

ACCESS CAVITY PREPARATION: THE FIRST STEP TO A SUCCESSFUL ENDODONTIC TREATMENT

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Abstract. The access cavity is probably the most important technical stage in root canal preparation because inadequate access can lead to canals being left untreated, and may lead to the failure of the treatment. This paper outlines basic principles of producing a good access cavity and offers teachers suggestions on how to help their students gain the skills for performing a correct tooth access cavity.

Introduction. The endodontic triad consisting of biomechanical preparation, microbial control and complete obturation of the canal space remains the basis of endodontic therapy. The process of cleaning and shaping the pulp complex can be divided into four stages—pre-access analysis, removal of the pulp chamber roof, identification of the pulp chamber and floor root canal orifices, and instrumentation of the root canals.

The most important aspect we want to highlight is the importance of knowing the Rankow and Krasner laws to create the access cavity, laws that can aid to determine the position of the pulp chamber and the exact location and number of root canals in any individual tooth. Two categories of laws are described according to the relationships of the pulp chamber to the clinical crown (the law of centrality; the law of concentricity; the law of the CEJ) and according to the relationships of orifices on the pulp-chamber floor (law of symmetry 1,2; law of color change; law of orifice location 1,2,3) (1).

- Relationships of the pulp chamber to the clinical crown.

The law of centrality: the floor of the pulp chamber is always located in the center of the tooth at the level of the CEJ. The law of concentricity: the walls of the pulp chamber are always concentric to the external surface

of the tooth at the level of the CEJ. The law of the CEJ: the CEJ is the most consistent, repeatable landmark for locating the position of the pulp chamber (fig.1).

- Relationships of orifices on the pulp chamber floor.

Law of symmetry 1: except for maxillary molars, the orifices of the canals are equidistant from a line drawn in a mesial distal direction through the pulp-chamber floor. Law of symmetry 2: except for the maxillary molars, the orifices of the canals lie on a line perpendicular to a line drawn in a mesial-distal direction across the center of the floor of the pulp chamber (fig.6,7,8).

Law of Color Change: the color of the pulp-chamber floor is always darker than the walls (fig.11). Law of orifice location 1: the orifices of the root canals are always located at the junction of the walls and the floor. Law of orifice location 2: the orifices of the root canals are located at the angles in the floor-wall junction. Law of orifice location 3: the orifices of the root canals are located at the terminus of the root developmental fusion lines (fig.12,13).

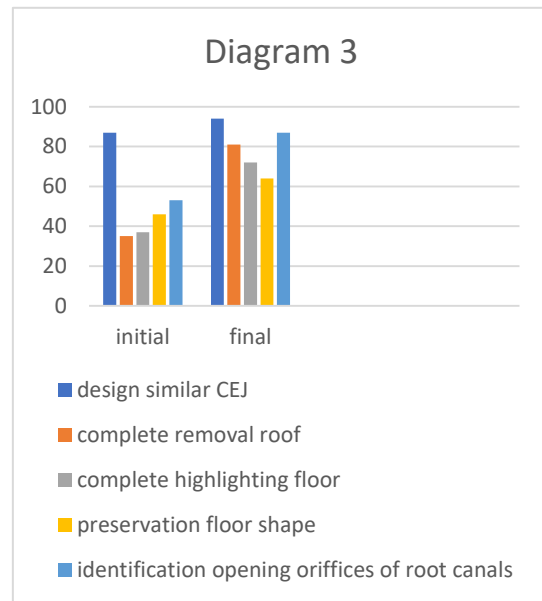
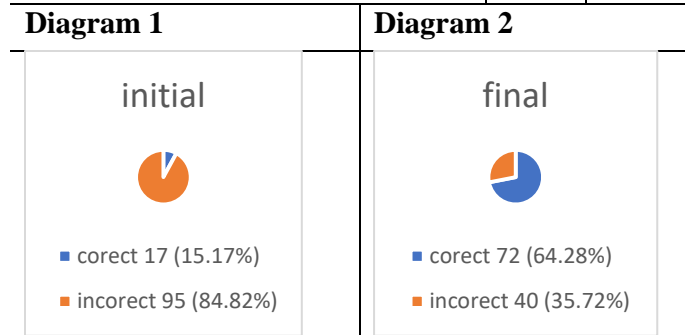
Methodology. The method used to teach the students to prepare correct access cavities was by using natural extracted teeth, respecting the laws of Rankow and Krasner and a didactic microscope for self-control (Handheld Digital

Microscope USB, AnMo Electronics Corporation). Each student had to prepare at least one access cavity for an upper and lower molar, an upper premolar, and incisor, a canine or a lower premolar. The practical examination consisted in the preparation of an access cavity. All images were stored in the microscope's memory and examined by all students in order to assess the quality of the preparations and to identify the technical defects. The main checked elements were: the design similar to CEJ (fig.2,3,4,5), the complete removal of the roof of the pulp chamber (fig.9), the complete highlighting of the floor (fig.10) with the preservation of its original shape (fig.14), the identification of the opening orifices of the root canals (fig.12,13,15). About 540 access cavities

prepared by 112 students were examined during a semester. The first 112 cavities were compared to the last 112 cavities made during examination.

Results. Out of 112 cavities performed at the beginning of the semester, only 17 (15.17%) met the criteria of a correct access cavity, compared with 72 (64.28%) correct cavities prepared during the practical examination. The most common mistakes were incomplete removal of the roof of the pulp chamber (initial evaluation), respectively floor destruction (final evaluation). The results with properly performed steps in the both evaluations are given in the table 1 and diagrams 1,2,3.

