CASE REPORT

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Root Amputation and Autologous Platelet Concentrate Application in Treating Endo-Periodontal Lesion Caused by Root Groove Malformation: A Case Report

Nur Zety Mohd Noh[a*], Sobrina Mohamed Khazin[b]

[a]*Department of Restorative Dentistry (Periodontics Unit), Kulliyyah of Dentistry, International Islamic University Malaysia, 25200 Kuantan, Pahang Darul Makmur, Malaysia*

[b]*Department of Restorative Dentistry (Endodontics Unit), Kulliyyah of Dentistry, International Islamic University Malaysia, 25200 Kuantan, Pahang Darul Makmur, Malaysia*

[*]Corresponding author: zety_noh@iium.edu.my

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ABSTRACT

Root groove malformation can pose significant challenges in dental treatment, including endo-periodontal lesions (EPLs). This case report presents the management of such a lesion via root amputation and the application of autologous platelet concentrate. The patient is a 63-year-old female with a persistent deep pocket in the maxillary first molar due to a developmental root groove. Based on clinical examination, a localised deep periodontal pocket depth was identified on the mesio-buccal site of the tooth, with radiographic evidence of bone loss. Root amputation was performed on the affected root post-endodontic therapy. To enhance healing and tissue regeneration, an autologous platelet concentrate was prepared and applied to the surgical site. Complete resolution of the lesion was demonstrated through post-operative evaluations over a 12-month period, with significant periodontal healing. The patient remained asymptomatic and was satisfied with the current clinical outcome. Overall, combining root amputation with autologous platelet concentrate is instrumental in treating EPL caused by root groove malformations.

Keywords: *Developmental root anomaly; Endo-periodontal lesion; Platelet rich fibrin; Root amputation; Root groove malformation*

INTRODUCTION

Periodontal disease, which encompasses gingivitis, periodontitis, and peri-implant diseases, is a prevalent chronic inflammatory condition that affects the periodontium. Approximately 11.2% of the global population (743 million people) are afflicted by severe periodontitis, which adversely impacts their oral health quality (Wong *et al.*, 2021; Yilmaz *et al.*, 2022; Agnese *et al.*, 2024). Unsurprisingly, global healthcare systems are increasingly burdened by the prevalence of periodontal diseases (Mohd Dom *et al.*, 2016; Tonetti *et al.*, 2017; Nascimento *et al.*, 2024). Local factors

also contribute to the risk of periodontal tissue deterioration alongside systemic, genetic, and environmental ones (Nunn, 2003; Mihaela *et al.*, 2019; Inna *et al.*, 2024).

Developmental root grooves are recognised local tooth-related factors contributing to periodontal breakdown by promoting plaque retention and hindering effective oral hygiene (Nunn, 2003; Evans, 2023). These grooves are most commonly located on the palatal surface of maxillary lateral incisors and the lingual surface of mandibular second molars, where they are frequently associated with localised deep periodontal pockets (Bhusari & Chopra, 2011; Yanik & Nalbantoğlu, 2022; Gaudex *et al.*, 2024). Beyond their role in periodontal disease, developmental root groove malformations may also serve as communication pathways between the dental pulp and periodontal tissues, alongside the apical foramen, lateral and accessory canals, and dentinal tubules (Rotstein, 2017; Evans, 2023; Chen *et al.*, 2024). Consequently, the presence of a developmental root groove increases the risk of endo-periodontal lesions (EPL) and may adversely affect the prognosis of the affected tooth (Herrera *et al.*, 2018).

The EPL is a condition characterised by deep periodontal pockets extending or with proximity to the apex, alongside a negative or altered response to pulp vitality tests (Herrera *et al.*, 2018; Chen *et al.*, 2024). Based on long-term clinical studies, periodontal disease alone rarely necessitates endodontic treatment when the cementum remains intact, and the pulp remains vital (Ross & Thompson, 1978; Jaoui *et al.*, 1995). The pulp's defences are compromised when the periodontal pocket deepens and extends towards the apical foramen, leading to infection and necrosis (Evans, 2023; Gaudex *et al.*, 2024). As cementum may be thin or absent at the apical groove, reduced dentin thickness can allow direct communication between the pulp and the bacterial biofilm (Yanik & Nalbantoğlu, 2022; Evans, 2023).

