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RESEARCH ARTICLE

PALATO GINGIVAL GROOVE: UNIQUE ANOMALY IN MAXILLARY ANTERIOR REGION

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ABSTRACT

Dental Anomalies are most commonly observed in maxillary anterior region. Palatogingival groove is one of them seen with maxillary lateral incisor either unilaterally or bilaterally. It is an artifice for plaque accumulation which leads to osseous defect. Diagnosis – proper diagnosis is base for treatment plan, which is made on the basis of clinical examination, along with radiographic examination as well as CBCT scan. Treatment –treatment is based on (i) complete eradication of microbials, (ii) permanent and thorough sealing of the root groove that communicates between the root canal and the periodontium, and (iii) periodontal regeneration and complete healing of the periodontium. In 2003, Kerezoudis *et al.* summarized the treatment interventions needed in cases of relatively shallow PGG:

(i) Surgical removal of granulation tissue and irritants,
(ii) A gingivectomy and apically positioned flap,
(iii) Surgical exposure and flattening of the groove by grinding, with or without application of guided tissue regeneration techniques,
(iv) Positioning a restoration in the groove and
(v) Orthodontic extrusion of the tooth.

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INTRODUCTION

The maxillary anterior incisors shows various morphologic and anatomic anomalies, including globulomaxillary cysts, cleft palate, congenital absence of tooth, supernumerary tooth, dens invaginatus, Eagle's talon, peg-shaped lateral incisor, germination, fusion, accessory root, and palatal gingival grooved incisors (Iqbal *et al.,* 2011; Sharma *et al.,* 2015). Among the abnormalities, palatogingival groove (PGG) is defined as 'a developmental anomaly in a root that, when present, is usually found on the lingual surface of maxillary incisor teeth' (Lee *et al.,* 1968). The maxillary lateral incisor is most commonly involved because of the embryological hazard of having its tooth germ locked between those of the central incisor and canine. PGG originates when the central fossa crosses the cingulum and extends to varying distances in an apical direction (Withers *et al.,* 1981). The term 'Palatogingival groove' (PGG) term was coined by Lee *et al* which is a developmental anatomic aberration affecting external and internal morphology of the tooth. This is also known as radicular lingual groove, distolingual groove, syndesmo corono radicular groove and radicular groove (Alhezaimi *et al.,* 2009; Kgon, 1986). PGG is due to infolding of enamel organ and Hertwig's epithelial root sheath before the calcification phase. Embryo logically, it is correlated to a mild form of dens invaginatus (Everett and Kramer, 1972) but the exact etiology is still unclear (Gu *et al.,* 2011).

Palatogingival Groove

History and Etiopathogenesis: First described as developmental anomaly which extends from the central fossa of cingulum downwards to apical area crossing cementoenamel junction in apical direction along the root with a wide range of depths and lengths (Black *et al.,* 2003). Oehlers was the first who reported radicular invagination of a maxillary lateral incisor in a Chinese female in 1958[43]. A groove in the lateral incisor with palatal aspects was described as PGG by Lee *et al.* in 1968 (Lee *et al.,* 1968).

Diagnosis: Cases with palatogingival groove shows dull, intermittent or acute pain, mobility of the teeth, pain on percussion, pus discharge, sinus tract formation and gingival swelling. Sometimes it may be symptomless, in most of the cases patient had no history of dental trauma, caries and discoloration of tooth. Pulpal vitality depends upon nerve involvement, cases with deep grooves shows no pulpal response. A clinical examination shows funnel shaped hollow grooves with an accumulation of plaque and calculus, along with loss of epithelial attachment, pocket formation, and bleeding on probing. PGG is often observed bilaterally in the oral cavity. Radiographic examination shows teardrop-like radiolucency seen in some cases. A radiolucent parapulpal line can be observed as one or more dark lines extending along the length of the root parallel to or superimposed over the root canal.

