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Case Report

Palatogingival Groove: Recognizing and Managing the Hidden Tract in a Maxillary Incisor: A Case Report

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Abstract:

Palatogingival grooves are developmental malformations quite notorious for precipitating endodontic - periodontal lesions. Owing to their inconspicuous occurrence, funnel-shaped morphology and variable extent on tooth root, they promote adherence of plaque and bacteria to levels significant for the development of pathology. Several treatment approaches have been recognized in literature for the management of this anomaly. Here in this report, a 25-year-old patient reported with the complaint of pain and swelling in maxillary right lateral incisor. Clinical examination confirmed an endodontic - periodontal lesion in relation to palatogingival groove. Endodontic treatment was instituted, followed by odontoplasty of the groove and restoration with newer calcium silicate cement, Biodentine. Combined endodontic - periodontal approach was successful in resolving the pathology with complete healing seen both clinically and radiographically. Timely diagnosis, prevention and management are highly recommended to prevent tooth loss due to complications arising secondary to their presence.

Key Words: Biodentine, developmental malformation, groove, incisor, lesion

Introduction

Maxillary lateral incisors are amongst those few teeth frequently known to exhibit diverse morphologic and anatomic abnormalities such as peg shape, dens invaginatus, Eagle's talon, palatogingival groove, germination, fusion and accessory root. In most cases, the location and anatomy of these malformations are such that they promote adherence of plaque and render relatively easy involvement of the dental pulp contributing significantly towards the development of endodontic - periodontal lesions.

Palatogingival groove also referred to as *palato radicular groove, disto lingual groove, corono radicular groove or radiculo lingual groove* is described in literature as a developmental malformation that exists on the palatal aspect of the incisor teeth and runs towards the mesial, distal or midpalatal root regions.[1,2] It has a reported incidence ranging from 2.8 to 18%.[3] Though rare in its occurrence, its notoriety cannot be overlooked especially since it is mostly concealed and seldom easily recognized. Palato gingival groove usually begins as an anomalous tract in the central fossa, crosses over the cingulum to extend apically onto the root surface for varying distances and depths.[4,5] Several etiologies have laid claim for its development which include: (1) infolding of the enamel organ and Hertwig's epithelial root sheath simulating a mild form of dens invaginatus,[2] (2) an aborted attempt towards formation of an additional root on the affected tooth[6] and recently, (3) alteration of genetic mechanisms and racial link has been proposed.[7] Shaped as a funnel, the defect is concealed from the efforts of cleansing and serves as an appropriate milieu for accumulation of plaque or calculus; where from localized periodontal inflammation can ensue and proceed along the tunnel/fissure like pathway.[6,8] If the defect remains unchecked, it can precipitate a series of periodontal consequences like attachment loss, periodontal pocket formation, and progressive bone loss. In addition, endodontic involvement secondary to bacterial invasion from these catchment areas can predispose to the development of combined endodontic – periodontal lesions. Accessory canals are believed to be the main mode of communication between the pulp and periodontium of incisors with radicular lingual grooves.[9]

Diagnosis and treatment of palatogingival groove is often dilemmatic and clinically challenging especially when the clinical presentation increases in severity and turns complex. Early identification of this anomaly is highly recommended to prevent extensive involvement in future and enable efficient management of the consequences arising due to the defect. The purpose of this paper here is to present the detrimental effects of the presence of a palatogingival groove in lateral incisor and to assess the outcome of a newer tricalcium silicate material used in its management.