Despite reports on several root amputation cases, the majority were associated with furcation involvement (Garg *et al.*, 2022; Ajlan, 2024), endodontic complications (Alkahtany *et al.*, 2022; Garg *et al.*, 2022; Nasim *et al.*, 2022), vertical root fracture (Asgary, 2024), and EPL (Singh *et al.*, 2020; Isa *et al.*, 2024). However, there is limited documentation of root amputation for EPL caused by an unintentionally discovered apical root groove, particularly when biologically assisted using platelet-rich fibrin (PRF). Addressing this gap, the present case report describes the management of an upper-right first molar using root amputation combined with PRF application to enhance periodontal healing and treatment outcomes.

CASE REPORT

A 63-year-old non-smoking woman was referred from a private dental clinic to the Periodontics Specialist Clinic for evaluation and management of the recurrent gingival swelling associated with a persistent deep periodontal pocket at the upper-right first molar. Her medical history includes well-controlled asthma and gastritis. The patient is otherwise fit and healthy, with no current medications and no history of dental trauma or previous endodontic treatment of tooth 16.

An intact small occlusal amalgam restoration with cervical abrasion cavity on the buccal surface was identified through the clinical examination of tooth 16. The localised deep periodontal pocket measured 12 mm on the mesio-buccal (MB) aspect, with purulent discharge (Fig. 1). The tooth exhibited grade I mobility. Both the buccal and palatal surfaces, ranging from 1 mm to 4 mm, were affected by generalised gingival recession. A triple syringe was used to check for sensitivity to air stimulation. The tooth was tender to percussion, with pulp sensibility testing yielding a delayed response. The

patient's full-mouth plaque score (FMPS) and full-mouth bleeding score (FMBS) were 37.9% and 13.8%, respectively.

The intraoral periapical radiograph (IOPA) exhibited a shallow restoration, with radiopacity confined to the outer third of dentine, and no evidence of endodontic intervention, root perforation, or external root resorption. Crestal bone levels were normal, with the presence of an apical radiolucency (Fig. 2). To rule out cracked tooth as a potential factor contributing to the condition, the patient was referred to an endodontist.

An electric pulp test (Digitest™, Parkell Inc., New York, USA) and a cold test (Endo Frost, Coltene Whaledent Roeko, Germany) were conducted to check for pulp sensibility. Both tests revealed positive but delayed responses compared to the contralateral control tooth. A bite test using Tooth Sleuth revealed a positive response when the patient bit on the MB and mesio-palatal cusps. While the transillumination test revealed the presence of a craze line, no definitive crack line was initially observed.

The existing amalgam restoration on the occlusal surface was removed. Subsequently, methylene blue dye was applied within the cavity and around the tooth. A crack line was identified on the cavity's distal and buccal walls when observed using a dental operating microscope (DOM). Nevertheless, the crack was confined to the coronal tooth structure. No correlation was identified with the location of deep periodontal pockets and gingival swelling.

Fig. 1 Initial deep probing pocket depth of 12 mm on tooth 16 (MB).

Fig. 2 Tooth 16 shows a normal crestal bone level.

Cone-beam computed tomography (CBCT) was taken prior to the further treatment plan. While possible pathology, such as external root resorption and furcation involvement, was ruled out, buccal bone loss was extended to the apex of the MB root (Fig. 3).

