

A Comprehensive Review on Classification of Furcation Involvement

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ABSTRACT

Different classifications have been presented over the years for the furcation involvement examination. While each classification has advantages and disadvantages of its own, Glickman's classification remains the best to this day. You can find potential classifications in this article for quick reference to aid in the conclusion of the examination for furcation involvement. It also provides you with information on the diagnosis and toolkit used to clinically examine cases of furcation involvement, determine a definitive treatment plan, and raise the possibility of a better prognosis for the patient.

Keywords: Classification , Furcation Involvement , Glickman , Diagnosis , Prognosis

INTRODUCTION

According to the glossary of terms of the American Academy of Periodontology, a furcation involvement exists when periodontal disease has caused resorption of bone into the bi- or tri-furcation area of a multi-rooted tooth. Many authors have proposed classification based on the horizontal or vertical attachment loss. Glickman in 1953 classified based on the extent and main characteristics of the furcation defect. Hamp , Nyman and Linde , Tarnow and Fletcher classified based on the horizontal and vertical attachment loss. Other classifications based on the anatomy of the furcation, number of remaining bony walls , morphology of the existing bone walls , relationship between root trunk and horizontal or vertical attachment loss. This classifications can help the clinicians to provide a better diagnosis , prognosis , treatment plan.

Classifications

1. Glickman, et al (1953)

Grade I: Incipient lesion. Supra-bony pocket and slight bone loss in the furcation area.

Grade II: Loss of inter-radicular bone and pocket formation but a portion of the alveolar bone and periodontal ligament remain intact.

Grade III: Through-and-through lesion.

Grade IV: Through-and-through lesion with gingival recession, leading to a clearly visible furcation area.

