

## **Integration of PRF and Biodentine in Palatogingival Groove case**

Mele Puthukkudy Liji <sup>1</sup>, Maroli Rameshkumar <sup>2</sup>

1. (Junior Resident, Department of Conservative Dentistry and Endodontics, Government Dental College Kozhikode, South India)

2. (Professor and Head of the Department, Department of Conservative Dentistry and Endodontics, Government Dental College Kozhikode, South India)

---

**Abstract:** Endo-perio combined treatment modality incorporating careful steps at both stages of treatment determines the ultimate prognosis and success in case of endo-perio lesions. This case report describes the successful collaborative management of a maxillary lateral incisor with a coronoradicular groove showing an advanced periodontal destruction with necrotic pulp using a combination of nonsurgical endodontic therapy, use of biodentine to seal the groove and Platelet Rich Fibrin (PRF) as a periodontal regenerative material. The rationale for this treatment modality is also discussed.

**Key-words:** Palatogingival Groove, platelet rich fibrin (PRF), Biodentine

---

### **I. Introduction**

A palatogingival groove is usually seen as a breach on the enamel surface traversing the cingulum extending on to the root surface in varying depth and extension. The groove itself may represent a channel of communication between pulp and periodontium other than neural, vasculolymphatic pathways, dentinal tubules, apical foramina and lateral canals [1]. This anomaly is mostly seen on the maxillary lateral incisor which is notorious with regard to a number of morphologic and anatomic abnormalities [2].

In an attempt to elucidate the morphology of root grooves by micro Computed tomography Yong chug u et al, classified them into three types on the basis of severity: type I, the groove is short (not beyond the coronal third of the root); type II, the groove is long (beyond the coronal third of the root) but shallow, corresponding to a normal or simple root canal; and type III, the groove is long (beyond the coronal third of the root) and deep, corresponding to a complex root canal system. These grooves can be mesial, distal or medial when present on the palatal side [3].

Nothing has clearly been able to formulate regarding the etiology of palatogingival groove. Some authors proposed that this defect is a variant form of dens invaginatus [4], whereas others believe that it is the incomplete attempt of a tooth to form another root [5]. The usage of this trait in anthropologic studies indicates its racial link [6]. The incidence of radicular groove is reported to be between 2.8% and 18% [7-10].

The location of the groove as well as its narrow 'v' shaped configuration (type II) makes it a favourable site of plaque accumulation even in presence of generally good oral hygiene [3]. In cases where the pulp has also become necrotic, the tooth requires endodontic treatment in addition to periodontal therapy. Bacterial colonization of the root canal further aggravates the periodontal destruction through the release of bacterial byproducts expressed via the dentinal tubules. Most often patient will be presenting with a complaint of dull intermittent toothache, mobility, sinus tract formation. In addition a pathologic labial inclination of the concerned tooth may be seen as presented in this case. Once the pulp is necrosed, endodontic treatment with thorough cleaning and shaping and tight sealing of the groove with a restorative material becomes mandatory. At the same time, it is equally important to adequately treat the periodontal defect that ultimately determines the prognosis of these teeth [11]. Suggested treatment modalities for radicular groove are curettage of the affected tissues [12], elimination of the groove by grinding (saucerization) [3] or by sealing with a variety of filling materials [13], surgical procedures including placement of bone graft in addition to the conventional endodontic treatment [14].

At present platelet rich fibrin (PRF) which is the second generation platelet concentrate is the promising material for regenerative therapy [15]. Yu Chavo et al reported successful result with use of PRF as sole grafting material in infra bony defects where it act both as graft and a scaffold for the graft [16]. A material which is chosen to close the groove should be bio compatible, with a hermetic sealing of the groove and it would be an added advantage if the same material enhances the hard tissue formation in the vicinity. Biodentine which is based on tricalcium silicate has been chosen to close the groove. The presence of tricalcium silicate core ensures biocompatibility and the release of alkaline phosphatase which promote bone deposition with favorable physical properties justifies its selection [17, 18].