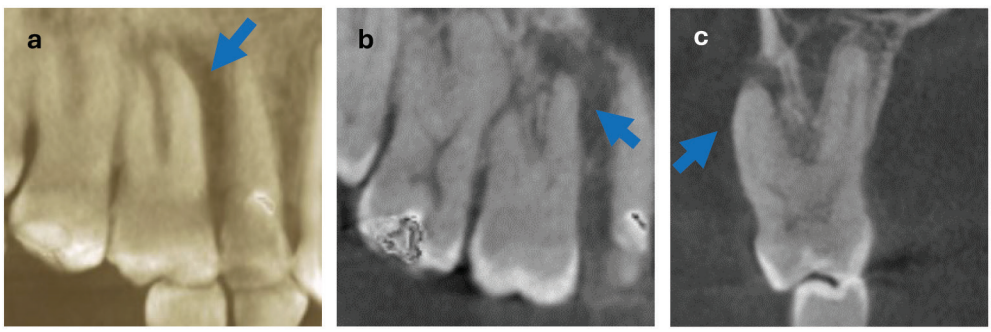

Fig. 3 CBCT images showing vertical buccal bone loss extending to the apical region along the MB root (arrow) of tooth 16: 3-dimensional reconstruction views from (a) buccal; (b) sagittal; and (c) coronal.

Tooth 16 was provisionally diagnosed with asymptomatic irreversible pulpitis with symptomatic apical periodontitis (Sigurdsson, 2019) linked to EPL without root damage in a non-periodontitis patient, grade 2 (Herrera *et al.*, 2018). The MB root amputation was planned. Furthermore, endodontic treatment was initiated alongside initial periodontal therapy involving professional mechanical plaque removal and root surface debridement.

Vital pulp was evident in the pulp chamber and palatal canal during endodontic treatment. On another note, the MB and distobuccal canals showed necrotic and sclerotic radicular pulp, respectively. The pulpal diagnosis was revised to pulp necrosis (Sigurdsson, 2019). Hence, the palatal pulp was extirpated and the distobuccal canal negotiated. The canals were obturated using a hydraulic technique after routine cleaning and shaping (iRoot® SP, IBC, Canada). Subsequently, the composite was used as a definitive restoration. While the MB canal remained unobturated, a composite dowel core was placed up to 4 mm in preparation for root amputation.

Six months following the completion of endodontic treatment, the periodontal pocket on the MB aspect of tooth 16 had reduced from 12 mm to 8 mm but remained deep. Access flap surgery was then performed as planned to amputate the MB root 16. An adjunct platelet-rich fibrin (PRF) was performed with informed consent. Notably, 12 mL of blood was drawn from the patient's right arm into two glass tubes before the periodontal surgery and immediately centrifuged at 2,700 rpm for 20 min to prepare and compress PRF into membranes using a PRF box® (Fig. 4). A full-thickness flap and chronic inflammatory tissue were elevated and debrided, respectively, following the administration of local anaesthesia. A deep vertical groove was incidentally observed on the MB root during the procedure, extending from the apical to the middle third. This may have contributed to tooth 16's EPL (Fig. 5). Observably, buccal bone loss extended to the root apex.

Fig. 4 PRF membrane prepared following centrifugation of autologous blood.

Fig. 5 Incidental finding of vertical groove (arrow) on the MB root of tooth 16.

The MB root was amputated at the furcation entrance level using a fissure bur and removed with a Coupland elevator after the localised scaling of tooth 16 (Fig. 6a). Characterised by buccal bone dehiscence involving two-thirds of the bone height, the socket was classified as an ST3C defect post-extraction (Steigmann *et al.*, 2022). Irregular bone margins were smoothed using a bone file and a round bur. To ensure the removal of all chronic inflammatory tissue, the socket was thoroughly irrigated with normal saline and debrided. A bone graft composed of xenograft material (Colocast®, Cologenesis Healthcare Pvt. Ltd., Salem, India) mixed with PRF fluid to form "sticky bone" was packed into the socket and surrounding bony defect (Fig. 6b). Subsequently, PRF membrane was placed over the graft pre-flap approximation (Fig. 6c). The surgical site was secured with a 4-0 black silk sling suture (Figs. 6d, 6e).

