Case Report

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The Management of Gingival/Mucosal Fenestration Defect Using Nanocrystalline Hydroxyapatite Bone Substitute with L-PRF : A Case Report

Abstract:

Clinically, mucosal fenestrations are uncommon and often challenging to treat. Most of the time, there are aesthetic considerations. The case report of a 24-year-old female patient with a history of childhood trauma is highlighted in this article. She presented with aesthetic concern regarding gingival/mucosal fenestration in her right lower central incisor. In this instance, a conservative endodontic and regenerative therapy approach using synthetic nanocrystaline hydroxyapatite bone substitute with leukocyte and platelet-rich fibrin was used to treat mucosal fenestration. A complete mucosal fenestration coverage with satisfactory aesthetic result was achieved.

Key-word: Mucosal fenestration, endodontic treatment, leukocyte and platelet-rich fibrin, Bone graft, Connective tissue graft.

Introduction :

Fenestration and dehiscence are two most commonly encountered alveolar defects. Without compromising the marginal bone, fenestration manifests as a limited breach in the cortical plate whereas, dehiscence is the defect that results when the breach extends through the marginal bone. Menendez' in 1967 described for the first time an oral alteration which he called “bone fenestration by roots of deciduous teeth”.[1] Serrano, in 1971 termed it as "gingivo-osseous pathologic fenestration".[2]

The root apex may become exposed to the oral environment due to mucosal fenestration, wherein a comparable defect of the overlying mucosa coexists with apical fenestration. The etiological factors responsible could be either physiological or pathogenic. Physiological factors which can induce mucosal fenestration are tooth malposition, conspicuous root apex morphology, weak or lacking alveolar bone, and pathogenic factors could be accidental trauma, traumatic occlusion, orthodontic treatment & severe chronic periapical inflammation resulting in bone deterioration.

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The most common site presenting for mucosal fenestration, is the anterior teeth region especially on the labial aspect of tooth angulation where the root apices are placed in a labial direction, observed in previously reported cases.[3]

The management of these lesions requires a deep understanding of the etiological factors. The main goal for treatment of endodontic infection should be to restore a more favourable relationship between the root apex and the alveolar bone that covers it. To manage mucosal fenestration defects, combined endodontic treatment and periodontal surgeries are used in order to attain consistent treatment results. Some of the reported treatment procedures for closure

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of mucosal defect are regenerative osseous surgery [4,5], pedicle flap surgery [6], autologous soft tissue graft or substitute, endodontic therapy with root-end resection [6,7], and root surface debridement with chlorhexidine mouth wash.

Autologous platelet concentrates, like platelet rich fibrin (PRF), have also been used alone for bone regeneration in recent years.[8].

The current case report presents mucosal fenestration defect in the mandibular anterior labial gingiva in a 24 year old female which was managed by conservative approach using synthetic nanocrystaline bone substitute with L-PRF along with endodontic treatment.

Case Report :

A 24 years old female patient with non-contributory medical history presented in the OPD of Department of Perioodontology, RUHS College of Dental Sciences, Jaipur with the chief complaint of visible root tip in the lower front tooth region for the past 6 months. She gave history of childhood trauma due to stair fall. Clinical examination revealed discoloured, non-vital #31and #41 teeth with approximately 7mm height x 4mm width mucosal fenestration, making the root tip of #41 visible.[Fig.1] No significant pocket probing depth was present in relation to #31and #41. Interproximal spacing was present between #41 &#42 with labial inclination of root apex of #41.

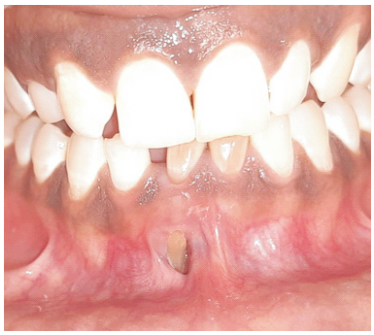

Fig 1: 7mm x 4mm mucosal fenestration in relation to #41.

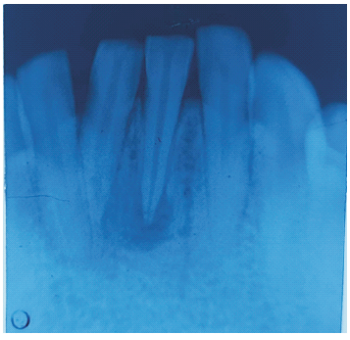

Fig 2: IOPA showing periapical radiolucency and widening of PDL space at #31 and #41.

