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Original Article

A new approach to endodontic access in anterior teeth – a pilot study

Uma nova abordagem para acesso endodôntico em dentes anteriores - estudo piloto

Maria Luisa Gomes FERREIRA[a], Thamiris MENDONÇA[b], Maria Luiza Zamparoni VICTORINO[c], Marcelo Augusto SERON[a], Fausto Rodrigo VICTORINO[a,b*]

[a]INVICTO/FACOP – Instituto Victorino de Odontologia, Faculdade do Centro Oeste Paulista, Maringá, PR, Brasil
[b]UniCesumar – Centro Universitário Cesumar, Maringá, PR, Brasil
[c]UEM – Universidade Estadual de Maringá, Maringá, PR, Brasil

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Resumo

Introdução: A abertura coronária é fundamental durante o tratamento endodôntico para um acesso direto aos canais radiculares. Em geral, em dentes anteriores, o acesso endodôntico é realizado na face palatina/lingual, mais especificamente em região de cíngulo. Entretanto, a falta de observação do posicionamento dentário pode levar a alguns acidentes e complicações, como as perfurações por vestibular, ocasionando dano estético e comprometendo o tratamento. **Objetivo:** Avaliar a aplicabilidade de uma nova abordagem de realização da abertura coronária em dentes anteriores, quanto ao desgaste ocasionado na coroa dentária, e avaliar a facilidade de execução da nova técnica para minimizar os riscos de perfurações. **Material e método:** Dez alunos (n=10) do curso de Aperfeiçoamento em Endodontia participaram do estudo. Foram utilizados vinte dentes artificiais, sendo eles incisivos centrais superiores. Cada participante realizou duas aberturas coronárias. Primeiramente sem nenhuma orientação (Grupo A – Técnica Convencional) e após, uma nova abertura, porém com orientação, com a ponta diamantada esférica posicionada paralelamente ao longo eixo do dente (Grupo B – Técnica Modificada). **Resultado:** Os resultados demonstraram que 90% dos participantes consideraram a Técnica Modificada como a de menor risco de acidentes e, ainda, de mais fácil localização da câmara pulpar. Houve diferença estatística tanto para a medida da área total de desgaste quanto para a largura, enquanto na altura não houve diferença estatística. **Conclusão:** Os dados preliminares coletados pelo questionário se mostraram satisfatórios para a Técnica Modificada. Estatisticamente, apresentou diferença favorável em relação à área de desgaste e largura, já em altura não houve diferença estatística.

Descritores: Abertura coronária; acesso conservador; endodontia.

Abstract

Introduction: The coronal opening is essential, during endodontic treatment, for direct access to the root canals. Usually, in the anterior teeth, endodontic access is achieved on the palatal/lingual surface, more specifically in the cingulum region. However, the lack of observation for dental positioning can lead to some accidents and complications, such as buccal perforations, causing esthetic damage and compromising the treatment. **Objective:** To evaluate the applicability of a new approach for performing coronal opening in anterior teeth, regarding the wear caused on the tooth crown, and to evaluate the ease of performing the new technique to minimize the risk of perforation. **Material and method:** Ten students (n=10) from the Improvement in Endodontics program participated in the present study. Twenty artificial teeth were used, which were upper, central incisors. Each participant performed two coronal openings. First, with no guidance (Group A – Conventional Technique) and afterward, a new opening, but with guidance with the spherical diamond tip placed parallel to the long axis of the tooth (Group B – Modified Technique). **Result:** The results showed that 90% of the participants considered the Modified Technique as having lower risk of accidents, as well as being easier for locating the pulp chamber. There was a statistical difference both in

the measurement of the total area of wear and in the width, while there was no statistical difference in the height. **Conclusion:** Preliminary data collected with the survey were satisfactory for the Modified Technique. Statistically, it showed a favorable difference in relation to the area of wear and the width. However, in height there was no statistical difference.

Descriptors: Coronal opening; conservative access; endodontics.

INTRODUCTION

The coronal opening is considered the initial phase of endodontic treatment, undeniably the fundamental phase of treatment, with the objective of direct access to the canals[1].