This is a case of coronoradicular groove in a maxillary lateral incisor treated successfully with a combined endodontic, biodentine and Platelet rich fibrin (PRF) membrane therapy.

## **II. Case report**

A healthy 14 year old girl reported with a complaint of mild forward displacement of upper right lateral incisor with intermittent pain since six months. Patient was unaware of any history of trauma to the concerned tooth. Clinically maxillary right lateral incisor was proclined about 2 mm compared to other maxillary teeth which maintained proper alignment and contact relation. The tooth had a grade II mobility and tenderness on lateral percussion. On the palatal aspect of tooth a groove starting from lingual fossa crossing over the cingulum and extending to root surface was seen (Fig.A). On probing, 8mm deep periodontal pocket appreciated on palatal aspect mesiodistally (Fig.B). Despite these findings general oral hygiene status was apparently good. The tooth did not respond to vitality test using Endo frost refrigerant spray or Electric pulp tester while the adjacent teeth responded normally to pulp test. IOPA revealed periradicular radiolucency of size about 2 x1.5 cm and bone loss up to middle third of root (Fig.C).

Based on clinical tests and radiographic findings our diagnosis was severe localized periodontitis, suppurative periradicular periodontitis and necrotic pulp secondary to palatal groove on 12. Patient was informed that the tooth had a questionable long term prognosis. In the next appointment the tooth was accessed and root canal cleaned and shaped with stainless steel hand file using 5.25 % hypochlorite as irrigant. After thoroughly drying calcium hydroxide paste applied over the canal walls with the help of a paste carrier and access cavity sealed with zinc oxide eugenol restoration. Patient was kept on antibiotics (amoxicillin 500 mg plus metronidazole 400 mg) and advised to follow chlorhexidine mouth rinse two times daily. In the next visit canal re-entered, cleaning and shaping proceeded up to size 50 instrument, irrigated with 2% chlorhexidine, followed by 17% EDTA. After drying, the canal coated with calcium hydroxide and zinc oxide eugenol cement restoration given. Obturation completed 3 weeks after initial visit using lateral compaction technique with gutta-percha points and zinc oxide eugenol cement as sealer (Fig.D). Access cavity sealed with Intermediate Restorative Material (IRM) and patient was advised to continue the medication.

Surgery was planned three months after initial obturation. Periodontium became healthier by this time as evidenced by decrease in probing pocket depth. After giving nasopalatine nerve block, palatal flap raised from 14 to 24. The palatine groove was extending up to the middle third of the root, starting from lingual fossa crossing over the cingulum and extending more on mesio-palatine aspect of root surface (Fig.E). Odontoplasty was performed and biodentine used to close the defect (Fig.F). After centrifuging patient's blood, PRF collected and placed over the bone defect (Fig.G). Palatal flap approximated and sutures placed.

The patient was given post operative instructions and kept 1 week under antibiotics and chlorhexidine oral prophylaxis. At 3 months follow up visit that is 6 months after obturation IOPA showed excellent healing with partial filling of the osseous defect (Fig.H). At one year follow up IOPA radiograph showed the healing of almost the entire lesion (Fig.I).

## **III. Discussion**

Pulpo periodontal communications when they exist may serve as potential paths for inflammatory reciprocity. The nature and extend of periodontal destruction depend on several factors including virulence of microbiota, duration of disease and host defense mechanism and probably the depth and extend of groove on to the root surface [19].