Intraoral periapical radiograph (IOPA) revealed periapical radiolucency and widening of PDL space with respect to #31 and #41.[Fig.2] A diagnosis of trauma-induced chronic periapical inflammation as an etiological factor for labial mucosal fenestration was made.

After Phase-I therapy, access opening was done in relation to #31 and #41 and calcium hydroxide (antimicrobial agent) dressing was placed for 2 weeks . The patient was re-evaluated and blueprint for surgery to manage both the hard and soft tissue fenestration using the endodontic and single-stage regenerative procedure with synthetic nanocrystaline bone substitute and L- PRF was planned.

Surgical Procedure :

Patient was explained about the treatment plan and written informed consent was obtained. The surgical site was anesthetized using 2.3cc local anesthesia, 2% lignocaine hydrochloride with adrenaline 1:180,000 infiltration, facially and lingually. With help of the crevicular incision and vertical releasing incision extending beyond the defect margins into alveolar mucosa, a full-thickness mucoperiosteal flap was raised from the #32 to #43 region, and the alveolar defect was exposed. [Fig.3]

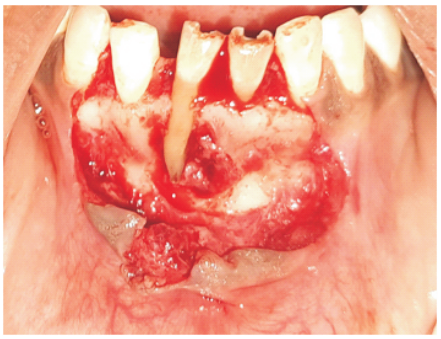

Fig 3: Reflected full thickness mucoperiosteal flap exposed dehiscence at #41.

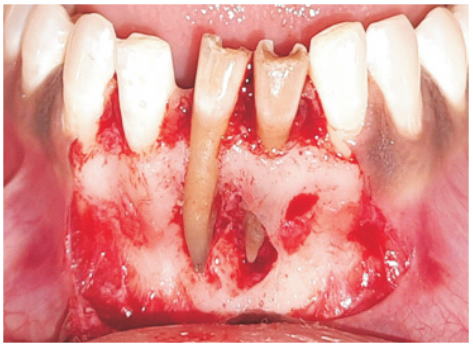

Fig 4: Debrided alveolar defect shows fenestration at #31

After a thorough debridement of the bony defect, scaling and root planing was performed. [Fig.4] Using gutta-percha in relation to #31 and #41, obturation was completed and

retrograde filling with an orthograde mineral trioxide aggregate (MTA) was placed to seal the root apex. [Fig.5]

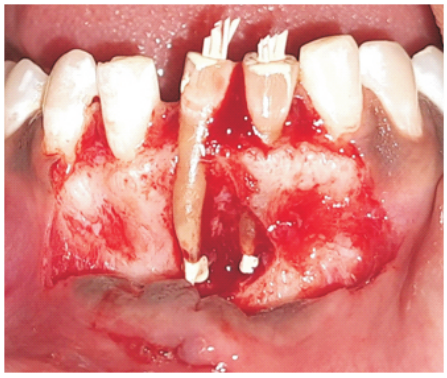

Fig 5: Gutta percha obturation and retrograde filling with MTA #31 and #41.

In order to prepare L-PRF, venous blood was drawn into two 10-ml sterile glass tubes with no additives. The tubes were centrifuged for 12 minutes at 2800 rpm. L-PRF was then carefully taken out of the tubes and separated from the red blood cell fraction using sterile tweezers and scissors. The alveolar defect was packed with synthetic nanocrystaline bone substitute (OstIN, Basic OSTeoINtegration, Basic Healthcare, Healthy Foundation, India) mixed with L- PRF and a L-PRF membrane was then placed over it. [Fig.6,7

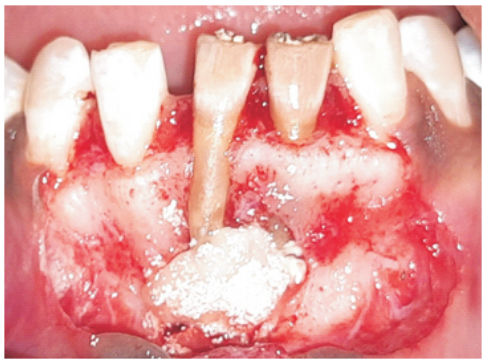

Fig 6 : Bone graft mixed with L-PRF placement at periapical bone defect.

