



## Original Research Article

## Evaluation of the quality of endodontic access cavities made by students of the institute of dentistry and stomatology of Dakar

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## ABSTRACT

**Introduction:** The aim of this study was to evaluate the technical quality of endodontic access cavities performed by M1 and M2 students during the clinical teaching of endodontics.

**Materials and Methods:** The study population consisted of patients who came for consultation in the clinic of the Conservative Odontology-Endodontics Department of the Institute of Odontology and Stomatology of Dakar. The inclusion criteria were for teeth for which endodontic treatment was indicated and an access cavity was performed for the first time and exclusively by a student as part of the clinical training in endodontics. A survey form was drawn up containing the following headings: contour shape, visibility of canal entrances, body shape, and accidents along the way (stop, perforations, or flattening of the pulp floor). The chi-squared test was used to compare quantitative and qualitative variables and the significance level was set at  $p < 0.05$ .

**Results:** A total of 139 endodontic access cavities were made by students (56.8% by Master 2 (M2) students and 43.2% by Master 1 (M1) students). Of these, 35% of the access cavities made by M1 students were acceptable versus 44% acceptable for M2. The difference was statistically significant ( $p < 0.05$ ).

**Conclusion:** It appears from this study that the rate of technically acceptable access cavities made by the students of the Institute of Odontology-Stomatology of Dakar was insufficient. Thus, modifications must be made in the preclinical and clinical training program of Endodontics students.

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### 1. Introduction

The objective of endodontic treatment is to treat diseases of the pulp and peri apex and thus transform a pathological tooth into a healthy, asymptomatic, and functional entity on the arch.<sup>1</sup>

Before any endodontic treatment, the internal morphology of the tooth to be treated must be determined. In this process, the importance of the access cavity is often overlooked. A poorly executed access cavity can

compromise the technical steps of treatment with an increased risk of procedural errors or failure in the proper conduct of the operative procedure.<sup>2</sup>

The successful completion of this step conditions and will facilitate the execution of the following steps. The objectives of the endodontic access cavity are to provide a permanent reservoir for irrigation solutions, to provide a good foundation for the temporary dressing, to eliminate the entire pulp ceiling, to have direct visual access to the root canal without harming the pulp floor, and to allow the instruments to have direct access to the apical third without interference with the coronary walls during shaping and

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canal filling.<sup>3</sup>

Most studies devoted to the evaluation of endodontic therapeutics have been conducted in dental schools and among practitioners to assess the quality of treatments.<sup>4-6</sup>

No studies evaluating the technical quality of endodontic access cavities made by students in initial training have been performed. It is in this context that this study was undertaken to evaluate the quality of endodontic access cavities made by students in the Endodontic Conservative Dentistry Clinic of the Institute of Odontology and Stomatology of the Cheikh Anta Diop University of Dakar.

## 2. Materials and Methods

This was a cross-sectional, descriptive study that took place during the 2021-2022 academic year (February 2022 to June 2022). It concerned Master 1 and Master 2 students of the Institute of Odontology and Stomatology.

Ethical approval for this study was obtained from the Cheikh Anta Diop University Research Ethics Committee. Data are retrieved anonymously and reported without breaching the privacy and confidentiality of the patients.

The inclusion criteria were for teeth for which endodontic treatment was indicated and an endodontic access cavity was performed for the first time and exclusively by a student as part of the clinical training in endodontics.

Non-inclusion criteria included teeth that had undergone endodontic treatment in patients under 16 years of age, teeth whose endodontic access cavities had been corrected by the supervising teacher, or access cavities that had been arranged in cases of endodontic reprocessing.

For the generation of the endodontic access cavity, the student had an examination tray containing a probe 6, a probe 17, a mirror, and a precelle. In addition to these basic instruments, the generation of the access cavity also required specific equipment including a turbine, a ball cutter, and a cylindrical-conical cutter, with a non-working tip: the Zekrya-Endo cutter (reference 152, Denstply Maillefer, Switzerland).

The operating protocol applied at the Institute of Odontology and Stomatology of Dakar essentially consists of three steps: opening of the pulp chamber, removal of the pulp ceiling, and the finishing of the walls of the cavity. The preliminary steps included, after the clinical examination which indicated the undertaking of the endodontic treatment, the preoperative radiography, the performance of the anesthesia, and the pre-endodontic reconstitution if necessary the establishment of the operating field, the removal of the caries, or the elimination of the old fillings or prosthetic reconstructions. The evaluation was made by a single observer who had a survey form containing the following headings: contour shape, visibility of the canal entrances, body shape, and accidents along the way (stop, perforations, or flattening of the pulp floor).

