

Evaluation of a strategic practice demonstration method applied to endodontic laboratory classes

Avaliação de um método estratégico de demonstração prática aplicado nas aulas de endodontia laboratorial

Abstract

Purpose: To evaluate a strategic method of real time visual demonstration of the operatory procedures using an intraoral camera system and monitor videos, comparing them to those of conventional laboratory classes.

Methods: Fifty-two structured, multiple choice questionnaires were applied to undergraduate students of the 4th year (G1) and 3rd year (G2) submitted to the traditional and strategic teaching methods, respectively. These tests were also able to detect the main problems faced by the students during the training of this operatory phase.

Results: Students of both groups (G1- 30.8% and G2- 34.6%) considered the access cavity to be one of the most difficult phase of endodontic treatment. The results of the evaluation among the 3rd year students demonstrated that 23.1% graded the new method as excellent, 38.4% as very good and 38.5% as good, whereas none of the students (0%) considered the method to be regular, bad or very bad. A minor accident occurrence ($P < 0.05$) was reported by the 3rd year students (G1- 50% and G2- 34.6%). **Conclusion:** The new strategy was found to favor learning, reduce the incidence of errors and was appraised as efficient by the students.

Key words: Dental education; Endodontics; teaching

Resumo

Objetivo: Avaliar um método estratégico nas aulas práticas, utilizando micro câmeras e monitores de vídeo para transmitir demonstrações da técnica operatória, comparando-o com o método de ensino aprendizagem clássico.

Metodologia: Foram aplicados 52 questionários direcionados aos alunos do 4^o ano (grupo 1) submetidos a esta nova prática e aos do 3^o ano (grupo 2) submetidos a metodologia de ensino tradicional. Este questionário também possibilitou detectar os principais problemas enfrentados pelos discentes durante o aprendizado desta etapa operatória.

Resultados: A fase de cirurgia de acesso foi considerada de difícil execução por ambos os grupos (G1- 30,8% e G2- 34,6%), sendo a manobra de localização dos orifícios de entrada dos canais a etapa mais complicada. Quanto à avaliação da metodologia empregada no 3^o ano, 23,1% dos alunos a consideraram excelente, 38,4% ótima, e 38,5% boa, ao passo que nenhum dos estudantes (0%) consideraram o método como regular, ruim ou péssimo. Uma menor ocorrência de erros ($P < 0,05$), foi relatada pelos alunos do 3^o ano (G1- 50% e G2- 34,6%).

Conclusão: A nova estratégia de ensino favoreceu a aprendizagem, diminuiu a incidência de erros e foi considerada eficaz pelos alunos.

Palavras-chave: Aprendizagem; educação; endodontia

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Introduction

Teaching Endodontics to undergraduate students includes scientific concepts and laboratory skill practice. Laboratory practice provides one of the best opportunities for active learning (1) and the adequate performance of endodontic techniques relies on specific knowledge regarding anatomic details of the teeth to be treated (2). However, in practice, perception of these details is limited since direct visualization of the pulp chamber is minimal during the operator act (3).

The endodontic cavity preparation is the initial phase of endodontic treatment and allows visibility and access to each canal orifice, facilitating instrumentation (4,5). Laboratory practical classes to teach students to access the endodontic cavity take place at the beginning of the undergraduate's preclinical training and these classes constitute one of the most difficult phases in training since numerous errors are performed by the students at this stage related to their lack of experience (6).

Such details make the learning process a difficult task for dental students, who become anxious and insecure about performing endodontic procedures. Thus, the search for strategic methods that improve learning skills becomes a constant challenge for the educators (7,8). Students who have never performed a technique must first be guided through the process; thus, a visual demonstration of laboratory procedures is a key element in teaching pedagogy (9).

Current technology advancements now play an important role in the teaching process. The use of interactive learning methods are now a pedagogical tool to aid learning process (10-12). This new technology offers new and fascinating tools (computers, video imaging, digitized radiology and electronic data transmission), which are considered to be good resources for the learning process (13,14).

Due to these considerations and the difficulties experienced by students during pre-clinical training, adjustments in the conventional teaching/learning process are necessary. The aim of this study was to evaluate an

alternative method applied during laboratory classes on the endodontic cavity preparation and compare this to conventional methodology, according to the students' own perception of their learning.

Methods

This study was analyzed and approved by the Ethical Research Committee (protocol # 348/2008) and the subjects of the study (undergraduate students) signed a term of informed consent. Fifty-two questionnaires were divided equally into two groups (n=26). In Group 1, the questionnaires were answered by students of the 4th year, who received the traditional learning process (theoretical classes and lectures followed by laboratory practice with extracted teeth fixed in a mannequin). In Group 2, the questionnaires were answered by undergraduate students of the 3rd year, who had the same theoretical classes and lectures as Group 1 and who, before the laboratory class, were submitted to an alternative teaching method. Real-time practical demonstrations to show the access cavity technique were performed on extracted teeth in the laboratory using an intraoral camera system (MICAM ci-SHARP, Curitiba Dentistry, Curitiba, PR, Brasil). The images were captured by a CCD micro camera (Curitiba Dentistry, Curitiba, PR, Brasil); sent through image processing electronics and the sequences of the procedures were transmitted by a cable to a 42-inch HD LCD television monitor (JVC- LT-42WX70, Kowloon, Hong Kong, Japan).