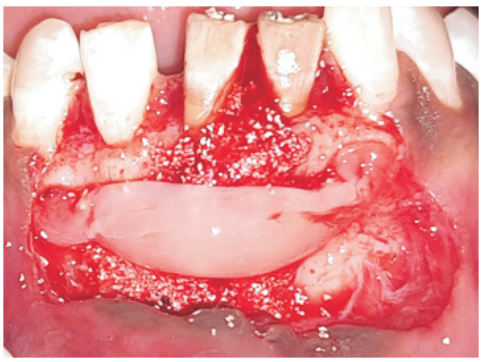

Fig 7: L-PRF membrane placement over the filled osseous defect site.

The flap was repositioned back to the original position and secured with 3-0 black silk sutures, at the same time the approximation for mucosal fenestration was also done. [Fig.8] A post-operative IOPA revealed complete obturation. [Fig. 9] After 10 days, the sutures were removed and favourable healing was observed at 1-month and 3-months postoperative follow-up. [Fig.10]

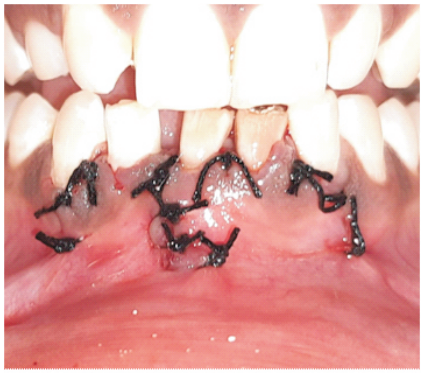

Fig 8: Flap repositioned and secured with3-0 black silk sutures.

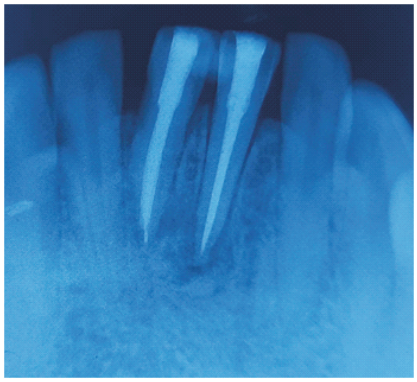

Fig 9: Post-Op IOPA showing complete obturation of #31and #41.

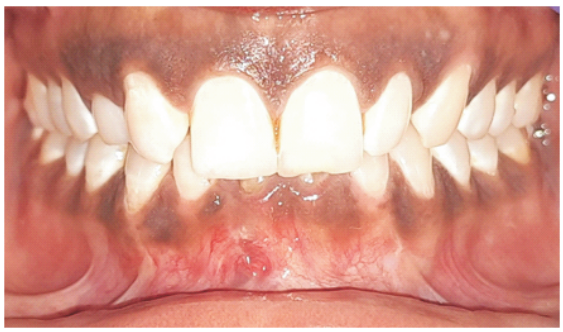

Fig 10: Clinical picture at 3 months showing uneventfull healing .

Postoperative follow-up at 3-months showed favourable wound healing and complete coverage of mucosal fenestration. In this case only synthetic nanocrystaline bone substitute was used along with L-PRF for bone defect fill and soft tissue coverage.

Discussion :

Combined mucosal and apical fenestrations are notably uncommon, primarily due to the limited number of clinical reports documenting such cases. Typically, clinical intervention is not required for these localized alveolar defects, which often remain asymptomatic in the absence of disease. [9] Nevertheless, the potential for biofilm development on exposed roots, along with the risk of microbial irritants from the oral cavity infiltrating the root canal system through the apical foramina, raises concerns. If the root apex or apices are connected to the oral cavity via a concurrent mucosal fenestration, this may increase the tooth's vulnerability to endodontic infections and complicate treatment. [7] Consequently, the coexistence of an apical fenestration with endodontic pathologies can significantly influence both diagnosis and treatment planning.

