ORIGINAL RESEARCH PAPER
Volume - 10 | Issue - 10 | October - 2021 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ACCESS CAVITY PREPARATION: A REVIEW

Endodontic

Dr Shantanu Sabnani	Postgraduate,
Dr H. Murali	Professor,
Dr Keshava Prasad	Professor and HOD,
Dr Tarun G. S.*	Professor. *Corresponding Author
Dr Harsh Abhigyan	Intern.
Dr Diksha	Intern.

KEYWORDS

INTRODUCTION

An access cavity can be described as an opening that is prepared in the coronal aspect of the tooth to gain access into the root canal system for cleaning and shaping and obturation. (1) An optimally designed access cavity facilitates thorough cleaning and shaping, adequate disinfection and irrigation and 3D obturation with hermetic seal. Errors in access cavity preparation negatively impact the quality of treatment rendered. Thus, it plays a pivotal role that governs the ease and success of the subsequent stages of treatment and is of paramount importance. A poorly designed access cavity significantly increases the likelihood of iatrogenic errors. (2, 3) Unwarranted and excessive tooth removal during the access cavity preparation exponentially reduces the fracture resistance of the tooth and negatively effects its longevity. The removal of tooth structure should be sufficient enough to permit instrumentation and simultaneously be restricted in size to conserve the strength of the tooth. (4, 5)

OBJECTIVES

The access cavity preparation must fulfil certain objectives

- To remove all caries
- Preserve sound tooth structure
- Deroof the pulp chamber
- Remove all coronal pulp tissue
- Locate all the canal orifices
- Straight line access to the apical foramen or the initial canal curvature
- To establish all the restorative margins on sound tooth structure so as to minimize marginal leakage of the restored tooth (1, 6)

Armamentarium

Mouth mirror, hand piece, magnification, illumination.

1.Burs- Carbide, diamond:

- Access opening bur (fig. 2)

(fig. 2)

- **Endo Z bur (fig. 3)**

(fig. 3)

- **Munce bur (fig. 4)**

(fig. 4)

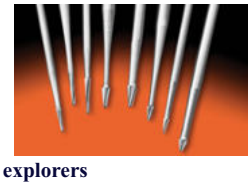
- **LN Bur (fig. 5)**

- **Endo Guide Burs (fig. 6)**

(fig. 6)

- **CK burs (fig. 7) (23)**

(fig. 7)



2. Endo explorers

- **DG - 16 (DG: David Green) - To locate canals (fig. 8)**

(fig. 8)

- **JW-17 (JW- John West) – For calcified canals (fig. 9)**

(fig. 9)

3. Micro opener- K file type flutes (fig. 10)

(fig. 10)

4. Micro debrider- H file type

(fig. 11)

5. Endodontic Spoon excavator (fig. 11)

6. Ultrasonic Unit and tips (fig. 12)

(fig. 12)

- Diamond coating: Spartan
- Hard tempered stainless steel: Store X
- Zirconium nitride coating: BUC tips

Traditional access cavity shape for maxillary teeth (fig.13)

Tooth	Shape	Number of canals
Central incisors	Rounded triangle	1
Lateral incisor	Smaller rounded triangle	1
Canine	Circular to ovoid – labio palatally	1
1st premolar	Ovoid	2 (1 or 3)
2nd premolar	Ovoid	2 or 1
1st molar	Triangular	4 or 3
2nd molar	Smaller triangle	4 or 3

(fig. 13)

Unusual anatomy observed in: 1st premolar: 3 canals: radicularis premolar Traditional access cavity shape for mandibular teeth (fig. 14)

Tooth	Shape	Number of canals
Central incisors	Long oval	1 (or 2)
Lateral incisor	Smaller rounded triangle	1 (or 2)
Canine	Circular to ovoid – labio palatally	1 (or 2)
1st premolar	Elliptical	2 (1 or 3)
2nd premolar	Elliptical	2 or 1
1st molar	Rectangular/ trapezoidal	4 or 3
2nd molar	Rectangular/ trapezoidal	4 or 3

(fig. 14)

Unusual anatomy observed in: 1st premolar: 2 or 3 canals, extra root, C shaped anatomy. Enigma to the endodontist.