Classification

I According to Extend & Complexity of groove	1) Mild: the grooves are gentle depressions of the coronal enamel that terminate at or immediately after crossing the CEJ 2) Moderate: the grooves extend some distance apically along the root surface in the form of a shallow or fissured defect 3) Complex: the grooves are deeply invaginated defects that involve the entire length of the root or that separate an accessory root from the main root trunk
II According to location of groove	1) Distal 2) Mesial 3) Central (or midpalatal)
III Degree of invagination of the groove towards the pulp cavity	1) Shallow/flat (< 1 mm) 2) Deep (> 1 mm) 3) Closed tube
IV Degree of severity based on microcomputed tomography studies	1) Type I: the groove is short (not beyond the coronal third of the root) 2) Type II: the groove is long (beyond the coronal third of the root) but shallow, corresponding to a normal or simple root canal 3) Type III: the groove is long (beyond the coronal third of the root) and deep, corresponding to a complex root canal system

Palatogingival Groove

Three dimensional radiographs using cone beam-computed tomography (CBCT) can provide accurate, sensitive information to assess and plan the treatment of the teeth with PGG.

Treatment of palatogingival groove: Earlier treatment option for PGG with periodontal problem and draining Sinus tract extraction was the only treatment option due to poor prognosis. The treatment approach for teeth with PGG is based on the following three strategies:

(i) Complete eradication of microbials,
(ii) Permanent and thorough sealing of the root groove that communicates between the root canal and the periodontium, and
(iii) Periodontal regeneration and complete healing of the periodontium.

For more complex cases, several methods have been proposed: granulation tissue removal through a flap, elimination of the defect at the level of the crestal bone using rotatory instruments (saucerization) with or without the guided tissue regeneration technique, intentional extraction of a problematic tooth to achieve complete removal of the groove and subsequent re-implantation (intentional replantation), orthodontic extrusion, and extraction. In cases with an extensive groove area, some authors have reported successful treatment outcomes with intentional replantation (Hee-Jin *et al.,* 2017).

In 2003, Kerezoudis *et al.* summarized the treatment interventions needed in cases of relatively shallow PGG:

(i) Surgical removal of granulation tissue and irritants,
(ii) A gingivectomy and apically positioned flap,
(iii) Surgical exposure and flattening of the groove by grinding, with or without application of guided tissue regeneration techniques,
(iv) Positioning a restoration in the groove and
(v) Orthodontic extrusion of the tooth.

DISCUSSION

The location of the groove, the extent and accessibility of the periodontal defect, depth, and length of the groove (shallow/deep or long/short) eventually decides the prognosis of teeth. If the groove is not extended beyond the CEJ then prognosis is good. It is also depend on choice of restorative material. Subgingival Restorative materials for sealing of this type of lesion should have following properties according to Dragoo *et al.* (i) biocompatibility, (ii) a dual-cure set, (iii) adhesiveness, (iv) radiopacity, (v) compactness, (vi) surface hardness, (vii) insolubility in oral fluids, (viii) absence of microleakage, (ix) low coefficient of thermal expansion, and (x) low cure shrinkage. In addition, convenience of use and rapid setting that does not interfere with hemostasis are important properties in clinical circumstances. Several materials, including amalgam, glass ionomer cement (GIC), composite resin, and calcium silicate based-cement such as

mineral trioxide aggregate (MTA), have been selected for PGG treatment (Hee-Jin Kim *et al.,* 2017).

Some Materials to fill PGG are as follows

1) Amalgam: Amalgam has antibacterial activity related to the presence of mercury, copper, and zinc. Along with its biocompatibility, ease of manipulation, and better hardiness to moist conditions than other materials, it has led amalgam to be widely used to fill PGG. Tooth discoloration from amalgam is one of its major disadvantages in PGG restoration of anterior teeth. With the development of various filling material, the frequency of use of amalgam has been decreased (Hee-Jin *et al.,* 2017).

2) Glass Ionomer cement (GIC): GIC has been widely used in the restoration of PGG because of its favorable characteristics for both the tooth surface and periodontal tissues. This material is resistant to water degradation at the tooth-cement interface, shows good sealing ability through chemical bonding, and has an antibacterial effect. The fluoride in GIC can interfere with the initial adherence of bacteria and inhibit their metabolism and growth. It has also been reported that epithelial and connective tissue attachment occurred on the cement surface (Hee-Jin *et al.,* 2017).