The treatment of radicular groove whether it is simple or complex type deserve careful attention to the endodontic treatment because microbes once colonized in the root canal continue the already initiated periodontal destruction in an aggressive manner by the toxins released through the exposed dentinal tubules or lateral canals and this is quite different from a periradicular involvement of an ordinary tooth either due to caries or trauma where radiolucency mostly confined to apical region and bacterial communication mostly through apical foramen because of the intact cemental layer. In this sense palatogingival groove represents a 'double edged sword'. Hence, a multivisit endodontic treatment approach with special attention to the cleaning and shaping of the canal; waiting period of three months after obturation to assess the treatment outcome as reduction in pocket depth and if needed a surgical procedure accomplished to close any further doors of communication between root canal and periodontium. Sometimes the involvement of periodontium can be so severe that involved tooth may incline labially subsequent to trauma from occlusion as presented in our case and so augmentation of periodontal regeneration was achieved by placing a PRF (platelet rich fibrin) in the osseous defect.

Our treatment approach was based on, 1) complete eradication of microbials from root canal 2) permanent thorough sealing of root groove which will close any remaining doors of communication between root canal and periodontium 3) periodontal regeneration and regaining the complete health of the periodontium.

Biodentine is a new tricalcium silicate based dental cement with excellent biocompatibility physical properties and good handling characteristics. It was introduced as a permanent dentine substitute [20]. It consists of powder- tricalcium silicate (as primary core material), dicalcium silicate, calcium carbonate and oxide as filler, iron oxide as pigment and ZrO<sub>2</sub> as radioopacifier. The liquid consist of CaCl<sub>2</sub> accelerator and hydro

soluble polymer or super plasticizer as water reducing agent. Compared to other calcium silicate cements like MTA physical properties are much improved by the elimination of tricalcium aluminate and other impurities. Setting time is comparable to fuji IX Glass Ionomer. This is achieved by addition of CaCl<sub>2</sub> (as accelerator) as well as super plasticizer to the liquid. The formation of CSH (hydrated calcium silicate gel) reduces the porosity over time [21]. The deposition of apatite like structure occurs at the interphase of natural dentine and biodentine which might increase marginal sealing. At a molecular level the release of alkaline phosphatase is enhanced and there by bone deposition [22].

Highly biocompatible due to its tricalcium silicate core, Biodentine eliminates the risk of adverse tissue response. And has outstanding sealing properties to reduce the risk of clinical failures through bacterial percolation. Biodentine needs no surface conditioning or bonding and sets quickly, making it simple and easy to use. So this material was chosen to close the groove. Glass ionomer has certain disadvantages like it requires surface conditioning, moisture sensitivity and not amenable to polishing immediately.

PRF is a matrix of autologous fibrin, in which are embedded a large quantity of platelet and leukocyte cytokines. The intrinsic incorporation of cytokines within the fibrin mesh allows for their progressive release over time (7-10 days), as the network of fibrin disintegrates [23]. Stimulated secretion of osteoprotegerin and indirect inhibition of RANKL RANK system may be responsible for osteoblastogenesis [24]. There is a slow sustained release of growth factors over time [25]. The properties of this natural fibrin biomaterial thus ensure accelerated healing of osseous defects. It has been clearly demonstrated that fibrin matrix leads directly to angiogenesis [26] ; Fibrin constitutes a natural support to immunity and reduces inflammatory process [27]. The collection of PRF is technique sensitive as success of this method depends on speed of collection. Since no anticoagulant is added to the collected blood, tendency to coagulate upon touching the walls of test tube during centrifugation are high. PRF clot (approximately 40-60% of the product) forms in the middle of the test tube between the lighter clear platelet poor plasma and the packed red blood cells [23].

It may be inferred from the current case that a coronaradicular groove which is exposed to the oral environment( due to its coronal extention) has clinical presentation in very early age itself even in presence of an apparently good oral hygiene without visible plaque or calculus formation. On the other hand a groove which is purely radicular without any supragingival extention more often present clinically when general oral health is compromised with gingivitis or periodontitis. Here the clinical presentation may depend on patients general oral hygiene status also. Thus the role of coronal extention of the groove cannot be overemphasized along with depth and apical extention of the groove which are considered as prognostic indicators. For the same reason the prevalence of a radicular groove may be greater than what is reported. On six month follow up period, the surface of biodentine was very hard and rough with dark staining which might invite plaque retention.staining had occurred either due to intrinsic iron content, contact with blood during surgery or invited extrinsic stain due to rough surface. Hence we assume that even though biodentine is suitable for sealing palatal groove, a restorative material which can retain its polish for long time should come in direct contact with gingival tissue so as to prevent plaque retention. This material is more favourable as a core build up material because of the excellent hardness it offers.