Knowledge of the anatomy and morphology of the different dental groups is extremely important for endodontic treatment, since the major causes of treatment failure are related to the inability to locate and prepare the root canals, due to their immense complexity. It is necessary to know the number, position, section and orientation of the root canals because, with this knowledge, the format of the coronal opening of each dental group and the direction of chemical-mechanical preparation will be defined[1]. In general, access to the upper and lower anterior teeth is performed on the palatal/lingual surface, in the cingulum region, for aesthetic reasons. It is also the best method for reaching the root canal system directly, due to the shorter distance between the cingulum and the pulp chamber of this dental group[2,3]. However, failure to observe the positioning of the tooth in the dental arch can easily lead to buccal perforations, causing serious aesthetic impairment and hindering the success of the endodontic treatment. Iatrogenic perforations cause loss of the entire tooth structure, regardless of whether they are in the crown or root[4,5].

Minimally Invasive Endodontic Access (MIEA), considered an alternative to Traditional Endodontic Access, has been reported in the literature. MIEA highlights the relevance of preserving the pericervical dentin, providing a gain in mechanical resistance to the teeth subjected to endodontic treatment[6]. This dentin, located close to the alveolar bone crest, is responsible for transferring occlusal loads to the entire root of the tooth. Thus, when it is preserved, with a partial removal of the pulp chamber roof, there is a gain in tooth resistance to the occlusal forces[7-9].

Conventional coronal opening of the anterior teeth is usually performed on the palatal surface, for aesthetic reasons, in the cingulum region. However, due to the presence of the lingual or palatal shoulder, compensatory wear to the pericervical dentin is necessary to obtain direct access to the root canal[10]. Thus, this method of coronal opening removes a considerable amount of healthy pericervical dentin, which could weaken or reduce tooth resistance to fracture[11]. Following the principles of minimally invasive access, an approach through the incisal edge has been suggested for anterior teeth, facilitating direct access without excessive wear on the pericervical dentin[10].

However, access through the incisal edge would compromise the esthetics of the anterior teeth, especially the upper ones. Thus, considering these issues, the objective of the present study was to evaluate a new, more conservative approach to performing the coronal opening in anterior teeth in terms of the wear caused to the dental crown and the ease of performing it.

MATERIAL AND METHOD

With the aim of verifying the feasibility of developing a new technique for coronal opening, preserving the healthy coronal structure, and facilitating the clinician's day-to-day activity, an exploratory study was conducted. A qualitative approach was used to verify the efficiency of the new technique, compared with the traditional one, and a quantitative approach was used to prove the technique itself.

The procedure was performed using 20 artificial teeth (IM do Brasil Ltda., São Paulo, SP), upper central incisors, to reduce interference. Ten students from the Improvement in

Endodontics program at the Instituto Victorino de Odontologia (INVICTO) participated in the qualitative stage, and the study was conducted at the same Institute. The present project was approved by the Permanent Committee for Ethics in Research of the Cesumar University, under opinion n° CAAE: 51880621.9.0000.5539.

The coronal opening was performed in two stages. First, ten students (n=10) individually performed the opening with no guidance, performing the technique according to their knowledge and experience, called the Conventional Technique. Hence, the ten teeth were identified as group A. Next, the same participants were guided in a new approach for performing the coronal opening, called the Modified Technique, in which the spherical drill bit should be positioned parallel to the long axis of the tooth (Figure 1). Thus, with new teeth, the participants performed the opening following the proposed guidance, and this group of teeth was identified as group B. Next, a questionnaire was applied to all participants regarding the difficulty encountered during the coronal opening, which technique presented lower risk of accidents, which technique provided greater ease in locating the pulp chamber, in addition to describing the main difference noted between the two techniques (Conventional and Modified).

Figure 1. Guidance scheme of the new approach to the coronal opening.

The teeth were photographed using a bench microscope (Alliance, São Paulo, SP), and the images were evaluated using the Adobe Photoshop 2020 software. To calibrate the Software, a ruler was used beside all the teeth in the photographing process, to define the actual scale. Then, the wear in the buccal/lingual direction (height), the mesio-distal wear (width), and the total area of wear on the structure of the tooth provided were evaluated (Figure 2). These data were compared using the *Student* t-test for paired samples ($p<0.05$). Only values outside the $\overline{XX} \pm 2\sigma\chi\sigma\chi$ interval were considered outliers. Both analyses were performed using the Bioestat 5.3® software.

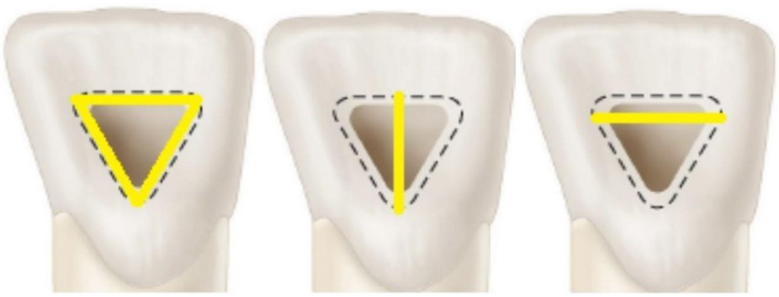

Figure 2. Identification scheme of the measurement of the area, height and width.