Radiographic evaluation of apical fenestrations accompanied by endodontic pathology reveals an apical radiolucency, indicative of inflammatory processes and bone resorption that may have contributed to the progression of these defects. [10,11] Additionally, IOPA radiographs provide only a two-dimensional representation of anatomical structures, complicating the identification of fenestrations, which are often situated on the buccal side of the alveolar bone. To accurately diagnose apical fenestrations, it is essential to assess the extent of the lesion and the position of the root apex in relation to the overlying alveolar bone; therefore, a CBCT scan should be considered for pre-operative planning.

The histological examination of apical fenestrations indicates the presence of chronic inflammatory cells accompanied by fibrous connective tissue, particularly in regions where significant bacterial biofilm formations are evident. Additionally, areas of cementum resorption were noted, alongside the accumulation of bacterial biofilms surrounding the apical foramen and within fragmented or detached cementum.

The primary aim of the surgical intervention in this scenario is to create a conducive anatomical structure and environment for healing. This is achieved by excising contaminated and inflamed periradicular tissues and modifying any prominent root apices to ensure they are situated within the alveolar bone housing. By sealing the mucosal opening, the surgical approach can effectively mitigate the risk of further microbial irritants infiltrating the root canal system from the oral cavity.
The literature review suggests a number of therapeutic strategies, such as covering the root surface with subepithelial CTGs, with GTR, filling the periapical defect with bioactive glass and PRF and then using CTG to cover the mucosal fenestration.

A case of labial mucosal fenestration defect #14, which had failed endodontic treatment, was successfully treated by Yuh-Ren Ju et al using a laterally positioned pedicle flap with a one-year follow-up. Yi-chun Lin et al examined five cases of mucosal fenestration defects that were successfully treated with CTGs and GTR therapy. In relation to #31, C C Tseng et al reported the successful use of a non-resorbable membrane and demineralized freeze-dried bone allograft in conjunction with endodontic and periodontal therapy to treat a large endodontically induced periradicular defect and soft tissue fenestration.

Bone is a very dynamic tissue that undergoes constant remodeling to maintain its shape and functionality. However, in clinical practice, patients may exhibit impaired bone healing, necessitating medical intervention in the form of natural or synthetic bone grafts to regenerate the tissue. Grafts and at times ceramic materials like hydroxyapatite are the best osteoinductive materials. Grafts have mechanical qualities like a Young's modulus comparable to native bone, biocompatibility and perfect osteointegration, in addition to their osteoinductive and osteoconductive properties.[12]
Within the three dimensional fibrin matrix of L-PRF, majority of leukocytes, macrophages, granulocytes and neutrophils are trapped, it drastically improved wound angiogenesis. It plays a significant role during host tissue to–biomaterial integration.[13] L-PRF contains TGF-β, a known agent responsible for the rapid proliferation of various cell types, PDGF, regulator for migration, proliferation, and survival of mesenchymal cells, VEGF for angiogenesis and future blood flow to damaged tissues. Direct contact of L-PRF with periosteum substantially improves the blood supply to the keratinized soft tissue favouring its thickness, as well as improves blood supply to the underlying bone tissues.[14] Neverthless, L-PRF along with bone graft, serves as an ideal scaffold for tissue regeneration fulfilling the three main criteria of tissue engineering including: scaffold, cells, and growth factors.

Although CTG is considered as a primary approach for soft tissue coverage, here in this case without use of CTG, acceptable soft tissue coverage for mucosal fenestration was achieved.

Conclusion :

While gingival fenestrations are rare, the appearance of a denuded root surface that penetrates the cortical plate and the mucosa above is not only an aesthetic issue for the patient; it

also presents additional difficulties that could result in a poor prognosis. Even though there are a number of documented treatment modalities for mucosal fenestrations, the surgical procedure we used in this instance has yielded aesthetic and satisfactory results.

For treatment to be successful, the root canal infection must be well controlled, and the root apex's anatomical relationship to the surrounding alveolar bone must be restored. Repair and regenerative potential, slower growth factor release kinetics of L-PRF, along with osteoconductive properties of synthetic bone graft, by acting as a scaffold, facilitates a proper and prompt wound healing and provide complete soft tissue coverage for mucosal fenestration.

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