The questionnaire was prepared using the Sphinx Léxica V. 5 software (Sphinx Brasil, Canoas, RS, Brasil) and the questions were elaborated in order to show which endodontic treatment phase was more complex in the students' opinion, which were the primary problems faced during the access cavity phase, as well as the most common errors/accidents made at this stage. Furthermore, the students' opinions and concerns about the teaching strategies were also attached to the questionnaire (Table 1).

Table 1. Questionnaire applied to the undergraduate students of the third and fourth year of UNITAU

<p>1. Concerning the endodontic treatment phases cited below, mark the most difficult to perform.</p> <p><input type="checkbox"/> 1. Access Cavity</p> <p><input type="checkbox"/> 2. Working length estimation</p> <p><input type="checkbox"/> 3. Root canal instrumentation</p> <p><input type="checkbox"/> 4. Intracanal medication</p> <p><input type="checkbox"/> 5. Obturation</p>	<p>4. If so, what kind of accident did you have? You can mark several alternatives.</p> <p><input type="checkbox"/> 1. Perforation</p> <p><input type="checkbox"/> 2. Excessive Tooth Wear</p> <p><input type="checkbox"/> 3. Incorrect outline form</p> <p><input type="checkbox"/> 4. Insufficient tooth wear</p> <p><input type="checkbox"/> 5. Other _____</p>
<p>2. What are the main difficulties you found during access cavity preparation? You can mark up to two alternatives.</p> <p><input type="checkbox"/> 1. Establishing the trepanation direction</p> <p><input type="checkbox"/> 2. Establishing the outline form</p> <p><input type="checkbox"/> 3. Establishing the convenience form</p> <p><input type="checkbox"/> 4. Locating root canal orifices</p>	<p>5. What is your opinion about the teaching-learning methodology for access cavity preparation?</p> <p><input type="checkbox"/> 1. Excellent</p> <p><input type="checkbox"/> 2. Very good</p> <p><input type="checkbox"/> 3. Good</p> <p><input type="checkbox"/> 4. Regular</p> <p><input type="checkbox"/> 5. Bad</p> <p><input type="checkbox"/> 6. Very bad</p>
<p>3. Did you have any accidents or commit errors during access cavity preparation in your pre-clinical training?</p> <p><input type="checkbox"/> 1. Yes</p> <p><input type="checkbox"/> 2. No</p>	<p>6. Among the teaching-learning strategies below, which do you consider the most efficient for improving the student's skill during the access cavity preparation?</p> <p><input type="checkbox"/> 1. Theoretical classes/lectures + laboratory classes</p> <p><input type="checkbox"/> 2. Theoretical classes/lectures + practical demonstrations</p> <p><input type="checkbox"/> 3. Theoretical classes/lectures + practical demonstrations + laboratory classes</p>

A previous pilot evaluation of the questionnaire was performed and handed out to twenty-six undergraduate students of the 4th year (students not submitted to the experiment itself). This initial evaluation aimed to correct and adapt the questionnaire to be applied. The undergraduate students of this pilot evaluation were only subjected to the traditional method of teaching.

Results

The results of the survey (%) are represented in Table 2. Undergraduates of the 4th and 3rd years (G1 and G2) revealed that access cavity preparation is the most complex endodontic treatment stage (34.6% and 30.8%, respectively). Both groups indicated the locating the root orifices as the most difficulty procedure during endodontic cavity preparation (Table 3).

Table 2. Technical difficulties in endodontic treatment stages (%), according to undergraduate students of the 4th (G1) and 3rd (G2) years

Technical Difficulty	G1 (%)	G2 (%)
Access Cavity	30.8	34.6
Working length estimation	19.2	33.5
Instrumentation	26.9	15.4
Intracanal Medication	3.8	3.8
Obturation	23.1	7.7

Table 3. Main difficulties during the access cavity preparation (%), reported by undergraduate students of the 4th (G1) and 3rd (G2) years

Main difficulties	G1 (%)	G2 (%)
Perforation	26.9	24.0
Outline Form	21.2	44.0
Convenience Form	25.0	32.0
Locating root canal orifices	65.4	48.0

The results of the remaining questions of this study are represented in Figures 1 to 3. The data obtained for the occurrence of error/accidents were submitted to statistical analysis by the Chi-square test. The results indicated that undergraduate students of the 3rd year presented a lower percentage of error/accidents compared to 4th year students ($P < 0.05$).

All the 3rd year (100%) and 92.3% of the 4th year students elected the association of theoretical classes/lectures with practical demonstrations and laboratory classes as the best teaching-learning method. A minority of the 4th year undergraduates (7.7%) considered the traditional teaching-learning (theoretical classes/lectures + practical classes) to be the most efficient strategy for improving the student's skill endodontic cavity preparation.