1st molar: 3 canals: mid mesial, radix, isthmus
2nd molar: fused roots, C shaped anatomy

Classification of root canal morphology:
Root canals are classified based on the number of canals, orifice and foramina. Most commonly used classifications are:

Wein's classification: (11) (fig. 15)

Type I: 1-1

Type II: 2-1

Type III: 2-2

Type IV: 1-2

(fig.15)

Vertucci classification: (fig. 16) **Wein's classification (fig. 13)**

Type I: 1-1

Type II: 2-1

Type III: 1-2-1

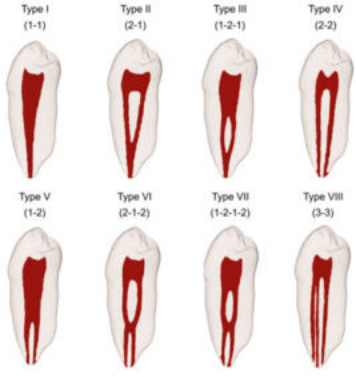
Type IV: 2-2

Type V: 1-2

Type VI 2-1-2

Type VII: 1-2-1-2

Type VIII: 3-3



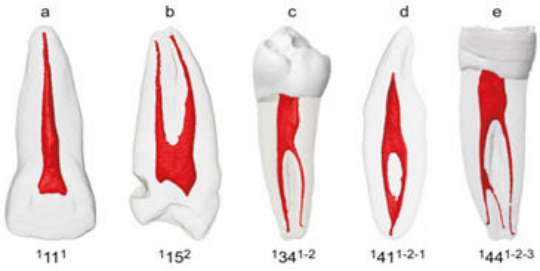
(fig. 16)

Ahmed et al classification: This recent classification includes codes for three individual parameters: the tooth number, the number of roots, and the root canal configuration. (11)

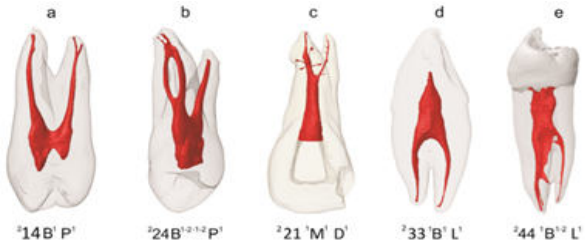
Tooth number: (TN) can be denoted using any numbering system (e.g. universal numbering system, FDI World Dental Federation System or the Palmer Notation Numbering System). Or a suitable abbreviation can be used, for example maxillary (upper) central incisor (UCI).

Number of roots: The number of roots (R) is added as a superscript before the tooth number ® TN). For instance, ^{n} TN means that tooth 'TN' has n roots. Any root division whether in the coronal, middle or apical third will be coded as two or more roots. Accordingly, a bifurcation is represented as 2 TN, and trifurcation is represented as 3 TN and so on.

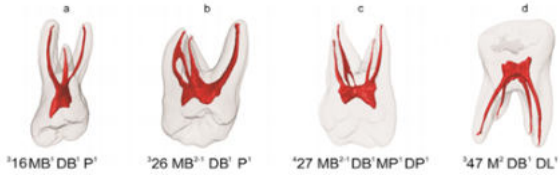
Root canal configuration: The type of root canal configuration in each root will be identified as a superscript number $^{(s)}$ after the tooth number and will define the morphology of the root canal system starting from the orifice(s) (O), through the canal (C) to the foramen (foramina) (F) (3) (fig. 17-19)



(fig. 17) Micro-CT 3D models of double-rooted teeth with root and root canal morphology classified according to the new system.



(fig. 18) Micro-CT 3D models of double-rooted teeth with root and root canal morphology classified according to the new system.

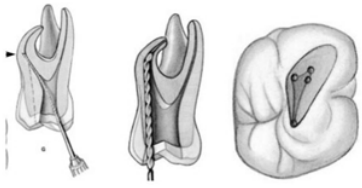


(fig. 19) Micro-CT 3D models of double-rooted teeth with root and root canal morphology classified according to the new system.

