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Recession Coverage and Periodontal Regeneration for Combined Periodontal–Endodontic Lesion Caused by Palatogingival Groove: A Case Report

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Abstract

During tooth development, various morphological deformities may exist that predisposes the periodontium to disease. One such developmental anomaly is the Palatogingival groove (PGG) which can lead to localized destruction of periodontal tissue with endodontic complications. It is usually located on the palatal aspect of maxillary incisors and often associated with worsening of periodontal or endodontic-periodontal lesions. Recognition and management of the PGG is critical, especially because of its diagnostic complexity that may present a clinical challenge to the operator and hence, require an interdisciplinary strategy for combined periodontal-endodontic lesions. In this case report, the diagnosis and management of PGG-associated intrabony defect along with gingival recession were discussed which included an interdisciplinary approach involving endodontic therapy, odontoplasty and restoration of PGG with GIC, periodontal surgery for the regeneration of the attachment apparatus with DFDBA and PRF and periodontal plastic surgery for the buccal gingival recession with connective tissue graft (CTG). This treatment modality resulted in a gain in attachment, reduction in pocket depth, recession coverage, and deposition of bone in the osseous defect with complete healing clinically and radiographically.

Keywords

Combined periodontal-endodontic lesions, connective tissue graft, Demineralized freeze-dried bone allograft, gingival recession, interdisciplinary approach, intrabony defects, odontoplasty, palatogingival groove, platelet-rich fibrin

Introduction

Maxillary lateral incisors (MLI) often exhibit various morphologic and anatomic anomalies such as peg shape, Eagle's talon, dens invaginatus, globulomaxillary cyst, germination, fusion, and accessory root. It could be due to the embryological hazard of having its tooth germ locked between those of the central incisor and canine.[1,2] One such anomaly occurring in that area is a palatogingival

groove (PGG) which is defined as 'a developmental anomaly in a root that is usually found on the lingual surface of maxillary incisor teeth'. PGGs were first described by Lee and coworkers in 1968, who discussed its clinical characteristics and potential etiology.[3] Gu (2011)[4] classified PGGs into three types based on their 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. Many terms were used to describe this particular kind of deformity such as distolingual groove, corono-radicular groove, radicular lingual groove, vertical developmental radicular groove, interruption groove, palatoradicular groove, and radicular groove.[1,5]

Different studies have reported the prevalence rate of PGGs. Withers *et al.*[2] (1981) observed that PGGs were found on 2.3% of maxillary incisors (4.4% laterals and 0.28% centrals), whereas Everett and Kramer[6] (1972) found 2.8% of lateral incisors with PGGs. In 1986 Kogon[7] found PGGs on 4.6% of maxillary incisors (3.4% centrals and 5.6% laterals) of which 54% terminated on the root, with 43% extending less than 5mm and 47% extending 610mm. PGG usually originates from the cingulum of maxillary incisors proceeds apically toward and beyond cementoenamel junction (CEJ) and may terminate at various levels in the root.[8] Several etiologies have been proposed for its development which includes (i) infolding of the enamel organ or Hertwig epithelial root sheath during tooth development, especially in odontogenesis, (ii) variant of dens invaginatus (iii) additional hypogentic root formation (iv) altered genetic mechanism.[9-11]

This funnel-shaped defect can provide a milieu that enhances the accumulation of plaque and subsequent inflammation as patients cannot completely clean the groove by standard oral hygiene maneuvers, so periodontal breakdown is near-inevitable leading to the formation of deep and narrow intrabony pockets.[5,12] Moreover, lateral or accessory canals and exposed dentinal tubules along the grooves provide additional routes for bacterial invasion to the pulp which may predispose combined periodontal-endodontic lesions with associated deep periodontal pockets and alveolar bone loss.[11] The chances of communication between the pulp chamber and periodontium vary according to the depth of the groove. Deeper the groove more is the chances of endo-perio communication. Clinical diagnosis and management of PGG often leave the clinician into a quandary particularly when the extent of the lesion increases and becomes complex. Periodontal probing can help in clinically diagnosing its extent. Radiographically, they appear as a "teardrop" shaped radiolucent area or sometimes one or more dark lines can be observed parallel to or superimposed on the root canal which is termed as "parapulpal lines".[1]

In this case report, the diagnosis and management of PGG-associated intrabony defect along with buccal gingival recession on right maxillary lateral incisor were discussed which included an interdisciplinary approach involving non-surgical endodontic therapy, periodontal surgical management for the regeneration of the attachment apparatus employing demineralized freeze-dried bone allograft (DFDBA) and platelet-rich fibrin (PRF); and periodontal plastic surgery for recession coverage with connective tissue graft (CTG). This treatment modality resulted in complete periodontal healing with resolution of the periapical radiolucency and esthetic recession coverage.