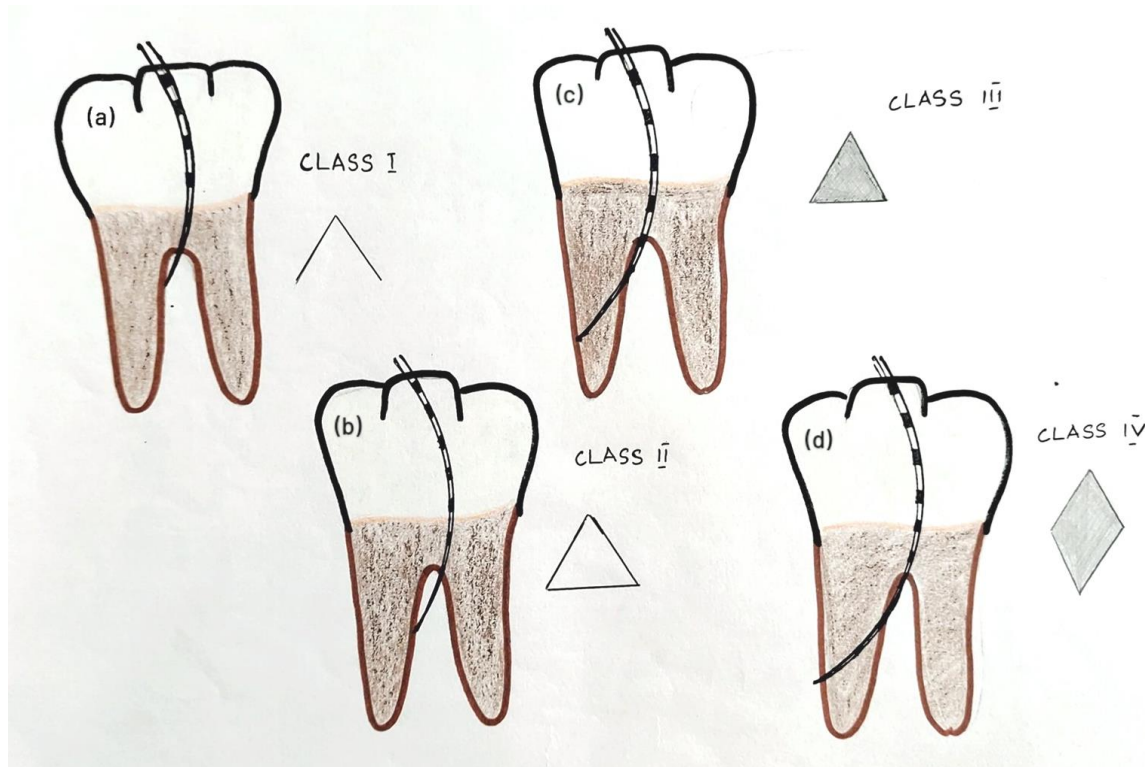


Figure 1: Glickman's classification (a) Class I (b) Class II (c) Class III (d) Class IV

2. Goldman HM (1958)

Grade I: Incipient lesion.

Grade II: Cul-de-sac lesion.

Grade III: Through-and-through lesion.

3. Staffileno HJ (1969)

Class I: Furcation with a soft tissue lesion extending to furcal level but with minor degree of osseous destruction.

Class II: Furcation with a soft tissue lesion and variable degree of osseous destruction but not a through-and-through communication through the furca.

Class II F: Furcation with osseous destruction from facial aspect only.

Class II L: Furcation with osseous destruction from lingual aspect only.

Class II M: Furcations with osseous destruction from mesial aspect only.

Class II D: Furcations with osseous destruction from distal aspect only.

Class III: Furcations with osseous destruction through and through communication.

4. Easley JR, et al (1969)

Class I: Incipient involvement, but there is no horizontal component to the furca.

Class II: Type 1. Horizontal attachment loss into the furcation.

Type 2. Vertical attachment loss into the furcation.

Class III: Through-and-through attachment loss into the furcation.

Type 1. Horizontal attachment loss into the furcation.

Type 2. Vertical attachment loss into the furcation.

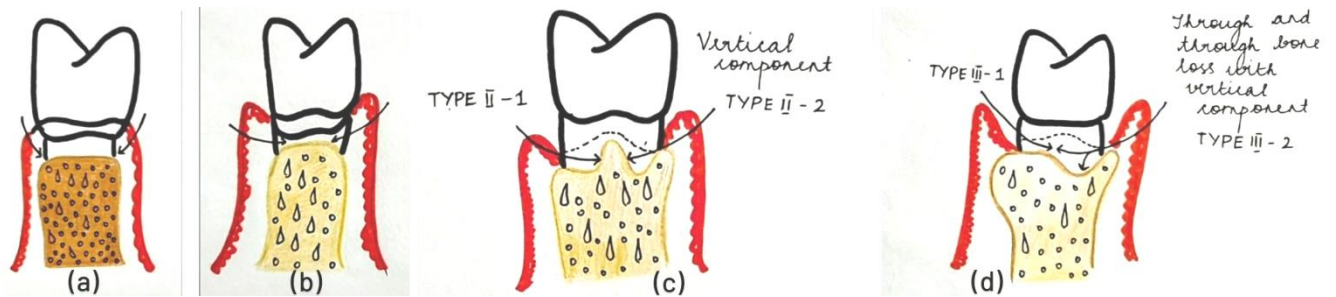


Figure 2: Easley, J.R.'s classification (a) No furcation involvement (b) Class I (c) Class II: Type 1 & Type 2 (d) Class III: Type 1 & Type 2

5. Hamp SE, et al. (1975)

Degree 0: the area of furcation is not accessible

Degree I: Horizontal attachment loss < 3 mm.

Degree II: Horizontal attachment loss > 3mm not encompassing the total width of the furcation area.

Degree III: Horizontal through and through destruction of the periodontal tissue in the furcation area.

