

**Palatoradicular groove – a pivotal threat to periodontitis, challenging the diagnosis and treatment -A review**

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**Abstract**

Palatoradicular groove, a rare developmental anomaly observed in 8.5% of the individuals is considered as an initial predisposing factor for localized periodontal destruction leading to endodontic complication. The prevalence of palatoradicular groove is found to be 5.6% on maxillary lateral incisor and 3.4% on maxillary central incisor. Presence of isolated deep periodontal pockets in maxillary incisor often suggest an examination for palatoradicular groove. Palatoradicular groove serves as a nidus for the retention of food debris resulting in periodontal destruction leading to bone loss. Palatoradicular groove complicates as dental caries which then communicates to the pulpal canal leading to a combined endodontic periodontal lesion. Prognosis and treatment largely depends on the extent, width and depth

of the groove. Various treatment modalities have been proposed to handle this etiological defect in the management of periodontal disease.

**Keywords:** Palatoradicular groove, localized periodontal destruction.

**Introduction**

Anomaly is a term meaning ‘irregularity’ or ‘different from normal’<sup>[1]</sup>. Developmental dental anomalies are marked deviations from normal color, size, number and degree of development of teeth. Anomalies of maxillary central and lateral incisors are not uncommon **Summers et al 1956**<sup>[2]</sup>. Palatoradicular groove has been defined as a developmental anomalous groove usually found on the palatal aspect of maxillary central and lateral incisor<sup>[3]</sup>. Hence it is important for the clinician to recognize the presence and understand its effect on diagnosis, prognosis

and treatment. An unrecognized palatoradicular groove can lead to a questionable prognosis in the management of pathological defect.

### Historical Review

**Brabant (1971)** recorded the prevalence of palatoradicular groove in the collections of teeth dating between 2500 and 1000 BC to be 12% to 21% in both maxillary central and lateral incisors. He also recorded its prevalence in lateral incisors alone to be 6.3% to 14%.<sup>[4]</sup>

**Kovacs (1971)** called it an “isyndesmocoronaradicular tooth”. He brought the attention of cemento-enamel junction associated with the groove.<sup>[5]</sup>

**Zeisz and Nuckolls (1949)** described five variations of palatal surfaces of maxillary incisor teeth depending on the appearance of cingulum. They also described the presence of maxillary incisor teeth.<sup>[6]</sup>

**Prichard** was the first to state that lingual grooves on the maxillary incisor teeth are a predisposing factor to localized periodontal destruction.<sup>[7]</sup>

**Lee et al** was the first to report an association between palatoradicular groove and localized periodontitis.<sup>[8]</sup>

### Other Terminologies

- A. Palato-gingival groove
- B. Radicular groove
- C. Disto-lingual groove
- D. Palatal groove

### Prevalence

**Everett and Kramer in 1972** reported the prevalence of less than 2% in 625 extracted teeth. 0.5% grooves extended to the root apex<sup>[9]</sup>.

**Withers et al (1981)** examined 531 military recruits and concluded the prevalence of palatoradicular groove to be 3.5% in both the incisors and 4.4% in maxillary lateral incisors alone<sup>[7]</sup>.

**Kogan (1986)** reported the prevalence of groove in 3168 extracted incisors to be 3.4% of central incisors and 5.6%

of lateral incisors. He also reported the total prevalence of 4.6% in both the incisors<sup>[8]</sup>.

**Bacic and Karacas (1990)** examined 1081 young male adults. He found 1.01% of the subjects to have incisors with a palatoradicular groove<sup>[10]</sup>. In the same study he examined 634 subjects aged 35-50 years with periodontal disease and found 0.79% of the subjects had a palatoradicular groove. Variations in the prevalence are likely due to difference in descriptive criteria. In all these studies maxillary lateral incisors were the most frequently affected teeth with prevalence ranging from 2.3% to 5.6%.

### Kogan SL (1986) study reveals,

|         | Location |        |            | Origin  |          |                         |      |          | Termination             |      |                                              |         |
|---------|----------|--------|------------|---------|----------|-------------------------|------|----------|-------------------------|------|----------------------------------------------|---------|
|         | Mesial   | Distal | Midpalatal | Lingual | Cingulum | Cemento enamel junction | Root | Cingulum | Cemento enamel junction | Root | Length of groove when terminated on the root |         |
| Lateral | 13*      | 25     | 62         | 15      | 77       | 7                       | 1    | 9        | 44                      | 47   | 43%                                          | 1-5 mm  |
|         |          |        |            |         |          |                         |      |          |                         |      | 47%                                          | 6-10 mm |
|         |          |        |            |         |          |                         |      |          |                         |      | 10%                                          | >10 mm  |
| Central | 38       | 17     | 45         | 11      | 74       | 13                      | 2    | 9        | 21                      | 70   | 39%                                          | 1-5 mm  |
|         |          |        |            |         |          |                         |      |          |                         |      | 37%                                          | 6-10 mm |
|         |          |        |            |         |          |                         |      |          |                         |      | 24%                                          | >10 mm  |

\* Expressed as percentage of total teeth in that class with grooves.