Case Report

An apparently healthy 34-year-old male patient (ASA-1) reported to the Department of Periodontology and Implantology of Saraswati Dental College, Lucknow (UP), India, with a chief complaint of pain and pus discharge from the right maxillary lateral incisor (#12) for the past 4 months (Figure1). He also complained of sensitivity and exposure of root in that tooth. He had intermittent dull pain with recurrent episodes that subsided on medication. There was occasional bleeding from the affected tooth while brushing. He had no history of trauma, caries, or any discoloration in this tooth. On examination, there was a localized circumscribed swelling of the marginal gingiva on the palatal aspect. Miller Class II gingival recession of 6 mm in midbuccal region of the concerned tooth was seen (Figure2). His personal history revealed that he used horizontal scrub motion to brush teeth which could be a probable cause of the recession.

Figure 1: Pus discharge from the labial aspect of right maxillary lateral incisor (#12)

Figure 2: The midbuccal region of tooth #12 showing Miller Class II gingival recession of 6 mm

Periodontal examination using UNC-15 probe revealed a 12mm deep midpalatal periodontal pocket, which overlapped with the location of the PGG (Figure3). However, other sides revealed normal probing depths. Tooth showed mobility of grade I. The tooth did not react to an electric pulp test or cold test using ice-cold chilled water indicating the presence of a non-vital pulp. Radiographic examination revealed periapical radiolucency with a deep intrabony defect on tooth #12, widening of the apical periodontium, and a parapulpal radiolucent line superimposed over the canal space which was indicative of PGG (Figure4). The diagnosis was localized chronic periodontitis and pulp necrosis indicating a combined periodontal-endodontic lesion potentially caused by a PGG. Written informed consent was obtained from the patient and then a collaborative treatment was performed as follows: root canal treatment (RCT), open flap debridement (OFD), ododntoplasty, sealing of the groove with GIC, regeneration with DFDBA+PRF, recession coverage with connective tissue graft (CTG).

Figure 3: A palatogingival groove was located on the palatal aspect of tooth #12 with a 12-mm deep periodontal pocket

Figure 4: The periapical radiograph of tooth #12 showing a periapical lesion and a parapulpal radiolucent line superimposed over the canal space, indicative of PGG

After proper isolation, the local anesthesia was administered and an access cavity was prepared to establish a straight-line pathway to the canal. The root canal was prepared with the ProTaper (Dentsply Maillefer, Ballaigues, Switzerland) rotary instrumentation system to working length using a size F3 apical file, following the manufacturer's manual. Sodium hypochlorite was used as an irrigation solution between instrumentations. Calcium hydroxide was used as an intracanal medication for seven days and on a succeeding visit after 7 days, the patient was asymptomatic and pus discharge had ceased, the tooth was obturated with gutta-percha by single cone technique. A week later, mineral trioxide aggregate (MTA) (ProRoot MTA; Dentsply Tulsa Dental) was placed at the root canal orifice to prevent infections and blood flow to the main root canal during periodontal surgery and the tooth was restored with glass ionomer cement (Fuji II, GC Corporation, Japan).

Surgical Procedure

The patient was scheduled for periodontal flap surgery after one week. The surgical area was made aseptic and local anesthesia was administered (2% lignocaine HCl with 1/80000 epinephrine), a sulcular incision was given and a full-thickness mucoperiosteal flap was elevated from the palatal aspect (Figure5). Then, thorough debridement was performed using Gracey curettes (Hu-Friedy, USA), after which the most apical extent of the PGG was evident. Also, a small circumferential periodontal defect related to the groove was detected below the apical region of #12 (Figure6). Following root planing and root conditioning with EDTA, odontoplasty of the PGG defect was performed using a round diamond bur under continuous air-water spray and then the restoration of the groove with glass-ionomer cement (GIC) was done. PRF was prepared following the protocol developed by Choukroun et al. (Figure7). Then, the mixture of DFDBA+PRF was placed in the intrabony defect, and flaps were approximated and sutured applying simple interrupted sutures with a 4-0 silk suture (Figure8). The patient was instructed on post-surgical precautions and medications were prescribed.