Recent Trends:

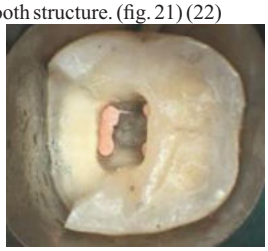
- Shamrock access
- Caries driven access cavity
- Restoration driven access cavity
- Conservative endodontic access
- Truss access- Separate cavities prepared to access canals
- Ninja access cavity
- Guided and micro-guided access cavity
- Dynamically guided access (12, 13, 14, 15, 16)

Shamrock access: Traditional access preparations require extended and diverging walls to prevent instrument impingement on the walls. In Shamrock preparations, only the portion of the wall that is interfering with the motion of instruments is extended rather than the entire wall. (fig. 20)



(fig. 20)

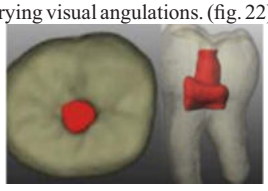
Caries leveraged access: access to the canals is established by removal of low or zero value tooth or restorative structures i.e., carious tooth structure, existing restorative materials, less strategic tooth structure etc. Thus, conserving healthy dentin by elimination of discontinuities in tooth structure. (fig. 21) (22)



(fig. 21)

Conservative endodontic access: Teeth are opened in the region of the central fossa and extended only to detect the canal orifices, thus preserving the peri cervical dentin and part of the chamber floor.

Ninja Endodontic Access Cavity (NECs): An access with a 'Ninja' outline, the oblique projection is towards the central fossa of the canal orifices in an occlusal plane. It is parallel with the enamel cut of 90^{0} or more to the occlusal plane, making it easier to trace the root canal orifices from the varying visual angulations. (fig. 22)



(fig. 22)

Truss access: Separate cavities are made to approach the canals, leaving a truss of dentin between the two cavities. Two separate cavities are made to approach the mesial and the distal canals in mandibular molars where as mesiobuccal and the distobuccal canals are approached in one cavity with a separate cavity for the palatal canal is prepared in the case of maxillary molars. (21) (fig. 23)

(fig. 23)

Cala Lilly Enamel Preparation: The enamel is cut back at 45 degrees in contrast to the conventional butt joint preparation with a box shape preparation. The Cala Lilly shape maximizes enamel rod engagement and simultaneously reduces the chances of crak initiation and propagation.

Micro guided endodontic access: virtual planning of an ideal access cavity is performed using CBCT image information. A template is fabricated using a 3D printer which guides a minimally invasive drill to the calcified root canal.

Dynamically guided access: Introduced by Dr. Charles M., the access cavity is planned using data relating to its size and position by means of a CBCT. Overhead tracking cameras relate the position of the patient's jaw and the clinician's bur in 3- dimensional space. The clinician, by looking at the software interface, gets immediate feedback about the position of the bur as it relates to the position of the planned access and the tooth

Principles of minimally invasive endodontics

- Preservation of pericervical dentin:
- Heat- treated NiTi file systems:
- Magnification and illumination:
- Soffit
- 3D ferrule (6)

Procedural errors:

- Over extension
- Under extension
- Lateral perforation- Mandibular central and lateral incisors M-D very narrow

- Angled crown to root

- Gouging
- Missed canals- Mandibular incisors, MB-2 in maxillary molars, mandibular premolar

Drawbacks of Conservative preparation:

- Increased chances of missed canals
- Increased strain on instrument
- Chances of pulp below preserved dentin

CONCLUSION:

Minimally invasive endodontics focuses on the preservation of tooth structure and relies upon magnification aids (dental operating microscope), ultrasonic-assisted preparation techniques, modern file systems, burs, drills and instruments. Knowledge of the tooth, canal anatomy and its variations are essential. Minimal cavity preparations may lead to a higher rate of procedural errors and benefit may be outweighed by poor clinical outcome; however, overzealous tooth removal will severely compromise the long-term outcome. (24) Hence, the clinician should establish the optimum balance between minimal preparation and traditional endodontic preparation, with their advantages and drawbacks, prior to the preparation.

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