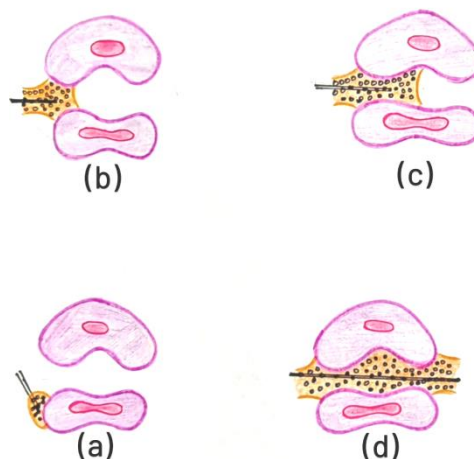


Figure 3: Easley, J.R.'s classification (a) Degree 0 (b) Degree I (c) Degree II (d) Degree III

6. Rosemberg MM (1978)

1. Horizontal

Degree I: Probing < 4 mm.

Degree II: Probing > 4 mm.

Degree III: Two or three furcations classified as degree II are found.

2. Vertical

Shallow: Slight lateral extension of an interradicular defect, from the center of the trifurcation in a horizontal direction.

Deep: Internal furcation involvement but not penetrating the adjacent furcation.

7. Ramjford SP, et al.(1979)

Class I: Tissue destruction < 2 mm (1/3 of tooth width) into the furcation.

Class II: Tissue destruction > 2 mm (>1/3 of tooth width).

Class III: Through-and-through involvement.

8. Goldman HM, et al. (1980)

- Degree I: Involves furcation entrance.
- Degree II: Involvement extends under the roof of furcation.
- Degree III: Through-and-through involvement.

9. Richietti PA (1982)

- Class I: 1 mm of horizontal invasion.
- Class Ia. 1–2 mm of horizontal invasion.
- Class II: 2–4 mm of horizontal invasion.
- Class IIa. 4–6 mm of horizontal invasion.
- Class III: >6 mm of horizontal invasion.

10. Tal H, et al. (1982)

- Furcation involvement index (FII) scores:
- Furcal rating 1: Depth of the furcation is 0 mm.
 - Furcal rating 2: Depth of the furcation is 1–2 mm.
 - Furcal rating 3: Depth of the furcation is 3 mm
 - Furcal rating 4: Depth of the furcation is 4 mm or more.

11. Tarnow D, et al. (1984)

For each class of horizontal classification (I–III), a subclass based on the vertical bone resorption was added:

- Subclass A: 0–3 mm.
- Subclass B: 4–6 mm.
- Subclass C: >7 mm.