Figure 5: A sulcular incision was given and a full-thickness mucoperiosteal flap was elevated from the palatal aspect

Figure 6: The reflection of the flap allowed a direct visualization of the intrabony defect and the PGG

Figure 7: Mixture of DFDBA and PRF

Figure 8: The DFDBA+PRF mixture was placed in the osseous defect and the flap is sutured with 4-0 silk suture

Periodontal plastic surgery for Recession coverage

After 4 months of periodontal flap surgical procedure, the compliant patient with satisfactory oral hygiene maintenance was appointed for recession coverage procedure on the labial surface of the affected tooth #12 (Figure9). The operative site was anesthetized with lignocaine HCl with adrenaline (1:80,000). The recipient site was prepared by giving a sulcular incision through the recession area using #15C blade, and the tissues were gently undermined to create a deep pouch beyond the mucogingival junction to relax the flap sufficiently to allow placement of the CTG while keeping the tip of the interproximal papillae attached to the teeth. Following root planing, root conditioning was done with EDTA. Then, the donor site was selected for graft harvesting. Graft was removed from the left palatal vault, 2–3 mm away from the gingival margin in the region between canine and first molar. (Figure10). Using a Class II type A incision design as described by Liu & Weisgold (2002)[13] approach, connective tissue graft (CTG) was harvested from the palate and kept in saline. The graft was placed within the prepared pouch, stretched, and stabilized with the help of sutures and composite buttons (Figure11&12).

The light-cured periodontal dressing (Barricaid, Dentsply) was placed on the recipient site (Figure13). Then, the donor site was also sutured and covered with the periodontal dressing (Figure14). Post-operative instructions were given to the patient and medications were prescribed.

Figure 9: After 4 months of periodontal flap surgery, recession coverage procedure on the labial surface of tooth #12 was performed

Figure 10: CTG was harvested from the left palatal vault using Class II type A incision

Figure 11: CTG placed and stabilized on the recipient site

Figure 12: CTG placed within the pouch and stabilized with the help of composite buttons

Figure 13: Light-cured periodontal dressing (Barricaid, Dentsply, USA) was applied on the recipient site

Figure 14: Donor site was sutured

Postoperative instructions after surgical procedures

The patient was prescribed systemic antibiotics including Amoxicillin 500mg thrice daily for 7 days and Ketorol DT twice daily for 3 days to alleviate postoperative pain and edema. The patient was advised not to brush at the surgical site for at least two weeks to avoid any trauma or traction and not to consume hard food during the first 5 days. Local plaque control was maintained by 0.2% chlorhexidine rinse thrice daily. Optimal oral hygiene and patient compliance are critical factors that affect the outcome of the regenerative surgeries. So these were reinforced to the patient at every visit.

Results

Sutures and periodontal dressings were removed at the 10-day postoperative visit. Postoperative healing of all the surgeries was uneventful with no signs of infection or allergic reactions. The patient was followed regularly at 1, 2, 4 weeks, and then every 3 months for clinical and radiographic evaluation (Figure15). Clinical probing was avoided during the first 3 months. Clinical examination revealed no tooth mobility, gain in attachment, and PPD recovered to 3 mm after 3 months. Radiographic examination 12 months after surgical intervention showed complete disappearance of the radiolucency around the lateral incisor, suggesting bone regeneration in the site of the defect (Figure16).

Follow up on the tenth day of periodontal plastic surgery revealed signs of graft acceptance. After 1 month, local examination showed that the graft was completely accepted and the recession was markedly covered with the graft tissue (Figure17). The donor site was completely healed (Figure18). After 6 months of follow up, further coverage of recession was noted with increased width of attached gingiva by the probable process of creeping attachment (Figure19). The patient reported satisfactory aesthetic results and loss of hypersensitivity.