Before the evaluation of each endodontic access cavity, the observer was first asked to state the student's year of study, the location and type of tooth, the indication for endodontic treatment, and the initial condition of the tooth.

The criteria used in this study can be found in most current endodontic textbooks.<sup>2,7</sup>

1. The contour shape of the access cavity was evaluated according to three levels of assessment: good: more than two walls complied with the shape,
2. Medium: two walls complied with the shape,
3. Bad: no wall complied with the shape.
4. The visibility of the canal entrances was evaluated according to the type of tooth:
5. Multiradicated teeth: it was good if two ductal entrances were visible and bad if one canal entrance was visible.
6. Monoradicated teeth: it was good if the canal entrance was visible and bad if it was not.

The shape of the remains was acceptable if the walls were occluso-divergent with respect to the axis of the tooth.

Route errors were also investigated, namely stops, perforations, and modifications of the pulp floor for multiradicates. The evaluation was done by direct visualization with a probe 6, a probe 17, a mirror, and under good lighting.

Data collection was carried out with SPSS software (version 20.0). The variables were described by their number and percentage. The chi-square-squared test was used to compare results. The significance threshold was set at  $p < 0.05$ .

## 3. Results

They were studied according to the year of study, the type and location of the tooth, the indications for endodontic treatment, and the initial state of the tooth.

Of the 139 access cavities evaluated, 56.8%, or 79 cavities, were made by M2 students, versus 43.2%, or 60 cavities, made by M1 students. The difference is not statistically significant because ( $p > 0.05$ ).

Depending on location and type, the treated teeth were distributed as follows:

1. 34 mandibular molars (24%).
2. 27 maxillary premolars (20%).
3. 28 teeth of the maxillary incisor canine group (20%).
4. 23 maxillary molars (17%).
5. 14 teeth of the mandibular incisor canine group (10%).
6. 13 mandibular premolars (9%).

The difference was not statistically significant ( $p > 0.05$ ).

The study showed that almost all endodontic treatments (99.3%) were indicated following a cavity (Table 1).

**Table 1:** Distribution of teeth by indication for endodontic treatment

	Effectives	Percentage (%)
Cavities	138	99.3
Conjoint prosthetic	1	0.7
Total	139	100

The results showed that most of the treated teeth (52.5%) had at least one destruction of one of their four walls before the completion of the access cavity and 47.5% retained all of their walls (Table 2).

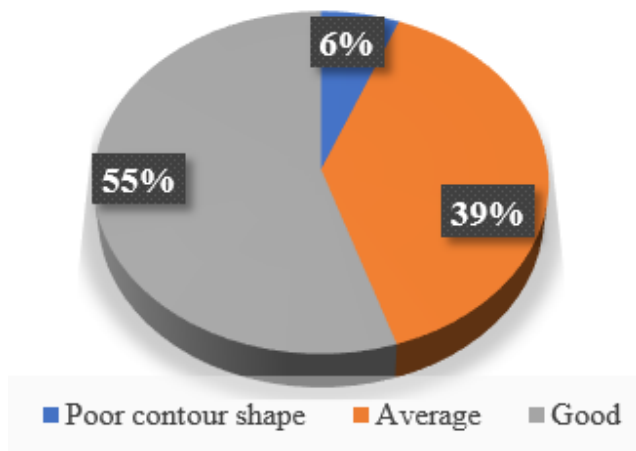
**Table 2:** Distribution of teeth according to their initial state

Four walls	Effectives	Percentage (%)
Yes	67	47.5
No	72	52.5
Total	139	100

Of the 72 teeth treated, at least one of the four walls was destroyed, and it was noted that in 80% of cases, pre-endodontic reconstitution had not been performed.

