



In vitro comparison of post-instrumentation preparation to identify pericervical dentin wear in mesial canals of mandibular molars

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Abstract

AIM. The present study aimed to compare the level of wear in the pericervical dentin of the mesial canal of the first mandibular molar using two types of endodontic file systems.

MATERIALS AND METHODS. 30 extracted human first mandibular molars were selected and divided into two groups of 15 teeth randomly to which an initial CT was performed. Group 1 was prepared with the Rotate NiTi file system and for group 2 the Endogal system was used. After the preparation of canals, a final CT was taken and the respective measurements were made comparing the beginning and end. Intergroup comparison was performed with independent t tests.

RESULTS. No statistically significant differences were found between the two groups of files with a value of 1.64 mm for Endogal and 1.92 mm for Rotate.

CONCLUSIONS. It is concluded that the pericervical dentin was preserved by conserving its anatomy, when using the two types of rotary file systems for the preparation of the root canals.

Keywords: mesial canal, danger zone, pericervical dentin, rotate NiTi, endogal, CT scan

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Сравнительное in vitro исследование постинструментальной обработки для выявления износа перицервикального дентина в мезиальных каналах нижних моляров

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Резюме

ЦЕЛЬ. Сравнить степень износа перицервикального дентина в мезиальном канале первого нижнего моляра при использовании двух типов эндодонтических файловых систем.

МАТЕРИАЛЫ И МЕТОДЫ. В исследование включено 30 удаленных первых нижних моляров человека, которые были случайным образом разделены на две группы по 15 зубов. Всем образцам первоначально выполнена компьютерная томография. В группе 1 препарирование проводилось с использованием системы файлов Rotate NiTi, в группе 2 – системы Endogal. После обработки каналов выполнена повторная компьютерная томография с последующим проведением измерений и сравнением исходных и конечных показателей. Межгрупповое сравнение проводилось с использованием независимого *t*-критерия.

РЕЗУЛЬТАТЫ. Статистически значимых различий между двумя файловыми системами не выявлено: средние значения составили 1,64 мм для Endogal и 1,92 мм для Rotate.

ВЫВОДЫ. Установлено, что при использовании обеих ротационных файловых систем сохраняется перицервикальный дентин с сохранением его анатомии при препарировании корневых каналов.

Ключевые слова: мезиальный канал, опасная зона, перицервикальный дентин, Rotate NiTi, Endogal, компьютерная томография

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INTRODUCTION

The complex anatomy and various variations in root canal systems are considered one of the greatest challenges for the endodontist [1], given the complications such as perforations or canal transport in the preparation process, directly affecting the success of endodontic treatment [2–4]. The main objective of the root canal formation is to prepare it according to the anatomy of each one of them without it being altered [5; 6] using the best techniques and instruments that have the greatest precision and the shortest working time, being few that achieve these primary objectives of root canal preparation [7; 8] and through this obtain the adequate elimination of pulp tissue, infected dentin and the various existing microorganisms, through the chemical action of disinfectant solutions [9] adapting the environment for a correct sealing of the pulp cavity and recovery of periapical tissues [10; 11].

The anatomical complexity of the mesial roots of mandibular molars is known due to the narrowness of its root, which is why it is considered a high-risk area, being the most prone to perforations and loss in the thickness of the dentin tissue after biomechanical instrumentation, making the dental organ less resistant after endodontics; adding to this the use of rotary instruments that due to their designs wear down the dentin more in the coronal and middle areas of the root canal.

Rotate NiTi is a system of sequenced files that shapes root canals while protecting the pericervical dentin. This system has a heat treatment that allows it to increase flexibility [12; 13]. One of its characteristics is to have a continuous rotation, initially it has an instrument with a tip of 0.15 mm in diameter, it also has a cross section with an S shape with a double blade, its design is off-center and has a constant taper of 0.04, which is useful for preparation in sliding. This system is manufactured with the Blue Wire Niti alloy.