Figure 15: 6 months post-operative radiograph showing healing of the periapical lesion

Figure 16: 12 months post-operative radiograph showing complete disappearance of the radiolucency around tooth #12

Figure 17: 1 month follow up after periodontal plastic surgery showing complete acceptance of the graft and recession coverage with the graft tissue

Figure 18: 3 months post-operative view of the well healed palatal donor site and healthy palatal aspect of tooth #12 with reduced PPD

Figure 19: 6 months follow up after periodontal plastic surgery showing further recession coverage with increased width of attached gingiva

Discussion

Anatomic aberrations like PGG create an accessibility problem in the MLI region and act as a "plaque trap" which facilitates bacterial colonization and gingival irritation that can breach the epithelial attachment and predisposes the tooth to severe periodontal disease that may spread to the pulp via accessory canals.[14,15] Atkinson et al. (1943) reported that the predominance of PGG in MLI could be due to the undesirable position of LI during the period of maxillary growth.[16] PGG could manifest either as true endodontic lesion, periodontal lesion, or may appear as a combined periodontal-endodontic lesions. These combined lesions are real clinical dilemmas in making a differential diagnosis and deciding a prognosis. Missed diagnosis might worsen the condition and result in tooth extraction. Thus, thorough clinical and radiographic examinations are needed for correct diagnosis and treatment planning in such cases. Although the detection of a notch in the crown is a good indicator, it is not always easy to find because it could be covered with the gingival margin or by plaque deposition. Also, a localized deep periodontal pocket could be a strong PGG predictor. Radiographically, a radiolucent parapulpal line is helpful to diagnose the palatal groove.[6,11] Location, depth, the extension of the groove, and the extent of periodontal destruction are the factors that determine the prognosis of teeth affected by this anomaly. Type I grooves located entirely on the crown might be corrected by odontoplasty and granulation tissue curettage. However, for a Type III advanced groove with associated extensive periodontal destruction, a complex treatment plan is required.[16,17]

In our case, PGG existing on the lateral incisor was classed as Type III since it was extended to more than two-thirds the length of the root. This was apparent on

radiographic examination, during clinical probing and confirmed later, on reflection of the flap. We have also observed a 12mm deep midpalatal periodontal pocket, an intrabony defect related to PGG on #12 along with non-vital pulp and esthetic deficiency of the gingival marginal contour on the labial side. Thus, we decided to treat the patient using an interdisciplinary approach. The rationale behind the selected treatment plan was the following: 1. Removal of granulation tissue followed by odontoplasty and sealing of the groove to eliminate bacterial colonization; 2. Reduction of periapical radiolucency and pocket depth by regeneration of periodontal attachment; 3. Correction of the esthetic deformity on the labial aspect of the tooth.

Various therapeutic options have been proposed for the treatment of PGG related defects, ranging from non-surgical to surgical procedures such as the granulation tissue curettage, restoration of the PGG at the coronal aspect, endodontic treatment as a primary or secondary lesion, additional root resection, odontoplasty, saucerization, intentional reimplantation, GTR, and bone grafting.[11,17] Materials such as composite, amalgam, GIC, biodentine, and MTA have been advocated for groove restoration.[16,18] We choose GIC for PGG restoration because it possesses good sealing ability, antibacterial effect, better chemical adhesion to the dentin, and it also enhances epithelial and connective tissue attachment. Moreover, it does not have the limitation of getting washed off from the transgingival defect like MTA.[16,19] Ercan et al.,[12] Forero- López et al.,[20] and Sultana and Alam[21] also used GIC for the restoration of the PGG and concluded that periodontal health was maintained when GIC was used for subgingival restorations and it has more positive effects on biofilm. Sharma et al.[22] and Naik et al.[23] used biodentine to seal PGG and were successful in preventing apical ingress of microorganisms and in promoting excellent healing.

Bone fill is a desired result of periodontal regeneration procedures. Different regenerative materials used by various authors include emdogain by Corbella et al.[5] and Al-Hezaimi et al.[24] and hydroxyapatite crystals by Bains et al.[25] which promotes periodontal regeneration by osteoconduction showed successful results. Liji and Rameshkumar[26] reported the use of GIC to seal PGG and PRF as a regenerative material. Johns et al.[27] used freeze-dried bone allograft (FDBA) and PRF membrane to fill the osseous defect and obtained gain in attachment, reduction in PPD, and deposition of bone in the osseous defect.