### Etiology

The location of lateral incisor is an area of embryological risk where a number of malformations may occur such as deformation in shape (peg laterals), in number (supernumerary teeth), in surface (developmental groove, dens in dente), with associated structures (cleft palate) so on. One such morphological defect associated with the surface of maxillary lateral incisor is palatoradicular groove.

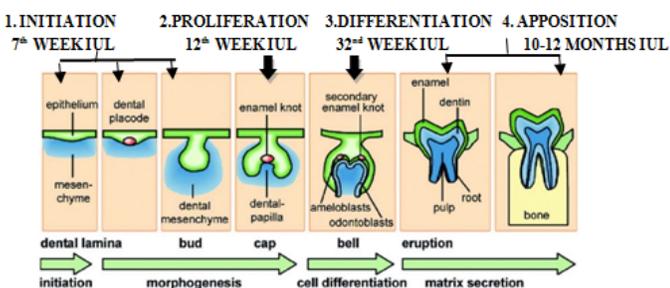
Several etiologies have been claimed, which includes

1. It is considered as the result of infoldings of inner enamel epithelium and Hertwig epithelial root sheath during odontogenesis **Lee et al 1968**<sup>[11]</sup>.
2. **Cohen 1919** claimed palatoradicular groove is a radicular variety of dens in dente.<sup>[7]</sup>
3. **Oehlers 1958** regarded it as a variant of root morphology.<sup>[11]</sup>
4. **Simon et al 1971, Peikoff et al 1985** claimed that it was the result of incomplete attempt of root bifurcation.

[12]

5. **Atkinson 1943** suggested the undesirable position of maxillary lateral incisor and also its period of mineralization which occurs later when compared to other teeth made the tooth germ susceptible to infoldings of epithelium resulting in this developmental anomaly. [2]

**Development of Tooth**



First evidence of calcification of permanent maxillary lateral incisor occurs at 10-12 months of age while crown completion takes place at 4-5 years. Normally lateral incisors erupt at 8-9 years of age and its root completion takes place at 11 years.

**Classification**

Palatoradicular groove begins in the central fossa of the incisor, crosses the cingulum and extends frequently up to the cemento enamel junction. Occasionally the groove extends up to the root apex.

**Kogan SL 1986** [8] classified groove according to the I

**Location**

- A. Mesial (fig I.A)
- B. Distal (fig I.B)
- C. Mid-palatal (fig I.C)

**MESIAL**



Fig I.A

**DISTAL**



Fig I.B

**MIDPALATAL**

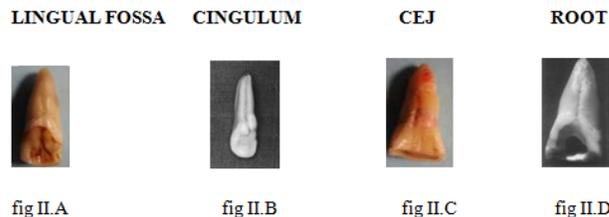


Fig I.C

**Origin**

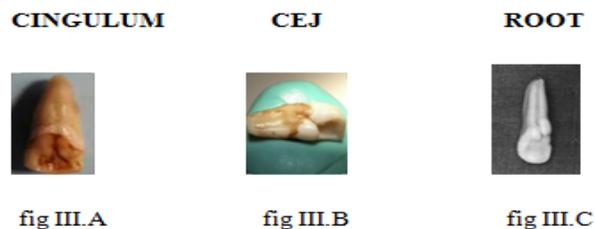
- A. Lingual fossa (fig II.A)

- B. Cingulum (fig II.B)
- C. Cemento-enamel junction (fig II.C)
- D. Root (fig II.D)