RESULT

Among the participants in the study, 90% are female and 10% are male.

When questioned as to the greatest difficulty encountered during the coronal opening process, 80% reported the placement of the drill bit as the greatest difficulty, 20% the locating of the pulp chamber, and no participant considered the stage of selecting the drill bit as the greatest difficulty during the coronal opening process.

Regarding the risk of accidents, 90% of the participants pointed to the Modified Technique as the safest, or as having less probability of some accident occurring during its execution.

Most of the participants (90%) pointed out that it was easier to find the pulp chamber when they applied the Modified Technique.

Finally, the participants were asked to describe the difference they noticed between the two techniques, and the responses and/or notes are listed in Table 1.

Table 1. Responses of the participants

Participant	Response
1	*"In the modified technique, it was easier to locate the pulp chamber, with greater preservation of the dental structure."*
2	*"Angle of the drill bit."*
3	*"The modified technique,allows greater preservation of the dental structure and there is less risk of perforation and anatomical accidents."*
4	*"Ease of reaching the pulp with minimal wear."*
5	*"Ease of directing the drill bit."*
6	*"The angle of the drill bit in the conventional technique I believe is easier to have a deviation of the bit, or even a perforation of the tooth."*
7	*"The risk of too much wear with the modified technique appears to be less."*
8	*"Guiding the direction of the drill bit."*
9	*"In the modified technique, locating the pulp chamber is easier, it seems that the drill bit goes directly to the right place."*
10	*"The modified technique had direct access to the pulp chamber and access to the canals."*

The results of the statistical analyses for area, height and width are shown in Table 2. There was a statistical difference for area and width measurements ($p<0.05$). However, for the height variable, there was no statistical difference ($p>0.05$).

Table 2. Values of the mean, standard deviation of the sample and standard error for the area, width and height data

GROUPS		**A**	**B**
AREA	$\overline{XX}$ [1]	9.611[a]	5.234[b]
	SD[2]	3.017	2.265
	SE[3]	1.067	0.801
WIDTH	$\overline{XX}$ [1]	2.824[a]	2.192[b]
	SD[2]	0.2505	0.4639
	SE[3]	0.0886	0.164
HEIGHT	$\overline{XX}$ [1]	3.975[a]	3.602 [a]
	SD[2]	0.907	1.247
	SE[3]	0.321	0.441

[1]Sample means. [2]Standard deviation of the sample. [3]Standard error of the mean; Different letters over the means indicate statistical difference for the *Student* t-test for paired samples ($p<0.05$). Equal letters over the means indicate statistical equality for the *Student* t-test for paired samples ($p<0.05$).

Table 3. T-Values, degrees of freedom, unilateral and bilateral p-values for area, width and height data

GROUPS		A	B
AREA	*(t)=*	3.217	
	DF [1]	7.000	
	(p) unilateral =	0.007*	
	(p) bilateral =	0.015*	
WIDTH	*(t)=*	3.8851	
	DF [1]	7	
	(p) unilateral =	0.003*	
	(p) bilateral =	0.006*	
HEIGHT	*(t)=*	0.7819	
	DF [1]	7	
	(p) unilateral =	0.2299§	
	(p) bilateral =	0.4599§	

[1]Degrees of Freedom. *Indication of statistical difference for the *Student* t-test for paired samples ($p<0.05$). § Indication of statistical equality for the *Student* t-test for paired samples ($p>0.05$).

DISCUSSION

Considering that excessive wear and coronal perforation are common accidents arising from coronal opening, a new, more conservative approach was proposed to reduce such risks during this procedure, using artificial upper, central incisors. It was shown that 90% of the participants in the present study considered that the Modified Technique presented less risk of accidents during the coronal opening process, made it easier to locate the pulp chamber, and presented characteristics that facilitate its performance compared to the conventional technique.

Some authors have also evaluated the efficiency of the instrumentation in the Traditional Endodontic Access (TEA) and the Minimally Invasive Endodontic Access (MIEA) in the instrumentation of the root canals of upper molars. Using computerized tomography, Moore et al. (2016)[12] concluded that the MIEA did not compromise the instrumentation of the upper molars when V-Taper D12 rotary files (0.64mm for 20/v06) were used in the instrumentation of the root canals of the upper molars.