Case Report

A 25-year-old male patient reported to the dental clinic with complaint of pain and swelling in maxillary right lateral incisor for the past 10 days. Dental history did not reveal any previous trauma and the patient also did not report any earlier episodes

of severe pain or swelling with respect to the concerned tooth. Facial clinical examination of tooth #7 revealed an intact crown devoid of any carious lesion or fracture line. Palatal examination disclosed a localized circumscribed swelling of the marginal gingiva, which appeared cyanotic (Figure 1a). It overlay an indentation that in all probability though concealed seemed to continue as a groove onto the lingual surface. Tenderness on percussion was mild with absence of mobility. Overall hygiene status of the patient appeared satisfactory. Further, on periodontal probing, a 10 mm pocket could be probed on the mid palatal aspect of the root (Figure 1b). Electric pulp testing elicited no response indicating the presence of a non-vital pulp. Pulp most likely turned necrotic after the periodontal pocket developed adjacent to the palatogingival groove. Intraoral peri-apical radiograph of the tooth showed a lateral peri-apical radiolucency and a dark radiolucent line superimposed over the canal space (Figure 1c). Gutta-percha tracing of the periodontal pocket pointed towards the periapical area (Figure 1d). Based on these findings, it was concluded that tooth #7 having a palato gingival groove predisposed to the development of localized periodontitis, suppurative apical periodontitis, and necrotic pulp.

A combined endodontic - periodontal treatment was planned for this tooth. In the first/endodontic phase of therapy, the tooth was accessed under rubber dam isolation and working length determined using electronic apex locator (Root ZX, J. Morita Mfg. Corporation, Kyoto, Japan) and radiographs. The canal was cleaned and shaped with stainless steel K-files (Dentsply- Maillefer, Switzerland) and rotary Ni-Ti files (Protaper, Dentsply-Maillefer, Switzerland) using crown-down technique. Irrigation was performed throughout using 5.2% NaClO (Novo Dental Product, India). For maximal

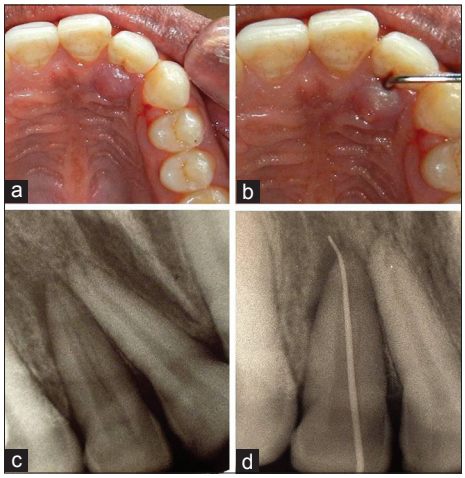

Figure 1: Preoperative images, (a) Clinical palatal view showing swelling of marginal gingiva, (b) probing depth of 10 mm seen at the cingulum, (c) intra oral periapical (IOPA) radiograph showing lateral peri apical radiolucency with a thin radiolucent line superimposed on the canal space and (d) IOPA radiograph showing gutta percha cone tracing.

debridement of canal, the irrigant was passively activated with ultrasonic unit, Piezon EMS (EMS GmbH, Munich, Germany) for 1 min. Calcium hydroxide (Metapex, Meta Biomed Co. Ltd., Korea) was packed into the canal as an intra-canal medicament and the access cavity temporarily sealed with intermediate restorative material (IRM, Dentsply Caulk, Milford, DE). On next visit after 1 week, the swelling had reduced in size and the groove was now more visible. Repeated irrigation of the canal was performed using 5.2% NaClO and $Ca(OH)_2$ placed into the canal for another 1 week. On subsequent visit, after a final rinse with normal saline, the canal was thoroughly dried and obturated with thermoplasticized gutta percha (BeeFill® 2 in 1, VDW GmbH, Germany) and AH-Plus sealer (Dentsply DeTrey GmbH, Konstanz, Germany). Access cavity and the accessible portion of the groove on the crown were restored with glass ionomer (Ketac Molar, 3M ESPE AG, Germany). On recall visit after 1 week, pocket depth had reduced to 6 mm but did exist (Figure 2a). Anticipating the need for odontoplasty of the groove and to provide an efficient seal; gutta-percha and glass ionomer cement (GIC) were removed from the coronal part of root canal and crown and replaced with dual cure resin (Luxacore; DMG, Hamburg, Germany) and light cure composite (Filtek P60; 3M, Saint Paul, MN, USA) respectively. A post-operative radiograph was shot (Figure 2b).