**(A)**–pre operative view showing the palatogingival groove crossing the cingulum extending on to the root surface ,with a labial inclination of the tooth



**(B)**–periodontal probing depth of 8 – mm mesiopalatally in the first appointment



**(C)**–pre operative radiograph showing severe bone loss and peri radicular radiolucency



(D)-IOPA radiograph immediately after obturation of root canal



(E)-after flap reflection groove exposed showing the shallow groove extending half of the root surface starting from the cingulum



(F)-initial placement of biodentine onto the groove after odontoplasty



(G)-placement of platelet rich fibrin membrane (PRF) in the osseous defect



(H)- IOPA radiograph three months after surgery showing partial healing of osseous defect



(I) - IOPA radiograph one year after surgery showing complete healing of the defect.

#### IV. Conclusion

An interdisciplinary treatment approach extracting the contemporary possibilities of regenerative endodontics succeeded in saving a tooth marked by its poor prognosis. Success of this treatment modality was assessed by gain in attachment level, significant reduction in pocket length, a mild self correction of forward drift and radiologically by the healing of periapical lesion and bone formation around the tooth. On the other hand this is a single case report. Long term follow up studies are still required involving the restorative procedures using biodentine by evaluating its biologic and physical properties for a more conclusive evidence.

#### References:

- [1]. Kenneth MH, Stephen Cohen *Cohen's pathways of the pulp*. Mosby, St.Louis, Missouri.2011
- [2]. Lara VS, Consolaro A, Bruce RS. Macroscopic and microscopic analysis of the palato-gingival groove. *J Endod* 26, 2000, 345–50.
- [3]. Yong-chun Gu A Micro-Computed Tomographic Analysis of Maxillary Lateral Incisors with Radicular Groove *J Endod* 37,2011;789–792
- [4]. Lee KW, Lee EC, Poon KY. Palato-gingival grooves in maxillary incisors: a possible predisposing factor to localised periodontal disease. *Br Dent J*, 124, 1968, 14–8.
- [5]. Peikoff MD, Perry JB, Chapnick LA. Endodontic failure attributable to a complex radicular lingual groove. *J Endod*, 11, 1985, 573–7.
- [6]. Scott GR, Turner CG II. The anthropology of modern human teeth: dental morphology and its variation in recent human populations. Cambridge, NY: Cambridge University Press; 1997
- [7]. Hou GL, Tsai CC. Relationship between palato-radicular grooves and localized periodontitis. *J Clin Periodontol*, 20, 1993, 678–82.
- [8]. Kogon SL. The prevalence, location and conformation of palato-radicular grooves in maxillary incisors. *J Periodontol*, 57, 1986, 231–4.