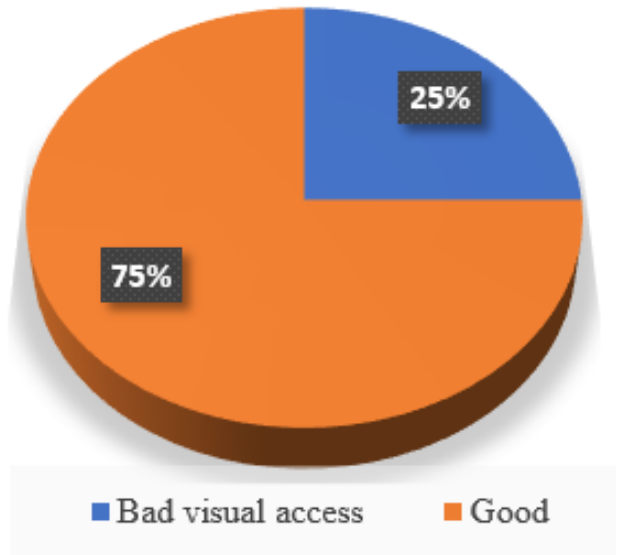
According to the evaluation criteria, of the 139 access cavities made by the students, 56 (40.2%) were technically acceptable. Depending on the year of study, of the 60 access cavities generated by M1 students, 21 (35%) were acceptable; for M2 students, of the 79 endodontic access cavities generated, 35 (44%) were acceptable. The difference was statistically significant ( $p < 0.05$ ).

Evaluation of the contour shapes showed that 55.4% of the cavities had a good contour shape, 38.8% had a medium contour shape, and 5.8% had a poor contour shape (Figure 1).



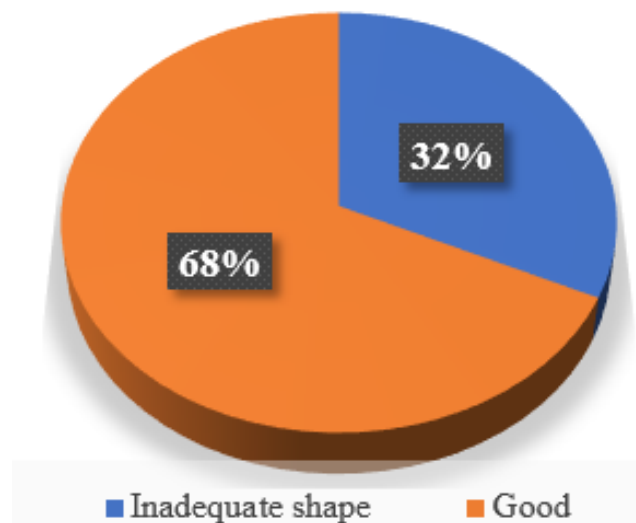
**Figure 1:** Distribution by contour

Of the 139 endodontic access cavities performed, 75% had good visual access compared to 25% who did not have good visual access (Figure 2).



**Figure 2:** Distribution of cavities according to visual access to the root canals

Access cavities with a good body shape accounted for 68% of the sample compared to 32% with an inadequate shape (Figure 3).



**Figure 3:** Distribution of access cavities according to the shape

With regard to route errors, it was noted:

1. 31 cases of flattening of the pulp floor (22.3%),
2. 2 cases of stops (1.8%),
3. 8 cases of perforations (5.8%) (Table 3).

**Table 3:** Distribution of access cavities according to route error

Errors of practice	Effectives		Percentage (%)	
	Yes	No	Yes	No
Abutment	2	137	1.4	98.6
Perforations	8	131	5.8	94.2
Flattening of the pulp floor	31	108	22.3	77.7

#### 4. Discussion

The generation of the endodontic access cavity is an important part of endodontic treatment. Failure to comply with these objectives can lead to difficulties in the proper performance of endodontic therapy. Inadequate access can lead to untreated, poorly disinfected canals that are difficult to shape and seal.<sup>7</sup>

This study was undertaken given the lack of studies to evaluate the technical quality of endodontic access cavities made by students during their clinical training. The criteria used in this work can be found in endodontic textbooks.<sup>2,7,8</sup>

They essentially comprise four types: contour shape, visibility of canal entrances, body shape, and accidents of course (stop, perforations, or flattening of the pulp floor). These criteria can be assessed by a direct visual examination but also by radiography, which allows better assessment of the shape of the entity for better evaluation of accidents along the way. The main limitation of this study was the non-use of imaging.

The results show that the 139 endodontic access cavities were evaluated, they were evaluated for M1 students (43.2%) and M2 students (56.8%) with a difference that was not statistically significant ( $p > 0.05$ ). This difference could also be explained by the experience of M2 students compared to M1 students, who were in their first clinical experience. The same trends have been reported by the studies of Khabbaz and Saatchi.<sup>9,10</sup>

Regarding the type of teeth, the molars were more representative, with a rate of 41%. This high rate could be due to the fact that these are the teeth that are most susceptible to carious pathology. This vulnerability to caries is also related to their anatomical complexity, which promotes the retention of bacterial plaque at the occlusal level.<sup>11</sup>