Table 1. Properly performed steps	initial	Final
design similar to CEJ	87	94
complete removal of the roof of the pulp chamber	35	81
complete highlighting of the floor	37	72
preservation of the original shape of the floor	46	64
Identification of the opening orifices of the root canals	53	87



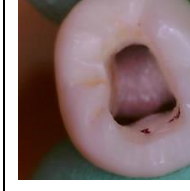


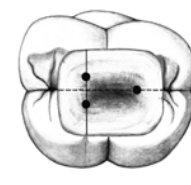
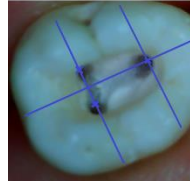
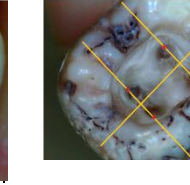









Discussions.

The full visualization of the floor of the pulp chamber requires the complete removal of the entire roof and all dentin and enamel obstructions of the pulp chamber but most textbooks offer no guidelines or landmarks to indicate precisely when access becomes adequate. The only way an operator can be

sure that the roof is completely removed is when he/she can see that all of the walls of the chamber meet the floor of the chamber 360 degrees around (2,3,4,5). If the meeting line between the walls and the floor is not highlighted, there is the possibility of a hidden orifice lying beneath an overhang. (Fig. 2). It is very difficult for beginners to notice when

the pulp chamber is opened and to assess whether the entire roof is removed. Rankow came with an idea of a simple box (The Access Box) (fig. 16) that can show clearly the advantages and disadvantages of complete roof removal.

				
Fig.1	Fig.2	Fig.3	Fig.4	Fig.5
Cut specimens showing the law of centrality and concentricity (fig. 1,2,3).			Incorrect design (fig.4,5)	
				
Fig.6	Fig.7	Fig.8	Fig.9	Fig.10
A diagram and examples of the Law of Symmetry 1,2 (fig. 6,7,8)			Partial removal of the roof of the pulp chamber.	Incomplete highlighting of the floor
				
Fig. 11.	Fig.12	Fig.13	Fig.14.	Fig.15
A diagram and examples of the Law of Color Change	Examples of the Law of Orifice Location 1,2,3		No preservation of the original shape of the floor	Impossibility of identification of the opening orifices of the root canals

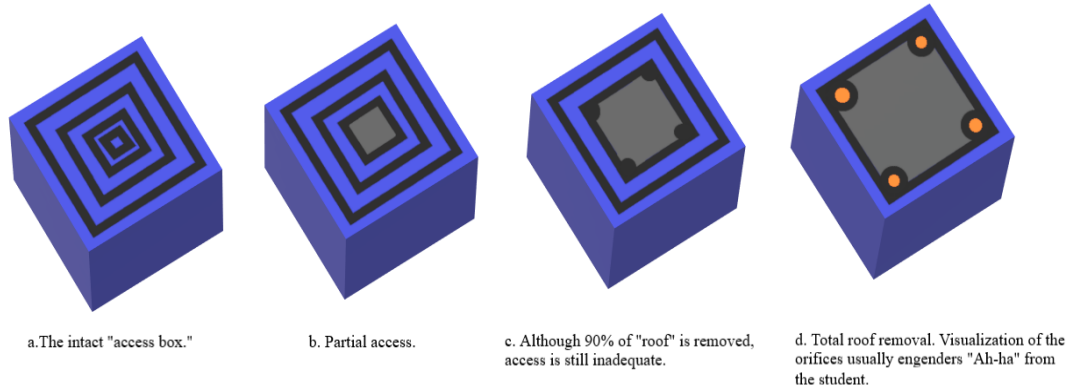


Fig. 16. The Access Box

The box represents the pulp chamber with the walls at right angles to the floor and parallel with each other. The top of the box (roof) is created in four pieces to show various stages of inadequate roof removal. The roof is removed in a series of steps that reveal sequentially more of the underlying floor and at each step, the student is asked to identify the number of orifices present on the floor of the box. The student cannot fully visualize the walls that meet the floor even with 90% of the roof removed and his answer remains in doubt. When the last section of roof is removed) and the student can see the walls meeting the floor for 360 degrees the student can identify very easy the number and position of the orifices, and experiences an "Ah-ha phenomenon."

Another aspect is the practice of the clinical visualization of the contour of the ECJ in order to follow the initial contour of the

cavity according to the law of concentricity. Students do this exercise during the semester by examining three patients each recording all the coronary lesions present treated or untreated (6,7). Students must also perform a preoperative evaluation and locate the roof of the pulp chamber based on an x-ray and determine the height of the pulp chamber in the pluriradicular teeth. This aspect is important in choosing the technique of opening the pulp chamber: direct drilling in the case of a bulky pulp chamber or layer by layer, in the case of a pulp chamber with a low height, below 2mm or even less. If the roof of the pulp chamber is very close to the floor, the opening of the pulp chamber can be very difficult to make. In this case, after an initial design of cavity access, the dentine can be removed in successive layers until the pulp tissue is discovered and the roof can be removed in one entire piece (Fig.17).



Fig.17. Complete removal of roof layer by layer.

Conclusion. In order to perform a successful endodontic treatment, all of the root canal orifices in a pulp chamber must be found utilizing (using, based on the, considering) the

laws of anatomy of the pulp chamber floor that permits the visualization of the pulp chamber walls meeting the floor 360 degrees around. A very useful learning method for students is to practice access cavities on

extracted natural teeth and subsequent control using a teaching microscope.

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