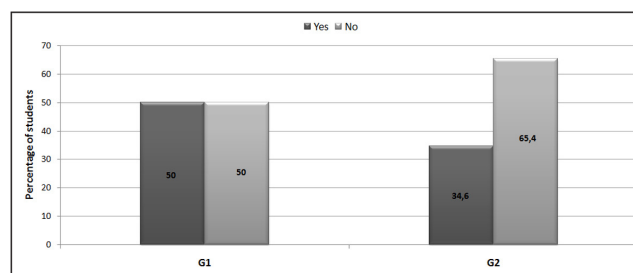


Fig. 1. Occurrence of error/accidents during access cavity preparation by the undergraduate of the 4th (G1) and 3rd (G2) year.

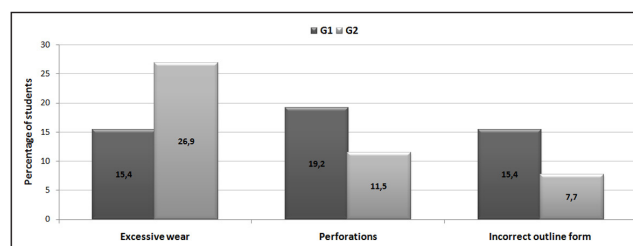


Fig. 2. Types of error/accidents most commonly performed during access cavity preparation by the undergraduate of the 4th (G1) and 3rd (G2) year.

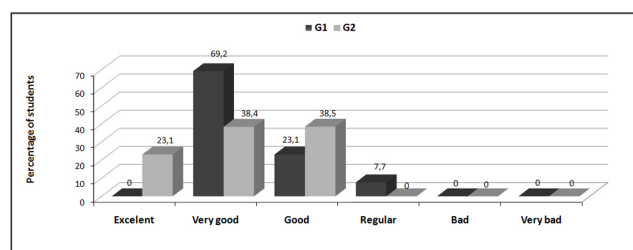


Fig. 3. Evaluation of teaching methodologies reported by undergraduate students of the 4th (G1) and 3rd (G2) year.

Discussion

Endodontic access cavity preparation is often considered to be one of the most difficult phases of endodontic treatment and is frequently associated with unsuccessful endodontic procedures (4,5). This occurrence could be observed in the present study in both groups of undergraduates evaluated (G1-34.6% and G2-30.8 %). The reason for these errors is possibly due to the no experience of the students once the access cavity preparation constitutes the initial phase of endodontic treatment and is also the first contact of the student with endodontic practice.

Computers, video imaging, digitized radiology, and electronic data transmission are becoming an integral part of dental education (1,15,16). Previous investigations regarding the use of these tools as preclinical teaching aids have reported favorable results in terms of both student attitudes and learning outcomes (13,17). The results of this study are in accordance with these findings since the

occurrence of errors and accidents during the endodontic cavity preparation, carried out by the students of 3rd year (G2), were significantly lower when compared with the students of the 4th year (G1). This observation reinforces the effectiveness of the strategy applied.

Aragon et al. (7) related that their dental students regularly complained about how difficult it was for them to visually appreciate the live demonstrations taught, since the mannequin's oral cavity is small. In addition, students have to take sequential turns during these demonstrations to be able to get close enough to their row instructor while a particular task is performed. The method tested in this study with the use of the intraoral micro camera, connected directly to video monitors, allows the amplification of the images and facilitates the visualization of the surgical act with all the details of the procedures. This method corroborates the fundamental role of the technology in the current context of the teaching models, increasing and facilitating the levels of learning (8,10,12).

Brüllman et al. (3) has also showed in an in vitro study the practical application of computer-aided techniques for detecting root canal orifices through the access cavity using a video camera mounted on a microscope. A total of 165 extracted human teeth (molars and premolars) were used as test data to collect 8,250 images via screenshots for the evaluation of the detection quality. The software provided a detection sensitivity of 90.1%, with only 11.9% of the images as false-positive detections. The study shows that

computer-aided recognition of root canal orifices with video cameras is possible.

Another important goal of this study was to reveal the impact of this method with regard to the improvement in the quality of the learning process, based on the students' point of view. Students' responses indicated that this strategy was appreciated by all (100%) the students who experienced it (G2). The results of this study also suggest that the demonstration of the surgical act in real time may be used in other phases during preclinical training in Endodontics, as an adjunct to conventional teaching, to improve and facilitate students' learning. In addition, the video output can be recorded. The recorded images can then be edited using video-editing software. This procedure can be especially beneficial if students have the opportunity to refer back to the material repeatedly (16,18).

Educators must break paradigms, modify ineffective education processes and seek adequate teaching methods in order to fulfill the students' real needs. Additionally, teachers must constantly evaluate the results of these changes, to adequate and increasingly improve them.

Conclusions

The alternative teaching method strategy favored learning and reduced the incidence of errors. Additionally, the related methodology was considered good and interesting in the students' opinion.

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