In second/periodontal phase of therapy, both intraoral and extraoral tissues on and around the surgical site were scrubbed with betadine. Anesthesia was achieved after administering 2% lignocaine with 1:100,000 adrenaline following which a full thickness periosteal flap was raised on the palatal surface of tooth #7 using intra sulcular incision. On raising the flap, a bony defect was seen extending apically along the palatogingival groove (Figure 3a). Thorough debridement around the groove was performed by meticulous scaling and root planning. Granulation tissue was debrided using Gracey curettes number 1/2 and 5/6 (Hu-Friedy Manufacturing Co., Chicago, IL).

Next, the groove was shaped with high-speed round diamond under continuous air-water spray and blended smoothly with the adjoining surface to receive the restorative material. Biodentine™ (Septodont, St. Maur-des-Fosses, France) was mixed according to the manufacturer's instructions and applied into the defect after proper control of bleeding (Figure 3b). The material was allowed to initial set for about 9 min. During the setting phase, the tissues were kept hydrated using moist gauze piece. The flap was approximated and sutured using 4-0 silk suture. Analgesics and antibiotics were prescribed, and the patient was given regular oral hygiene instructions including chlorhexidine (0.12%) mouth rinse for 2 weeks. The patient was recalled for checkup at 3, 6 and 12 months. At 3 months, gingiva appeared healthy and probing depth further reduced to 3 mm which continued to remain at the same level even

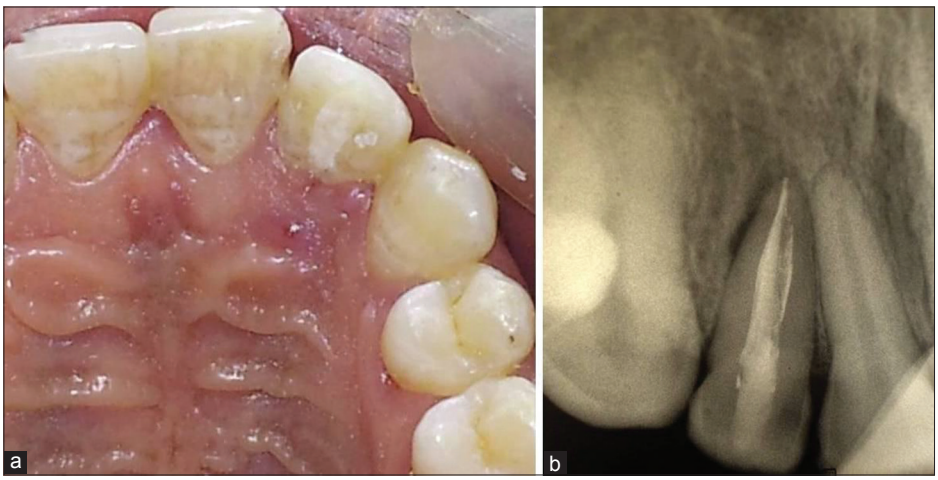

Figure 2: Immediate post endodontic treatment photographs, (a) Clinical photograph showing resolution of swelling but inflammation still present and, (b) radiograph showing well obturated canal.