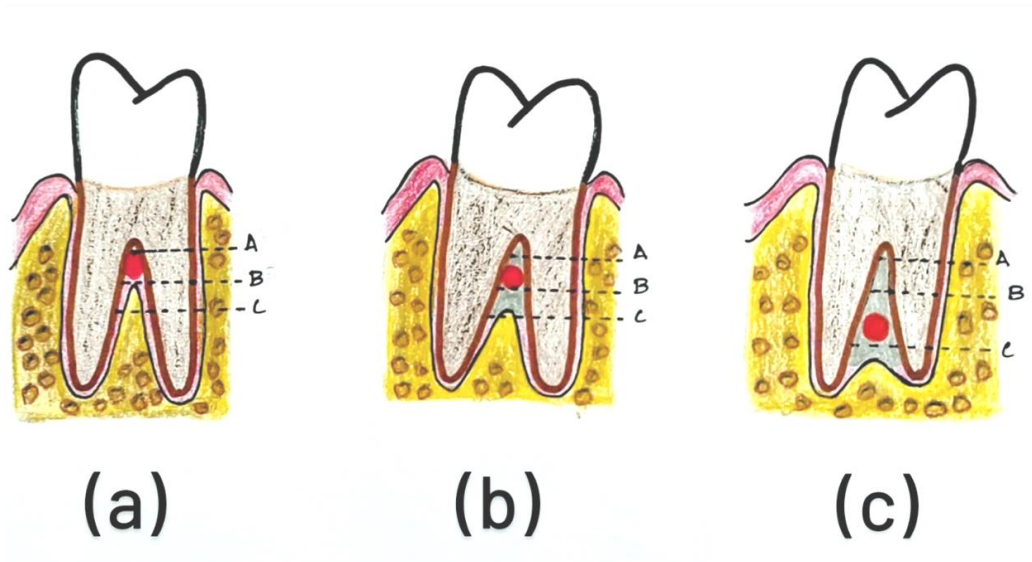


Figure 4: Tarnow's classification (a) SubClass A (b) SubClass B (c) SubClass C

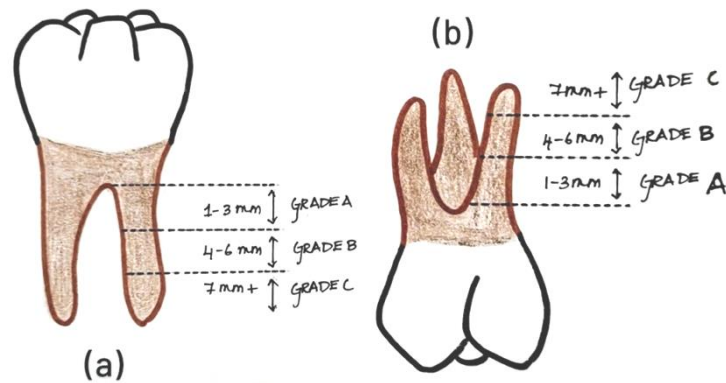


Figure 5: Tarnow's classification in (a) Mandibular molar (b) Maxillary molar

12. Eskow RN, et al. (1984)

Furcation involvement is classified as grade I subclasses A, B, and C (vertical involvement):

Subclass A: Vertical destruction $> 1/3$.

Subclass B: Vertical destruction of $2/3$.

Subclass C: Vertical destruction beyond apical third of interradicular height.

13. Fedi PF, (1985)

- Glickman + Hamp classifications. Grades are the same as Glickman's classification (I–IV).
- Grade II is subdivided into degrees I and II.
Degree I. Vertical bone loss 1–3 mm.
Degree II. Vertical bone loss > 3 mm, but not communicate through-and-through.

14. Grant DA, et al. (1988)

Class I: Involvement of the flute only.

Class II: Involvement partially under the roof.

Class III: Through-and-through loss.

15. Basaraba N, (1990)

Class I: Initial furcation involvement.

Class II: Partial furcation involvement.

Class III: Communicating furcation involvement.

16. Carnevale G, et al. (1994)

Degree I: Horizontal attachment loss $< 1/3$

Degree II: Horizontal attachment loss $> 1/3$.

Degree III: Horizontal through-and-through destruction.

17. Carnevale, et al. (1997)

- Modified Hamp et al. (1975)
- Classification wherein the horizontal depth of furcation involvement is expressed in terms of 3 mm instead of thirds.

18. Hou GL, et al. (1998)

- Classification based on root trunk length and horizontal and vertical bone loss.
- Types of root trunk:
 - Type A: Furcation involving cervical third of root length.
 - Type B: Furcation involving cervical third and cervical two thirds of root length.

- Type C: Furcation involving cervical two thirds of root length.
- Classes of furcation:
 - Class I: Horizontal loss of 3 mm.
 - Class II: Horizontal loss > 3 mm.
 - Class III: Horizontal “through-and-through” loss.
- Subclasses by radiographic assessment of the periapical view:
 - Sub-class ‘a’. Supra-bony defect.
 - Sub-class ‘b’. Infra-bony defect.
- Classification of furcation:
 - AI, AII, AIII. Type A root trunks with class I, class II and class III furcations.
 - BI, BII, BIII. Type B root trunks with class I, class II and class III furcations.
 - CI, CII, CIII. Type C root trunks with class I, class II and class III furcations.

19. Nevins and Capetta (1998)

Class I: Incipient or early loss of attachment.

Class II: A deeper invasion and loss of attachment that does not extend to a complete invasion.

Class III: Complete loss of periodontium extending from buccal to lingual surface.
Diagnosed radiographically and clinically.

20. Fedi, et al. (2000)

- Modified Glickman's classification
- Grade II degree I - exists when furcal bone loss possesses a vertical component of >1 but 3mm, but still does not communicate through-and-through.