Rover et al.[13] evaluated the volume of the instrumented canal, the amount of dentin removed, the area of instrumentation and accumulate debris in upper molars, using TEA and MIEA. These data were evaluated using images obtained using computerized tomography. In palatine canals, they used reciproc R40 (40.06). In the buccal canals, they used reciproc R25 files (25.08). They concluded that, after instrumentation between the two tested groups, AET and AEMI, there were no significant differences in the percentage of untouched areas and accumulated debris.

Neelakantan et al.[14] investigated the effectiveness of the instrumentation of the mesio-buccal and mesio-palatal canals of the upper molars using the TEA and MIEA and guided by the orifice. After all the chemical-mechanical preparation of the roots, histological tests were performed on both the mesio-buccal and mesio-palatal roots, which concluded that the access directed by the orifice ended up impairing the pulp debridement. In addition, it is noted that there was no significant difference for the AET and AEMI accesses.

The present study evaluated the coronal opening not only in relation to the ease of performing the new technique and the reduction of the risk of perforation, but also applying other criteria such as wear in the buccal/lingual (height) and mesio-distal (width) directions, in addition to the total area of wear on the dental structure provided. When the coronal opening was performed with no guidance, the total area of coronal wear was greater than when the procedure was performed on group B, with guidance. Based on these results, it is suggested that by positioning the drill bit parallel to the long axis of the tooth, the total area of wear on the crown is less. This

statistical difference is shown in Table 3, as it is present in both unilateral (p) and bilateral (p), both being less than ($p<0.05$).

When the wear on the height was evaluated, there was no statistical difference. That is, the Modified Technique did not interfere with the wear on the dental crown. On the other hand, in the wear on width, there was a statistical difference. This means that the Conventional Technique ends up causing greater wear in the mesio-distal direction than the Modified Technique. This statistical difference is shown in Table 3, as it is present both in unilateral (p) and in bilateral (p), both being smaller than ($p<0.05$).

As it shows less wear in relation to the total area and the width, it can be said that the Modified Technique is more conservative than when compared to the Conventional Technique.

Plotino et al.[15] evaluated the mechanical resistance of the pre-molars and the molars of both the upper and lower arches, with TEA and MIEA, ultraconservative and healthy accesses. They found that TEA eventually decreased mechanical strength when it was compared to the other control groups, ultraconservative and MIEA. Based on this, they concluded that there is no statistically significant difference for mechanical strength between the two control groups, MIEA and ultraconservative.

Chlup et al.[16] pointed out that the pre-molars of the lower arch, when compared to the upper pre-molars, may present greater resistance. They may present a 25 to 35% gain in resistance for teeth of the same group, in due course, both with TEA and MIEA access. They concluded that there was no significant gain in mechanical resistance for MIEA when compared with TEA, showing irrelevant results compared to the control group.

Therefore, when verifying the feasibility of developing a new coronal opening technique, considering the ease that this new approach could bring to dental surgeons in their daily clinical practice as well as the preservation of the healthy coronal structure, it was seen that participants' experiences and the reports indicate greater ease in performing the Modified Technique. This is due to the ease of locating the pulp chamber by placing the spherical drill bit parallel to the long axis of the tooth. This is unlike the Conventional Technique, in which the drill bit is placed 45° in relation to the palatal surface, favoring excessive wear or even perforation of the buccal surface. It was also evident that the Modified Technique solves the greatest fear reported by the participants during the coronal opening, which was the location of the pulp chamber.

Despite all this data, it is important to clarify that the present study has limitations. One of them is the lack of information about the resistance of the tooth, in relation to this new technique, since most of the studies do not show the capacity to increase the resistance of the teeth to fractures[12-15]. This makes it necessary to address these issues in future studies.

CONCLUSION

The modified technique made it easier for the participants to perform the coronal opening, minimizing the risk of accidents and complications. This is due to the positioning of the spherical drill bit, inserted parallel to the long axis of the tooth. In addition, the Modified Technique proved to be more conservative compared to the Conventional Technique, both in terms of total area and in width.

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CONFLICTS OF INTERESTS

The authors declare no conflicts of interest.

*CORRESPONDING AUTHOR

Fausto Rodrigo Victorino, Av. Londrina, 1017, Zona 08, 87050-730 Maringá - PR, Brasil, e-mail: frvictorino2014@gmail.com

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