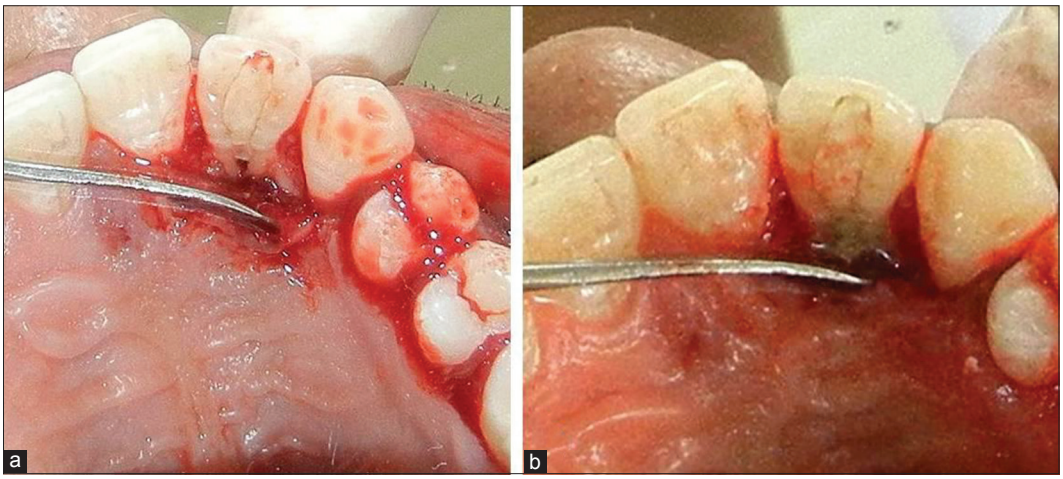

Figure 3: (a) Exposed palatogingival groove after elevation of palatal flap and, (b) sealed palatogingival groove with biodentine.

at 12 months (Figure 4a). Radiographic evidence showed excellent healing in the periradicular area (Figure 4b).

Discussion

Palatogingival groove is a morphological aberration known to frequently affect maxillary incisor teeth with a rate of affliction seen to be higher in lateral incisors (4.4-5.6%) compared to central incisors (0.28-3.4%).[1,10] Present as a structural variation, it is clinically significant because it serves as an ideal harbor for plaque and microorganisms from where focal periodontitis can initiate. More than 50% of the palatogingival grooves are seen to extend beyond the cemento-enamel junction onto the root surface. Amongst these grooves traversing the root, 43% have shown to extend apically <5 mm in distance, 47% between 6 and 10 mm and 10% have shown extension beyond 10 mm.[1] Based on the invagination of the groove towards the pulp cavity, these have been termed as shallow/flat (<1 mm), deep (>1 mm) and a closed tube.

Severity and complexity of the pathology developing secondary to the groove is greatly dictated by its depth, extent, and

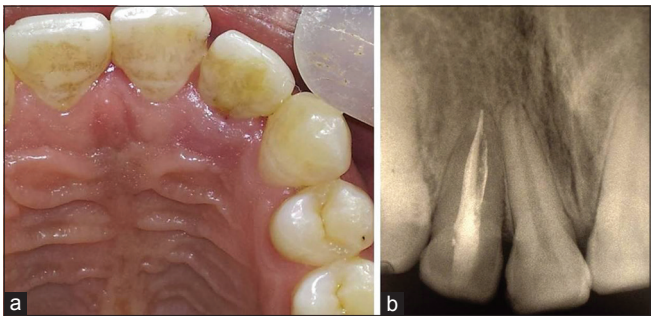

Figure 4: At 1 year, (a) Clinical photograph shows healthy well adapted gingiva and, (b) radiograph shows excellent peri radicular healing.

tortuousness. Goon *et al*. have classified palatogingival grooves as simple and complicated.[11] Simple grooves are less likely to cause severe destruction as they do not communicate with the pulp and represent only a minor infolding of the Hertwig's epithelial root sheath. On the contrary, complicated grooves communicate with the pulp cavity either laterally or apically owing to their severe depth and extent on the root. They are more likely to precipitate complex endo-perio lesions, have

guarded prognosis, and management in most cases demands an interdisciplinary approach.

In our case, palatogingival groove existing on the lateral incisor was classed as complicated/Type III since it was judged to extend 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. The radiographic impression of grooves manifesting as one or more dark lines extending along the length of the root parallel to or superimposed over the root canal known as parapulpal lines could be well appreciated on our patient's radiograph.[12] The origin of groove on the lingual surface of the crown could be clinically identified though most part of the groove was buried under the swollen and cyanotic marginal gingiva. Probing depth of about 10 mm adjacent to the enlarged gingiva indicative of a deep isolated periodontal pocket strongly suggested the presence of a long palatoradicular groove. The groove apparently rendered a communication between the oral environment and pulp resulting in concomitant endodontic and periodontal pathology.