Computed tomography (CT) is a precise method that allows evaluating the volume, the balance of the prepared surface, the conicity of the canal, the surface area, the shape of the cross section, among other parameters in the three dimensions of space; thus, being a method of choice to analyze the degree of deformation of the canals [6; 14].

MATERIALS AND METHODS

Thirty mandibular molars with two mesial root canals were selected and randomly divided into two groups of 15 each, thus obtaining a total sample of 30 mesial canals in each group. Mandibular molars with only one mesial canal, root caries, calcifications, incomplete root formation, and endodontically treated teeth were excluded. The samples were fixed in a silicone impres-

sion material and tomographic images were obtained for morphometric evaluation of the root canals. The tomographic images obtained from each of the teeth were analyzed with NTN viewer software using a Dell Precision T5400 workstation.

In each of the dental organs at the level of the cervical third, a measurement was made from the floor of the pulp chamber 2 mm below the external wall of the furcation and the distance between the entrance orifice of the canal and the mesial, buccal, lingual walls, furcation area and finally the intracanal distance was determined by means of an axial section in millimeters.

For this purpose, the teeth were accessed with a diamond bur and the working length of the mesiobuccal canals was determined by introducing a size 10 K-type file to the end of the root canal and subtracting 1 mm from this measurement. In addition, a sliding path was made using a size 15 K-type file and the root canal was irrigated with 2 ml of 2.5% sodium hypochlorite solution after each instrument change. The apical preparation was completed with a size 25 instrument, following the order specified by the manufacturer. All instruments were powered by an Eighteenth brand motor called the E-Value.

The preparation sequences were as follows:

- Group 1: Comprised 30 mesial canals of mandibular molars instrumented with a VDW Rotate file with a taper of 0.04 and a size of 25, with pressure-free entry and exit movements, at a rotation speed of 300–400 rpm and a torque of 2.3. When apical resistance was encountered, the instrument was removed, and the root canal was irrigated;

- Group 2: Comprised the remaining 30 mesial canals of mandibular molars which were instrumented with an Endogal file. For each file, an individual rotation speed of 250–350 rpm and a torque of 4 N.cm were used.

After preparation, the tomographic images of the prepared samples were repeated using the same position and the same measurement parameters to compare the pre- and post-images. The data obtained before and after instrumentation, considering the deformation and wear on each of the walls of the sample. The data obtained from the measurements of the mesial, furca, buccal, lingual areas and intracanal distance, delimited the areas of wear produced by the action of the instruments, between the initial extension of dentin and the remaining dentin after instrumentation, and it was observed which of these two systems best preserved the original anatomy of the canal.

Intergroup comparison was performed with independent *t* test, with Statistica software (version 12.0, Statsoft, Tulsa, USA), considering the level of significance of 5%.

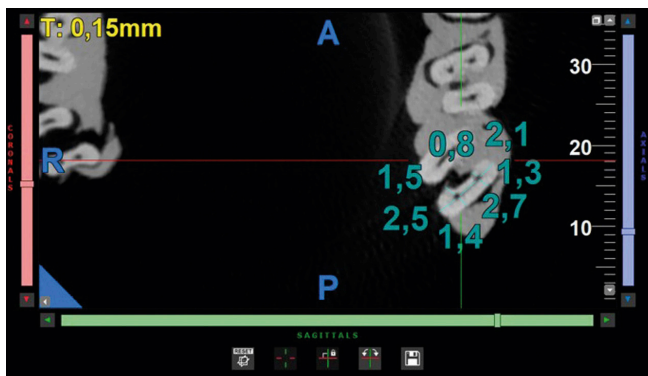


Fig. 1. Example of measurements obtained from cone beam computed tomography images

Рис. 1. Пример измерений, полученных на изображениях конусно-лучевой компьютерной томографии

Table 1. Intergroup comparison before instrumentation (independent *t* tests)

Таблица 1. Межгрупповое сравнение до инструментальной обработки (независимый *t*-критерий)