In the present case, periodontal regeneration was performed with DFDBA and PRF. The rationale behind the PRF adjunctively used with DFDBA, in this case, is that that there could be a synergistic interaction between them when used in the treatment of periodontal intrabony defects. DFDBA is an allograft that contains bone morphogenetic proteins (BMPs-2,4,7) to facilitate mesenchymal cell migration, attachment, and osteogenesis; have both osteoinductive as well as osteoconductive activity and the ability to create and maintain the space to enhance periodontal regeneration and/or bone fill.[28,29] PRF is a second-generation blood autologous preparation that was originally described by Choukroun et al.[30] Studies reported that PRF alone or in combination with bone graft materials enhances proliferation and differentiation of osteoblasts and periodontal ligament cells, both of which are significant for periodontal regeneration.[31,32] PRF organized as a dense fibrin scaffold, with a high number of leukocytes and specific slow release of growth factors (GFs) (such as TGF-β1, PDGF-AB, VEGF) and glycoproteins (such as thrombospondin-1) for at least 7 days, that aid in matrix

remodeling during healing and thereby stimulating new bone formation.[33] The use of PRF is a simple method that requires minimal cost and as it is an autologous product, the risk of disease transmission and graft rejection is negated. Rajendran et al.[34] also reported that in the treatment of PGG, PRF application along with bone graft on the bony defect area resulted in crestal bone formation after a 9-month follow-up. Similarly, Meharwade et al.[35] described the successful management of apicomarginal defect with the use of DFDBA and PRF. Studies conducted by Johns et al.,[36] Karunakaran et al.[37] and Shah et al.[38] showed successful use of PRF membranes in the management of PGG associated intrabony defects and found that the periodontal condition was stable and bone regeneration was evident at grafted site.

Reconstruction of gingiva is an essential part of periodontal plastic surgery. Gingival recession is the term used to characterize the apical shift of the marginal gingiva from its normal position on the crown of the tooth to the levels on the root surface beyond the CEJ.[39] The buccal gingival recession in the anterior region represents one of the most important functional and aesthetic challenges for periodontal patients. Different etiological factors may be responsible for contributing to the condition such as tooth brushing, thin gingival tissue pre-eminence of the buccal root, tooth malposition, bone dehiscence or fenestration, and frenum pull near the gingival margin. Gingival recession can be either localized or generalized, resulting in attachment loss and root exposure, which can lead to clinical problems such as root surface hypersensitivity, root caries, cervical root abrasions, difficult plaque control, and diminished cosmetic appeal and aesthetic concern.

Several periodontal plastic surgical techniques aiming at successful root coverage have been published such as free gingival grafts, pedicle flaps, (laterally or coronally displaced), and connective tissue grafts (CTG). Langer & Langer (1985)[40] introduced the CTG to improve the predictability of root coverage for teeth with gingival recession and it is now considered as the gold standard for localized recession defects and for increasing the width of keratinized gingiva. It has a dual blood supply from the overlying pedicle flap and the underlying periosteum. Zucchelli et al.,[41] Jepsen et al.[42] and Paolantonio et al.[43] achieved successful RC when CTG was used to cover buccal gingival recessions at their 1-year evaluation. The results of the present study are in agreement with these studies, in which complete recession coverage of Miller class II gingival recession along with increased width of keratinized gingiva was achieved at the 6-month follow up with the CTG procedure.

To the best of our knowledge, this report is the first to employ periodontal plastic surgery with CTG for esthetic gingival recession coverage along with the interdisciplinary approach involving endodontic therapy and periodontal regeneration surgery with DFDBA + PRF for the management of PGG associated combined periodontal–endodontic lesions on the maxillary right lateral incisor.

Limitation of the study

Well-designed, long-term randomized controlled clinical trials with an adequate sample size will be required to quantify these effects over other treatment modalities. Also, a timely and early diagnosis of PGG-related defect with additional investigations including pulp sensibility tests and better standardized radiographic techniques like a cone-beam computed tomography and digital subtraction radiography may further help establish an accurate assessment of the pulpal condition and bone destruction pattern that can modify the prognosis of the affected teeth and to evaluate the bone fill.

Conclusion

Palatogingival groove is a morphologic aberration on maxillary anterior teeth that can pose the most perplexing conundrum in diagnosis and treatment planning, especially when the condition is complicated by pulpal involvement. It can result in combined periodontal-endodontic lesions with extensive periodontal destruction which may be associated with poor prognosis of the affected tooth. Thus, we can speculate that the early detection of clinical signs and appropriate diagnostic tests are of vital importance to achieve long term success without complications. In the present case, an interdisciplinary approach involving a series of procedures including endodontic therapy with MTA, PGG restoration with GIC, periodontal regeneration with DFDBA+PRF, and esthetic gingival recession coverage with CTG was chosen to treat the right maxillary lateral incisor that resulted in complete clinical and radiographic resolution of the lesion.

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