21. Glossary of periodontal terms. (2001)

Class I: Minimal but notable bone loss in furcation.

Class II: Variable degree of bone destruction but not extending completely through furcation.

Class III: Bone resorption extending completely through furcation.

22. Walter C, et al. (2009)

- Modification of the Hamp et al. classification (degree II is divided into degrees II and II–III)
 - Degree I: Horizontal attachment loss < 1/3 of the width of the tooth.
 - Degree II: Horizontal loss of support > 3 mm, < 6 mm.
 - Degree II–III: Horizontal loss of support > 6 mm, but not extending completely through furcation.
 - Degree III: Horizontal through-and-through destruction.

23. Piloni A and Rojas MA (2018)

- NE = non exposed; E = exposed.
 - NEI: The furcation lesion is not clinically exposed. The horizontal attachment loss is 2 mm or less.
 - NEII: The furcation lesion is not clinically exposed. The horizontal attachment loss is 3 mm or more.
 - NEIII: The furcation lesion is not clinically exposed. The horizontal attachment loss is total, with through and through opening of the furcation.
 - EI: The furcation lesion is clinically exposed. The horizontal attachment loss is 2mm or less.
 - EII: The furcation lesion is clinically exposed. The horizontal attachment loss is 3mm or more.

EIII: The furcation lesion is clinically exposed. The horizontal attachment loss is total, with through and through opening of the furcation.

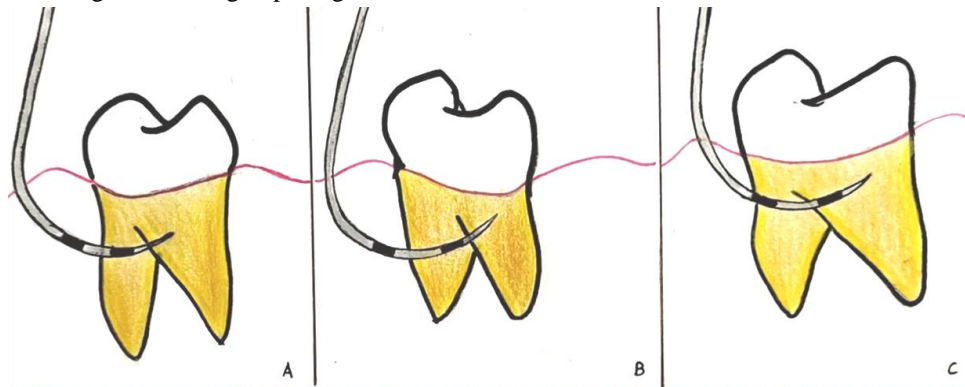


Figure 6: Piloni's classification – Non-exposed furcation lesion (NE): (a) Class I (b) Class II (c) Class III

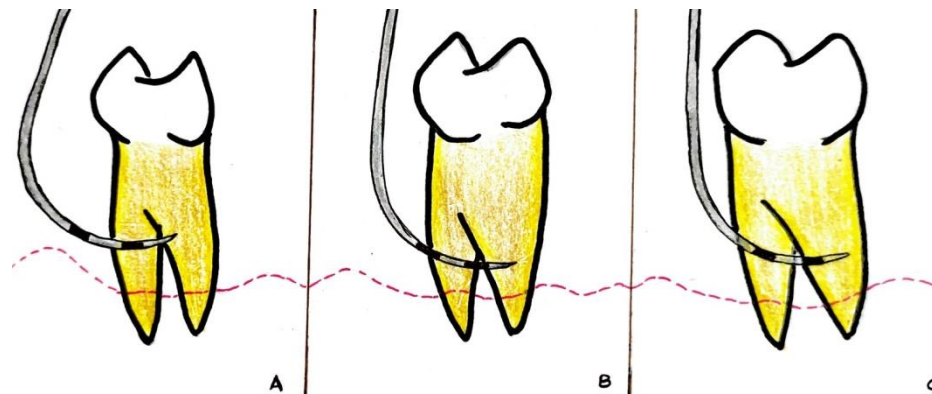


Figure 7: Piloni's classification – Exposed furcation lesion (E): (a) Class I (b) Class II (c) Class III

24. Kolte AP, et al. (2018)

Grade I - This type of furcation involvement is an inchoate lesion which develops by mild to moderate and uniform periodontal destruction extending into the flute of the furcation, and manifesting itself with increased probing depth.