Variables, mm	Endogal Rotate <i>n</i> = 15		VDW Rotate <i>n</i> = 15		<i>p</i>
	Mean	SD	Mean	SD	
Buccal wall	1.90	0.17	1.81	0.27	0.294
Lingual wall	1.77	0.31	1.78	0.37	0.958
Mesiobuccal-buccal wall	1.29	0.24	1.49	0.29	0.053
Mesiolingual-buccal wall	1.41	0.22	1.25	0.31	0.100
Mesiobuccal-furcation	1.11	0.16	1.09	0.24	0.858
Mesiolingual-furcation	1.03	0.22	1.05	0.29	0.889
Intracannal distance	1.79	0.64	1.77	0.46	0.922

Table 2. Intergroup comparison post-instrumentation (independent *t* tests)

Таблица 2. Межгрупповое сравнение после инструментальной обработки (независимый *t*-критерий)

Variables, mm	Endogal Rotate <i>n</i> = 15		VDW Rotate <i>n</i> = 15		<i>p</i>
	Mean	SD	Mean	SD	
Buccal wall	1.95	0.42	1.91	0.30	0.766
Lingual wall	1.94	0.44	1.90	0.35	0.784
Mesiobuccal-buccal wall	1.32	0.29	1.25	0.16	0.393
Mesiolingual-buccal wall	1.39	0.36	1.29	0.16	0.328
Mesiobuccal-furcation	1.03	0.21	1.13	0.21	0.228
Mesiolingual-furcation	1.10	0.25	1.06	0.29	0.689
Intracannal distance	1.92	0.68	1.64	0.59	0.236

RESULTS

There was no statistically significant difference between the Endogal Rotary and the VDW Rotate systems for all measurements performed before and after instrumentation (Tables 1, 2).

DISCUSSION

The thickness of the remaining pericervical dentin after instrumentation procedures is of great importance since it is considered a high-risk area due to its narrowness. Nowadays, thanks to the advances in the different types of rotary systems, we are closer to a less invasive endodontic treatment and in this way, we can preserve the dentin in a better way and thus preserve the dental organ for a longer time.

This study was carried out to compare the level of wear in the pericervical dentin of the mesial canal of the first mandibular molar using two types of endodontic file systems, Endogal and Rotate.

According to the results obtained in the same, there is no statistically significant difference between the two systems used for the preparation of root canals, and they also adequately preserve the thickness of the pericervical dentin.

There is little evidence comparing this type of rotary systems, which is why there is a need to evaluate their effectiveness, however there is information from other authors regarding wear with other rotary systems.

According to the study by Shyma et al. [15], ProTaper Gold caused the least amount of pericervical dentin loss, followed by TruNatomy, HyFlex EDM and conventional manual instrumentation with a 2% taper.

Aguiar et al. [16] mention in their study that the Nitiflex™ files and the ProTaper Universal™ system that the differences observed between the instrumented and non-instrumented walls were not statistically significant ($p < 0.05$), which is in agreement with this study taking into account that they are different types of instruments.

Zinge and Patil [17] perform an experimental study investigating the removal of pericervical dentin (PCD) induced by the rotary single file systems, Oneshape and Neolix, and the reciprocating single file systems, WaveOne and Reciproc, in teeth extracted by CBCT. The Reciproc system was found to remove more PCD, followed by Oneshape and WaveOne, while the Neolix system removed less PCD among all groups in this study.

Olivieri et al. [18] found that K3 instruments removed more dentin into the danger zone than K3XF instruments. This difference could explain the results of a previous study where K3 preparations required a statistically significant reduced preparation time compared to K3XF preparations with no differences in apical transport.

CONCLUSION

The level of wear in the pericervical dentin of the mesial canal of the first mandibular molar using the two types of endodontic file systems, Endogal and Rotate did not present statistically significant differences. Thus, it is determined that both instruments preserve the anatomy of the root canal of teeth, which is why they are considered safe instruments in endodontic preparation.

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