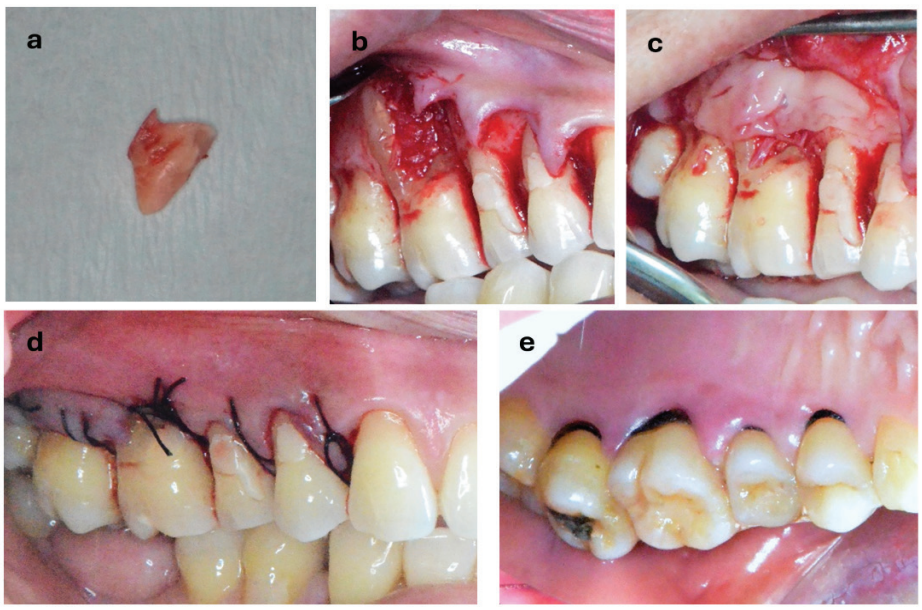

Fig. 6 (a) Amputated MB root of tooth 16; (b) Placement of xenograft material into the socket; (c) Placement of PRF membrane over the grafted site; Flap approximation of (d) buccal view; and (e) palatal view.

The patient was advised to maintain a soft diet, avoid brushing the surgical site, and rinse with 0.12% chlorhexidine mouthwash (Oradex™, Malaysia) twice daily for one week after surgery. For post-operative pain management, mefenamic acid 500 mg was prescribed thrice daily for three days. The patient was reviewed at one and two weeks, at one month, and on a monthly basis for up to 12 months (Figs. 7a, 7b). Professional prophylaxis was performed as required during follow-up visits. The patient reported no recurrence of pain, gingival swelling, or purulent discharge associated with tooth 16 during her most recent periodontal review. She expressed satisfaction with the current condition of the tooth. No signs of apical radiolucency were revealed through the IOPA (Fig. 7c). Furthermore, no tooth mobility and deep periodontal pocket were linked to tooth 16. As her FMBS is 12.6%, the patient is currently diagnosed with localised plaque-induced gingivitis (Trombelli *et al.*, 2018). Her oral hygiene is considered good (FMPS of 36.2%). The patient will be recalled for regular supportive periodontal care.