Grade Ia: It comprises of all the features of Grade I FI, with the normal position of gingival margin which is slightly coronal to the CEJ.

Grade Ib: It comprises of all features of Grade I FI, with the position of gingival margin, 0-3 mm apical to CEJ.

Grade Ic: It comprises of all features of Grade I FI, with the position of gingival margin which is more than 3 mm apical to CEJ and may lead to mucogingival problem.

Grade II: This type of FI is a confined lesion which develops by moderate periodontal destruction of varying amount extending into the inter-radicular area, with an arched roof created by the furca and bordered by roots and bone.

Grade II type 1a: It comprises of all the features of Grade II Type 1 FI with the normal position of gingival margin which is slightly coronal to the CEJ.

Grade II type 1b: It comprises of all the features of Grade II Type 1 FI with the position of gingival margin which is 0-3 mm apical to the CEJ.

Grade II type 1c: It comprises of all the features of Grade II Type 1 FI with the position of gingival margin which is more than 3 mm apical to the

CEJ and may lead to mucogingival problem.

Grade II type2a: It comprises of all the features of Grade II Type 2 FI with the normal position of gingival margin which is slightly coronal to the CEJ.

Grade II type2b: It comprises of all the features of Grade II Type 2 FI with the position of gingival margin which is 0-3 mm apical to the CEJ.

Grade II type2c: It comprises of all the features of Grade II Type 2 FI with the position of gingival margin which is more than 3 mm apical to the CEJ and may lead to mucogingival problem.

Grade III : This type of Furcation involvement is a complete lesion which develops by moderate to severe periodontal destruction in the furcation area permitting the passage of a probe bucco-lingually on the mandibular molars and bucco-mesially and buccodistally on the maxillary molars.

Grade III type1a: It comprises of all the features of Grade III Type 1 FI with the normal position of gingival margin which is slightly coronal to the CEJ.

Grade III type1b: It comprises of all the features of Grade III Type 1 FI with the position of gingival margin which is 0-3 mm apical to the CEJ.

Grade III type1c: It comprises of all the features of Grade III Type 1 FI with the position of gingival margin which is more than 3 mm apical to the CEJ and may lead to mucogingival problem.

Grade III type 2a: It comprises of all the features of Grade III Type 2 FI with the normal position of gingival margin which is slightly coronal to the CEJ.

Grade III type 2b: It comprises of all the features of Grade III Type 2 FI with the position of gingival margin which is 0-3 mm apical to the CEJ.

Grade III type 2c: It comprises of all the features of Grade III type 2 FI with the position of gingival margin which is more than 3 mm apical to the CEJ and may lead to mucogingival problem.

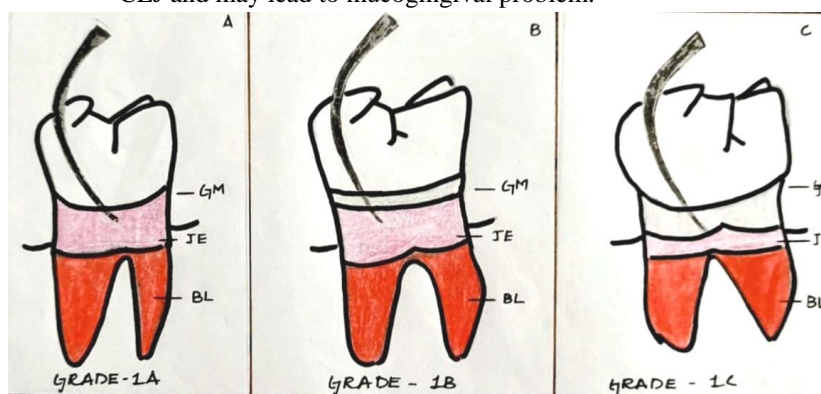


Figure 8: Kolte's classification – Grade I furcation involvement (a) Grade Ia (b) Grade Ib (c) Grade Ic

