table 2. Slow down group. Relationship between the initial and final weight of the samples.

GROUP 2	**SLOW DOWN**	
# SAMPLE	INITIAL WEIGHT	FIN WEIGHT
2	0.616	0.617
28	0.637	0.641
27	0.619	0.622
30	0.637	0.641
34	0.616	0.619
13	0.629	0.633
1	0.637	0.641
4	0.626	0.631
8	0.608	0.614
17	0.626	0.629
21	0.633	0.635
23	0.67	0.673

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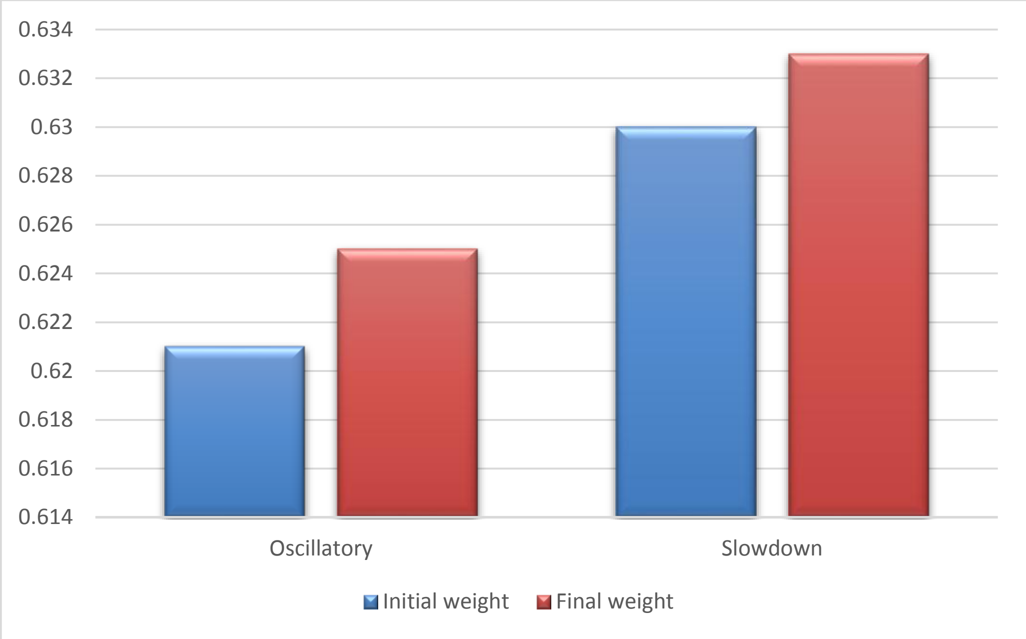

Figure 4. Comparative graph of the weight of debris between the groups and study times

IV. CONCLUSION

Under the limitations and conditions of the study, the following conclusions are established:

• In both the slow down and oscillatory functions, extrusion of debris was observed during instrumentation of the canals.

• The slow down function showed a greater reduction of dentinal debris during root canal instrumentation.

• The use of the slow down function can be a good option to carry out root canal instrumentation.

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