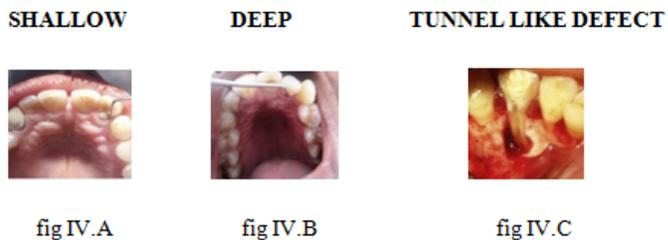
**Termination**

- A. Cingulum (fig III.A)
- B. Cementoenamel junction (fig III.B)
- C. Root (fig III.C)



**Conformation**

- A. Shallow (<1mm) (fig IV.A)
- B. Deep (>1mm) (fig IV.B)
- C. Closed tube which formed a tunnel like channel.(fig IV.C)



**Goon 1991** [13] classified according to the extent and complexity of the groove as

- A. Mild: grooves are gentle depressions of coronal enamel that terminate at or immediately after crossing CEJ. (fig V.A)
- B. Moderate: grooves extend some distance apically along the root surface in the form of a shallow or fissured defect. (fig V.B)
- C. Complex: grooves are deeply invaginated defects that

involve the length of the root or separates as an accessory root from the main root trunk (fig V.C)

**MILD**



fig V.A

**MODERATE.**



fig V.B

**COMPLEX**



fig V.C

**Degree of Severity: [GU YG 2011]**

- A. Type I:** the groove is short (not beyond the coronal third of the root) (fig VI.A)
- B. Type II:** the groove is long (beyond the coronal third of the root) but shallow, corresponding to a normal or simple root canal. (fig VI.B)
- C. Type III:** the groove is long (beyond the coronal third of the root) and deep, corresponding to a complex root canal system.(fig VI.C)

**TYPE I**



fig VI.A

**TYPE II**



fig VI.B

**TYPE III**



fig VI.C

**Histological Appearance**

Lee et al 1968<sup>[11]</sup> studied ground and decalcified sections of teeth with palatoradicular groove as follows:

- a. Shallow groove: gentle depression with base of the groove lined with mixture of cellular and acellular cementum.
- b. Marked groove: deep defect lined at the sides and base with varying amounts of cementum.
- c. Pathological defect: resorption at the sides and base of the groove exposing dentinal tubules.

**Radiographic Features**

Radiographically the groove appears as one or more dark lines extending along the length of the root parallel

or superimposed on pulp canal termed as ‘parapulpal lines’.

Everette and Kramer 1972<sup>[9]</sup> (fig VII.A)



Fig VII.A

These parapulpal lines should be associated with clinically observable groove only then the diagnosis of palatoradicular groove can be made. If it is associated with periapical pathology then periapical radiolucency is noted. If it is associated with periodontitis then deep vertical bone defects are noted along with the groove.

Lee et al 1968<sup>[11]</sup>

**Clinical Features**

Clinically appears as a small groove starting in the cingulum or central fossa and extends apically. When it is associated with localized periodontitis then following features are observed.

1. Bleeding on probing
2. Increased probing depth [5-8mm]
3. Clinical attachment loss
4. Periodontal abscess.
5. Tooth may be vital or non-vital leading to periapical pathology.

**Etiopathogenesis**

Bacterial plaque is the primary etiological factor in the initiation and progression of periodontal disease. Proper tooth contours, contacts and surfaces are essential for the prevention of accumulation of plaque and maintaining the health of gingiva. Any factor which compromises patient’s effort in removing plaque is regarded as a predisposing factor for periodontal destruction. The pathological effects resulting from palatoradicular groove are mainly because of its plaque promoting factor. Plaque retained in the

palatoradicular groove provides shelter for the microorganism which further ingress resulting in connective tissue breakdown and periodontitis. It can also involve pulpal canal causing endodontic periodontal lesion. Palatoradicular groove acting as an initial predisposing factor tends to accelerate the progression of periodontal disease often in a localized area leading to a combined endodontic periodontal lesion.

### Clinical Significance

Primary clinical significance includes

- Accumulation of plaque, calculus, food debris
- Inaccessibility to routine oral hygiene procedures
- Proximity to the dead space of proximal area

It could manifest as

- Periodontal lesion
- True endodontic lesion
- Combined endodontic periodontal lesion.

### Treatment

Treatment is of two aspects:

- Treating the contributing factor (i.e.) the groove.
- Treating the resultant pathology (i.e.) associated periodontal defect.