- [9]. Everett FG, Kramer GM. The disto-lingual groove in the maxillary lateral incisor; a periodontal hazard. *J Periodontol*, 43, 1972, 352–61.
- [10]. Withers JA, Brunsvold MA, Killoy WJ, et al. The relationship of palato-gingival grooves to localized periodontal disease. *J Periodontol*, 52, 1981, 41–4.
- [11]. Scott A S, Michael A K, David E D, Charles A P. Combined Endodontic-Periodontic Treatment of a Palatal Groove: A Case Report. *J Endod*, 32, 2006, 573–578.
- [12]. Schafer E, Cankay R, Ott K. Malformations in maxillary incisors: case report of radicular palatal groove. *Endod Dent Traumatol*, 16, 2000, 132–7
- [13]. Zucchelli G, Mele M, Checchi L. The papilla amplification flap for the treatment of a localized periodontal defect associated with a palatal groove. *J Periodontol*, 77, 2006, 1788–96
- [14]. Kanika Attam, Raj Tiwary, Sangeeta Talwar, Arundeeep Kaur Lamba. Palatogingival Groove: Endodontic-Periodontal Management—Case Report. *J Endod*, 36, 2010:1717–1720
- [15]. David M D, Antoine D, Guillaume O, Pierre D, Marie-Pascale H, Jean-Baptiste C. In vitro effects of Choukroun’s PRF (platelet-rich fibrin) on human gingival fibroblasts, dermal prekeratinocytes, preadipocytes, and maxillofacial osteoblasts in primary cultures. *Oral Surg Oral Pathol Oral Radiol Endod* 108, 2009, 341-352.
- [16]. Yu-Chao C, Kuo-Chin W, Jiing-Huei Z. Clinical application of platelet-rich fibrin as the sole grafting material in periodontal intrabony defects. *Journal of Dental Sciences*, 6, 2011, 181e188
- [17]. Marjorie Z, Jean M S, Ariane B, Stéphane S. Biodentine Induces Immortalized Murine Pulp Cell Differentiation into Odontoblast-like Cells and Stimulates Biomineralization. *J Endod*, In Press, Corrected Proof, Available online 24 July 2012.
- [18]. Allen N S, Sergej Y N Alaina K P, Li-na N, Kelli A A, Robert J L, Roger N W, David H P, Franklin R T. Effects of Calcium Silicate-based Materials on the Flexural Properties of Dentin. *J Endod*, 38 (5), 2012, 680-683.
- [19]. Chen SY, Wang HL, Glickman GN. The influence of endodontic treatment upon periodontal wound healing. *J Clin Periodontol*, 24, 1997;:449.
- [20]. Biodentine: active biosilicate technology. [www.septodont.fr/openfile.php](http://www.septodont.fr/openfile.php)
- [21]. Patrick L, Jean C, Michel De M’eo, Jacques D’ejoua, Imad A. Induction of specific cell responses to a Ca<sub>3</sub>SiO<sub>5</sub>-based posterior restorative material. *Dental materials*, 24, 2008, 1486-1494.
- [22]. Weiwei P, Weining L, Long J, Lifen Li, Jiang C, Yqin Z. Effect of tricalcium silicate on proliferation and odontogenic differentiation of human dental pulp cells. *J Endod*, 37, 2011, 1240-1246.
- [23]. David MD, Joseph C, Antoine D, Steve LD, Anthony JJ, Jaafar M, Bruno G. Platelet Rich Fibrin (PRF): A second-generation platelet concentrate. Part I: Technological concepts and evolution. *Oral Surg Oral Med Oral Radiol Endo*, 101, 2006, E37-44.
- [24]. Huang FM, Yang SF, Zhao JH, Chang YC. Platelet-rich fibrin increases proliferation and differentiation of human dental pulp cells. *J Endod*, 36, 2010, e1628-32.
- [25]. Mazor Z, Horowitz RA, Del Corso M, Prasad HS, Rohrer MD, Dohan Ehrenfest DM. Sinus floor augmentation with simultaneous implant placement using Choukroun’s PRF (Platelet-Rich Fibrin) as a sole grafting material: a radiological and histological study at 6 months. *J Periodontol*, 80, 2009, e2056-64.
- [26]. Diss A, Dohan DM, Mouhayi J, Mahler P. Osteotome sinus floor elevation using Choukroun’s platelet-rich fibrin as grafting material; a 1-year prospective pilot study with microthreaded implants *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*, 105, 2008, e572-9.
- [27]. Dohan DM, Choukroun J, Diss A. Platelet-rich fibrin (PRF): a second-generation platelet concentrate. Part III-Leucocyte activation: a new feature for platelet concentrates. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*, 101, 2006, E45-50.