3) Composite resin: Controversial data are available for the effects of composite resin on gingival health. Whereas some authors have shown that well-finished composite resin restorations do not damage the health of the gingiva, several researchers have reported that patients with composite resin restorations on a sub gingival area presented with more gingival bleeding and PD associated with gingival inflammation and higher bacterial counts than patients treated with other restoration materials. Moreover, in a long-term observation, gingival inflammation adjacent to composite resin restorations increased over time with a significantly higher prevalence rate than when other materials were used (Hee-Jin *et al.,* 2017). Increased wear and marginal leakage over time might adversely affect gingival health.

4) Calcium silicate-based cement: Recently, calcium silicate-based cements showing excellent biocompatible characteristics have been developed for the dental field. In several case reports, MTA has been used to restore the subgingival groove of a tooth. Although MTA has several favourable properties (excellent biocompatibility, sealing ability, and ability to set in moisture), difficulty in material handling and the possibility of wash-off, especially in a trans-gingival defect with a long setting time, make it difficult to use in PGGcases. Because PGG is mostly distributed from the crown area to the root of the tooth, mechanical properties that can endure intraoral conditions and biocompatibility with subgingival conditions are very important considerations. Some authors have reported a successful treatment outcome for PGG with Biodentine, describing advantages such as easy handling, a relatively short setting time of 9 to 12 minutes, improved mechanical properties, good biocompatibility, and regenerative potential (Van Dijken *et al.,* 1987).

5) Various regenerative materials currently used to fill intrabony defects: If the groove extends beyond the apical third of the root, surgical interventions are required to access the whole groove area and related lesions. For regeneration of periodontal tissues, diverse barrier or graft materials (bone grafts, platelet-rich plasma, and enamel matrix derivative) have been used, with consideration of the size of the bone defect and the presence of palatal bone loss.

1) Membrane: Attam *et al.* reported that a combined technique of bone graft and membrane significantly reduced the pocket depth compared with cases treated by open flap debridement. 35 Anderegg *et al.* also reported 10 cases of successful treatment after 6 month follow-up using a polytetrafluoroethylene membrane (Van Dijken *et al.,* 1987).

2) Bone graft: To achieve guided tissue regeneration, bone graft materials have been used along with membrane in the bone defect area to enhance the bone fill. McClain et al. reported that the attachment level was more predictable when combined graft/GTR therapy was used. Gandhi *et al.* also reported the use of synthetic bone graft material in an extensive bone defect area related to PGG (Gandhi *et al.,* 2012).

3) Platelet-rich fibrin: Platelet rich fibrin (PRF) is an immune platelet concentrate collecting all constituents of a blood sample favourable to healing and immunity on a single fibrin membrane. Rajendran *et al.* reported that, in the treatment of PGG, PRF application along with bone graft on the bony defect area resulted in crestal bone formation after 9 month follow-up (Al-Hezaimi *et al.,* 2009).

4) Enamel matrix derivative: The proteins of the enamel matrix secreted by Hertwig's epithelial root sheath in the process of root formation can contribute to apposition of the acellular cementum.17 The justification for the use of enamel matrix derivative (EMD, Emdogain, Straumann, Basel, Switzerland) is to emulate this process and facilitate the role of acellular cementum in the formation and repair mechanisms of the periodontal ligament and alveolar bone.[5]Hammarström et al. reported the actual formation of acellular cementum with EMD.17 EMD has also been used to prevent external root resorption and ankylosis onto the bone in cases of intentional replantation (Goon *et al.,* 1991). Al-Hezaimi et al. reported a favorable 4 year outcome after treatment of PGG with intentional replantation accompanied by EMD

Prognosis

Even if the prognosis is compromised due to complex anatomy, proper diagnosis, treatment planning and recent advances of restorative material can improve the prognosis.

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