### Management of the groove

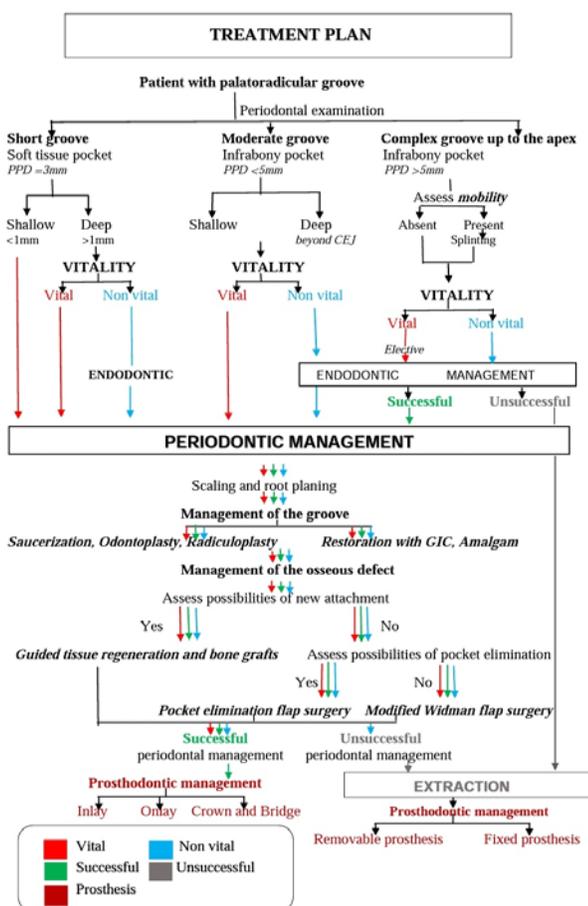
- Saucerization:** flatten the root defect by grinding with fine stones **Goldman, Cohen 1968** <sup>[14]</sup>.
- Restoration** of the groove with amalgam or with glass ionomer cement **Simon et al 1971** <sup>[12]</sup>.
- Odontoplasty, radiculoplasty** – Elimination of groove by means of a surgical length diamond periodontal bur on high speed under constant water spray. This bur is used in a mesio-distal direction with a very slight pressure on the root **Zuelene Alves et al 2000** <sup>[15]</sup>.

### Periodontal management of the defect

- Scaling and root planing:** Non-surgical periodontal therapy has been reported to be less successful <sup>[16]</sup>.
- Localized gingivectomy** to the base of the groove and subgingival curettage with or without a flap for treating any pocketing that may extend beyond the groove **Wickham 1965**.
- Flap surgery** with or without bone grafts.
- Guided tissue regeneration** <sup>[17]</sup>
- Enamel matrix derivative** <sup>[18]</sup>
- Combined approach** – conservative periodontal surgery and radiculoplasty <sup>[19]</sup>.
- Extraction** – The prognosis of severe destructive periodontal disease in the presence of a groove which extends to the apex is not favorable and extraction of the involved tooth may only be the option. **Everett and Kramer 1972** <sup>[9]</sup>.

If the tooth is non-vital, endodontic treatment should be combined with the periodontal management.

### Treatment of the palatoradicular groove with GTR-



**Charles and David 1993** <sup>[17]</sup>: Many of the procedures do not lead to periodontal regeneration. Cells of the periodontal ligament have the capacity to re-establish the connective tissue attachment once the contact between the gingiva and the root surface is prevented by the use of a barrier membrane. **Nyman et al 1982** <sup>[20]</sup>

### Procedure

Surgical procedure consists of a sulcular incision, elevation of full thickness flap and soft tissue debridement. The tooth including the groove was root planed to eliminate any deep fissures. Using a sling suture an expanded polytetrafluoroethylene membrane was positioned to completely cover the groove extending 3-4mm beyond the groove margins. The soft tissue flap was replaced to cover the membrane. Immediate post treatment care consists of periodontal dressing, mild analgesics and suture removal in one week. The membrane remained in place for 6 weeks and then it was removed. Studies suggest a six month follow up period revealed significant gain in clinical attachment level and reduction in probing depth. Resorbable collagen membrane can also be used to treat palatoradicular groove which has an added advantage of not requiring a second surgery for membrane removal.

### Management of groove with guided tissue regeneration using concentrated growth factor and osseograft <sup>[21]</sup>



### Conclusion

Palatoradicular groove is a mild developmental anomaly which occurs most commonly in the upper lateral and central incisors. When the palatoradicular groove extends into the root, it is associated with poor periodontal health. Treatment includes both i) the management of the groove

which paves way to periodontal infection and ii) management of the periodontal defect caused by palatogingival groove. Early detection of the groove and meticulous treatment during routine periodontal examination is the key to the prevention of periodontal disease associated with the groove.

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