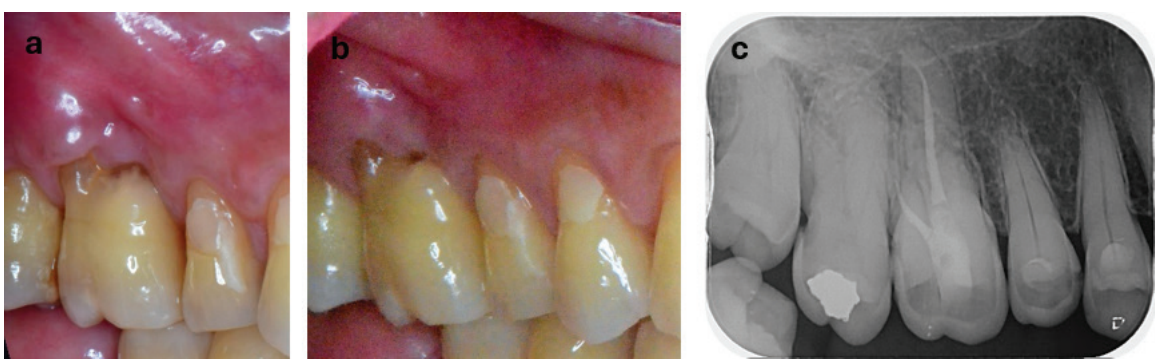

Fig. 7 Postoperative healing observation during (a) one-month review; and (b) 12-month review; with (c) IOPA showing no apical radiolucency with intact obturation on tooth 16.

DISCUSSION

Radicular grooves predispose teeth to localised periodontal destruction by promoting plaque retention and hindering oral hygiene (Bhusari & Chopra, 2011; Evans, 2023). These developmental anomalies are most commonly reported in maxillary lateral incisors but may also occur in molars, as in this case. They are associated with deep periodontal pockets, bleeding on probing, and attachment loss, which can progress apically to form self-sustaining infrabony defects (Rotstein, 2017; Tan *et al.*, 2022). Beyond periodontal effects, developmental root grooves may serve as communication pathways between the pulp and periodontium, increasing the risk of EPL (Rotstein, 2017; Chen *et al.*, 2024).

Accurate EPL diagnosis requires careful clinical and radiographic evaluation to differentiate endodontic involvement, localised periodontal defects, and root-related anatomical factors. The presence of an isolated deep pocket in a patient without generalised periodontitis may indicate EPL of endodontic origin or due to root damage. In this case, the latter was excluded using the methylene blue dye under a DOM (Al-Sibassi *et al.*, 2025).

In multi-rooted teeth, pulp sensibility testing may yield variable responses due to partial necrosis, sclerosis, or calcifications, as seen in the sclerotic distobuccal canal of tooth 16, which may represent a pulpal protective mechanism (Fouad & Levin, 2020; Ricucci *et al.*, 2021). Endodontic treatment is typically initiated first, followed by monitoring to evaluate the periodontal component and guide further therapy (Rotstein, 2017; Evans, 2023). Non-surgical periodontal therapy is recommended concurrently to reduce inflammation and infection, though persistent deep pockets may indicate anatomical factors such as radicular grooves, as confirmed in the present case.

Root amputation is indicated when one root of a multi-rooted tooth exhibits advanced periodontal destruction, vertical bone loss, furcation involvement, or structural compromise due to endodontic or restorative factors (Lee *et al.*, 2012; Isa *et al.*, 2024). Tooth 16's MB root demonstrated localised vertical bone loss, buccal dehiscence, a developmental groove extending to the apical third, and grade I mobility, justifying root amputation following established periodontal indications. Survival rates for root amputation are generally favourable, ranging from 38% to 94%, with failures primarily attributed to periodontal disease, root fracture, or caries (Setzer *et al.*, 2019; Dommisch *et al.*, 2020).

Adjunctive regenerative strategies, including autologous PRF, support periodontal healing by providing a stable fibrin matrix that releases growth factors over time, facilitating cellular migration and tissue regeneration (Marcazzan *et al.*, 2018; Guida *et al.*, 2020; Mohd Noh *et al.*, 2022). In this case, PRF membranes were applied during MB root amputation to enhance healing of the residual deep pocket, extensive root exposure with buccal bone dehiscence, and groove defect. This approach effectively resolved the persistent periodontal defect while tailoring treatment to the anatomical complexity and biological potential of the tooth.

CONCLUSION

Identifying the aetiology is crucial for managing the case. In this case report, the groove extending from the middle to the apical part of the root poses a challenge for disease management. Root amputation is key to maintaining the function and longevity of compromised teeth, with adjunctive PRF promoting faster periodontal healing. This case emphasises the importance of individualised, anatomy-driven treatment strategies to optimise long-term outcomes in complex EPL cases.

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