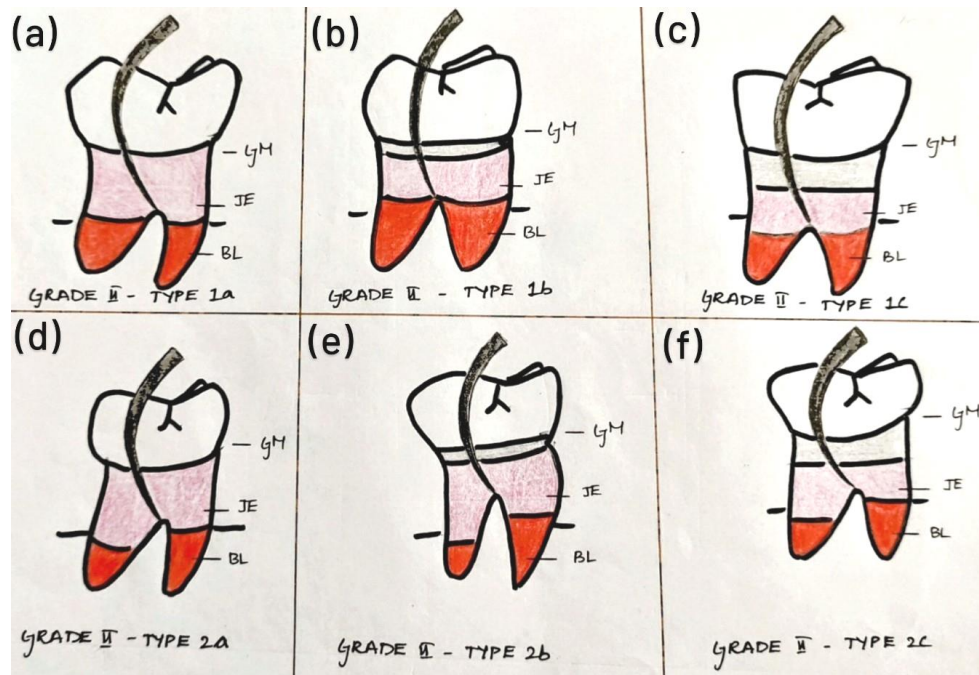


Figure 9: Kolte's classification – Grade II furcation involvement (a) Grade II type 1a (b) Grade II type 1b (c) Grade II type 1c (d) Grade II type 2a (e) Grade II type 2b (f) Grade II type 2c