As for the first molars (six-year-old teeth) in particular, they appear in the oral cavity at a time in life when the individual is particularly prone to tooth decay. As for the location of the teeth, almost all sectors were involved, with more noted difficulties when making access cavities at the level of the molars because of their posterior position on the dental arch and also by their anatomical complexity.<sup>12</sup>

This study found that tooth decay was the most common cause that could lead to endodontic treatment, which could keep the tooth on the arch the longest. It was found that

the reason for consultation due to caries was observed in 99.3% of cases. This carious disease leads to the gradual destruction of the tooth with a pulpal inflammatory response. These two elements lead to a certain stage of progression of the carious lesion and the performance of an endodontic treatment.<sup>13,14</sup>

Two types of pathologies were the main indications: acute irreversible pulpitis and pulpal necrosis with or without periapical complications.

Only one case of endodontic treatment was indicated for the needs of joint prosthesis abutments. These indications must be increasingly limited in favor of prosthetic reconstructions on living teeth for better preservation of dental tissues and thus avoidance of failures related to endodontic treatments.

The study found that 52.5% of the treated teeth had at least one destruction of one of their four walls before the access cavity was completed. These losses of substances could be due to the progression of the decay leading to the destruction of the hard tissues of the tooth. They are often too advanced when patients delay in consulting. These results are corroborated by those of Yavari.<sup>11</sup>

The initial condition of the tooth is an important factor in the technical quality of endodontic access cavities. The results show that teeth with four walls underwent pre-endodontic reconstruction. The latter is a mandatory prerequisite if one or more walls of the tooth are missing. It has several objectives, including limiting the risk of fractures of a very compromised tooth with reinforcement of the residual walls or obtaining reliable occlusal markers to properly delineate the contours of the endodontic access cavity.<sup>7,15</sup>

The results of the study show that, of the 139 access cavities made by the students, 56 (40.2%) were technically acceptable. Comparison with other studies is difficult because no other assessment using the same methodology and criteria could be found in the endodontic literature. The only studies available at this level were comparative assessments between access cavities carried out according to the classical model and carried out according to a new ultra-conservative approach using optical aids such as magnifying glasses and the operating microscope.<sup>16</sup>

The technically unacceptable access cavity rate in this study can be attributed to the approach used during the operative protocol. Indeed, the access cavities were made at the Institute of Odontology and Stomatology according to the classical technique. For financial reasons, the facility is not yet equipped with optical aids as part of the clinical training of students. This result regarding the rate of technically unacceptable access cavities could also be related to the lack of experience of students, associated with the stress of the latter during clinical teaching in Conservative Dentistry-Endodontics according to a study by Ndiaye et al. in 2018.<sup>17</sup>

The results also show that 55% of the cavities had a good contour shape, 39% had a medium contour shape, and 6% had a bad contour shape. The recorded contour shape defects show that the students had difficulty determining the marks allowing the drawing of the ideal access cavity on the occlusal, palatine, and lingual faces. These defects can compromise the next steps of endodontic treatment (cleaning, shaping, irrigation, and root canal filling).

As for visual access, 25% of the cavities did not have good visual access, and this could have direct consequences on the quality of the overall endodontic treatment. Good visual access to the root canal is a key element in the success of endodontic treatment. This would allow the preparation of all canals, even those supernumerary cases of the second mesiovestibular duct of the first maxillary molar (MV2) or the second distal canal of the first mandibular molar. Also, it would initiate a good root canal preparation, with elimination of coronary stresses that can facilitate the passage of preparation instruments up to the level of the apical third.<sup>7,18</sup>

The preparation of an endodontic access cavity involves performance of a form of remains that consists of making an occluso-divergent cavity. The study showed that 32% had an inadequate body shape. This could be a cause of failure during endodontic therapy.

In this study, the main mistake made by the students during the performance of the access cavities was flattening of the pulp floor (22.3%). This makes it difficult to locate root canals and promotes other types of errors such as stops and perforations. Indeed, two cases of stops and eight cases of perforations were recorded. These errors of course are factors of failure of endodontic treatment reported in the literature by several authors.<sup>8,19,20</sup>

## 5. Conclusion

This study shows that technically acceptable access cavities made by the students were insufficient. To limit errors related to its performance or accidents during endodontic treatment, the emphasis must be placed on practical training but also the introduction of students to preclinical training in endodontics.

## 6. Conflict of Interest

The authors declare no potential conflict of interests related to this article.

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The authors declare that they have not received any support in financial or any other form from any source for this article.

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