Understanding the anatomic complexities associated with palato radicular groove is critical to the overall success of the treatment. Gu *et al.* based on microcomputed tomographic examination were able to elucidate a relationship between the type of grooves and root canal system.[13] Teeth with Type I grooves were recognized to have grooves extending apically not beyond the coronal third of the root and with a normal root canal configuration. Type II grooves extended beyond the coronal third of the root corresponding to a normal or simple root canal. Type III grooves extended beyond the coronal third of the root while corresponding to a complex root canal system. Mostly, C-shaped canals, invagination canals and additional root with secondary canals have been seen to be associated with Type III grooves. Deep grooves tend to deform the contour of the pulp cavity subjacent to the invagination along with diminished enamel and dentin thickness predisposing to pulpal involvement.[14]

Pulp in the affected lateral incisor in our case was necrotic; hence there was a need to institute endodontic treatment in addition to periodontal therapy. The radicular groove was deep; hence the internal canal system in all probability was also presumed to be complex. When entry was gained into the pulp chamber, an invagination was noticeable on the lingual wall of the canal compressing the pulp cavity towards the facial. Taking into view the likely existence of an aberrant root canal anatomy, necessary measures were taken to debride, prepare and obturate the pulp canals. Passive ultrasonic irrigation was performed to enable flow of irrigant into maximum possible areas. To ensure absolute fill of the entire root canal, injectable thermoplasticized gutta-percha technique was preferred for obturation.

Treatment in such cases cannot be considered absolute unless further measures are directed towards eradication of the anatomical defect and inflammatory stimulus.[12] Amongst the several known treatment strategies for correction of periodontal pathology, the one most discussed includes saucerization or odontoplasty of the groove; best known to treat simple/shallow grooves. Complicated grooves in addition to odontoplasty may necessitate additional measures like restoration of the defect with amalgam, GIC, composite or mineral trioxide aggregate (MTA).

Biodentine, a tricalcium silicate-based material popularly known as "dentin replacement and repair material" was introduced commercially in 2009. Compared to MTA whose setting time is several hours, Biodentine is stated to have a reduced initial setting time of 9-12 min and a final setting time of 45 min thereby improving its handling characteristics. It has proven bioactive properties, is known to promote hard tissue regeneration and is biocompatible. Compared to glass ionomer cement, this material is more approving when adhesion and growth of fibroblasts is concerned. The ability to form hydroxyapatite crystals at the surface especially when formed at the dentin material interface is known to improve its sealing ability. Favorable features of higher push-out bond strength unaffected by blood contamination and better physical and mechanical properties in comparison to MTA further contributes towards a superior repair material. In addition to documented uses of biodentine in diverse clinical applications like retrograde filling material, perforation repair, pulp capping and pulpotomy; our case also shows successful application of Biodentine in management of complicated palato gingival groove similar to reported cases by Johns *et al.* and Liji and Rameshkumar.[15,16]

It can therefore be concluded that an interdisciplinary approach combining endodontic treatment and periodontal therapy most often needs to be instituted when managing such type of complex cases. Endodontic treatment with open flap debridement coupled with simple closure of the corono radicular groove with Biodentine proved successful in preventing apical ingress of microorganisms and in promoting excellent healing both clinically and radiographically. Biodentin, because of its easier handling characteristics, shorter setting time, improved mechanical properties, good biocompatibility, and regenerative potential appears to qualify as a promising alternative to routinely used reparative materials for treatment of anatomic defects.

Conclusion

Presence of a palatogingival groove does not always imply that pathology will develop. Unless there is a breach in the epithelial attachment subsequent to post plaque retention resulting in progressively advancing inflammation, the groove may

continue to exist undetected. Thorough clinical examination of the lingual surface of incisors should be encouraged as a part of the routine protocol. If their presence is suspected, they should be restored either preventively to restrain subsequent complications; or subjected to regular prophylaxis and the concerned tooth kept under constant reevaluation.

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