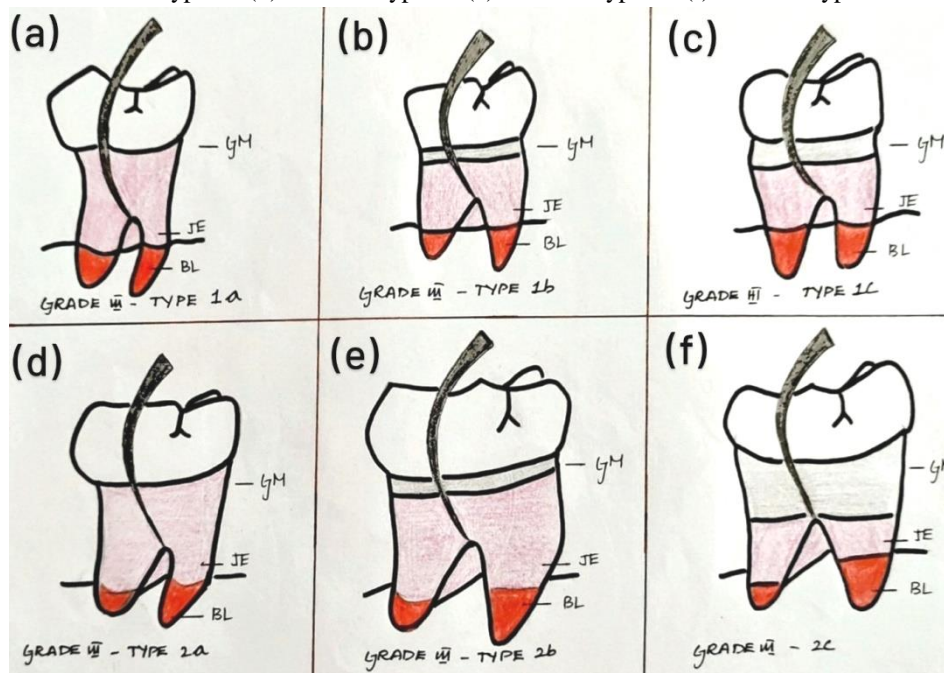


Figure 10: Kolte's classification – Grade III furcation involvement (a) Grade III type 1a (b) Grade III type 1b (c) Grade III type 1c (d) Grade III type 2a (e) Grade III type 2b (f) Grade III type 2c

25. Proposed New Classification (Shrestha's Furcation Index)

The proposed system is based on the site-specific clinical presentation of the furcation defects and takes into consideration the horizontal and vertical components of furcation as well as its exposure

- Horizontal component of the furcation.
 - Score 0: no horizontal component.
 - Score 1: Furcation involvement < 3 mm.
 - Score 2: furcation involvement ≥ 3 mm but not through and through.

Score 3: through and through involvement of the furcation

- Vertical component of the furcation.
Score 0: no vertical component.
Score 1: furcation involvement of 1–3mm.
Score 2: furcation involvement of 4–6 mm.
Score 3: furcation involvement of ≥ 7 mm

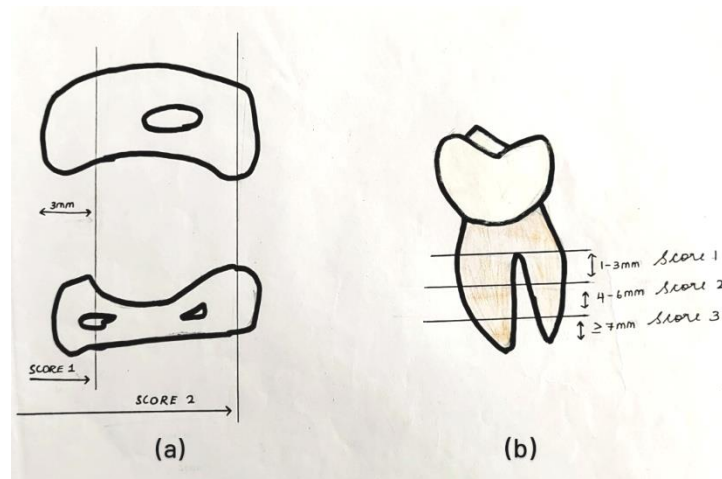


Figure 11: Shrestha's furcation index (a) Horizontal component of the furcation (b) Vertical component of the furcation

CONCLUSION

The treatment plan and prognosis in cases of furcation involvement cases are a herculean challenge for clinicians since it depends on several elements anatomy of tooth involved , age of the patient , dental hygiene of the patient , degree of furcation and certain other factors. Furcation is an area which has complex anatomy and cannot be inspected in routine oral examinations. To find out the degree of furcation would be the crucial step in these cases to end up in better treatment planning. So many people came up with various classifications to improve the prognosis of the affected tooth and arrive at a better treatment option. The classification proposed by various people takes both hard and soft tissue into account. The classification proposed by Kolte.et.al in 2018 proved to be the only classification that relates the extent of alveolar bone damage both horizontally and vertically .The ideal classification which helps clinicians to provide better treatment and easy to assess and diagnosis would be Glickman's classification. To evaluate the three-dimensional view of the furcation involvement and to suggest more complex classification for the purpose of global communication, additional research and cutting-edge technology are needed.

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