CASE REPORT

Three-dimensional Assessment of Two-rooted Maxillary Central Incisor with Labiogingival Groove: Endodontic and Periodontal Surgical Management

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Abstract

Understanding the diversity of root canal systems and their anatomical/morphological variations helps in achieving improved outcomes of root canal treatment. The outcome of endodontic treatment depends on a thorough knowledge of dental anatomy and its variations. Maxillary central incisor with two roots is a rare entity, so a complete clinical and radiological examination is important before initiating the treatment. Recently, three-dimensional (3D) radiography has improved the diagnosis and treatment planning in endodontics. So, the current report describes the endodontic and periodontal surgical management of traumatized discolored maxillary central incisors with two separated roots and root canals identified by two-dimensional (2D) and 3D radiographic examination.

Keywords: Biodentine, Central incisors, Cone beam computed tomography, Endodontic management, Periapical lesion, Periodontal disease.

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Introduction

With modern techniques, it has been possible to achieve three-dimensional (3D) cleaning and shaping of root canal systems. The main aim of nonsurgical root canal treatment is the eradication of bacterial infection and 3D obturation to provide a bacterial tight seal which reduces the chances of reinfection.[1] Often, root canals are inadequately cleaned and shaped because the clinician is not able to spot their existence, especially in teeth having anatomical variations like developmental grooves or extra roots.[2] Understanding root canal morphology and their variations helps the clinician to locate and negotiate all the canals which can increase success in such challenging anatomical or developmental variations. The labiogingival groove/notch is one such developmental anomaly present on the labial surface of maxillary anterior teeth. Self-cleansing in such areas is difficult and if unnoticed can cause periodontal and endodontic complications. Ben-Bassat and Brin in their study on 123 children's reported a 6.5% prevalence of labiogingival groove on at least one central incisor. In 96 children, the groove was present on one central incisor whereas, in 27 children the groove was present in both central incisors.[3]

The labiogingival groove can appear as a shallow depression or can penetrate deeper into the enamel alongside the cementoenamel junction. Usually, the gingival margin closely follows the natural contour of the enamel; however, in the case of a deep notch, it has an irregular contour. Brin and Ben-Bassat concluded that trauma during early childhood was the major cause of this anomaly.[4] Shallow defects can get unnoticed unless examined while deeper defects require restorative and periodontal management. Two-dimensional (2D) radiography depicts only the mesiodistal and apico-coronal extension of the tooth and supporting tissues. Imposition of thick buccal and lingual cortical plates is abolished with 3D cone-beam computed tomography (CBCT) with the better demarcation of lesion margins.

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Root anatomy also can be evaluated from all three dimensions, which minimizes chances of missing defects such as fractures, cracks, missed canals, resorption, etc.

The objective of the present case report is to describe a systematic management approach using advanced diagnostic and treatment protocols to improve the success rate in such endo-perio lesions.

Case Description

A 47-year-old female, complaining of swelling and repeated pus discharge alongside upper front teeth came to the Department of Endodontics. Patient gave a history of on-and-off swelling and pus discharge around the apical region of tooth 11 from the palatal aspect. Symptoms subsided after taking antibiotics and reappeared after discontinuing them. The patient recalled trauma to maxillary anterior teeth before 6 years for which she had received no dental treatment except antibiotics and analgesics. Past medical history was noncontributory. No extraoral facial asymmetry or swelling

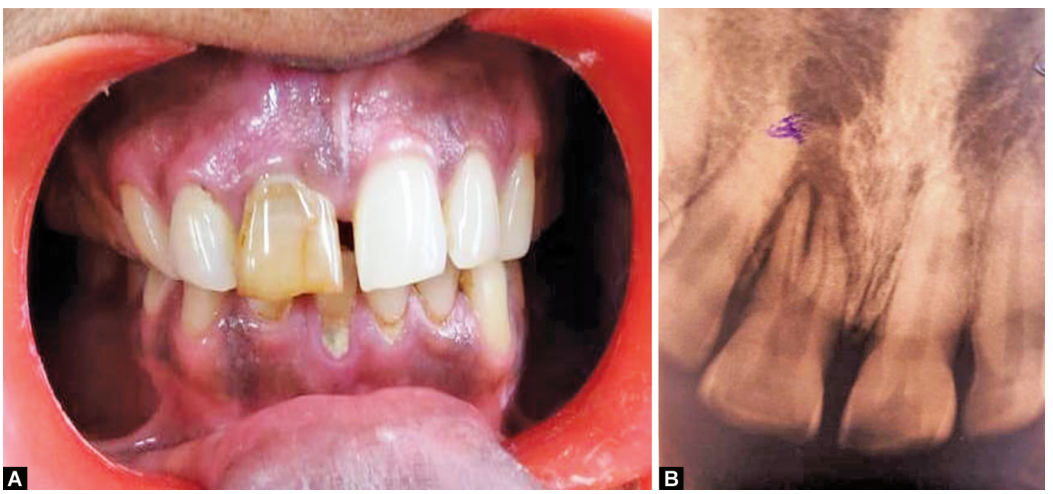
of the face was noticed. Intraoral examination showed discolored tooth 11 (Fig. 1A) with incisal chipping. Midline diastema was observed between the upper central incisors. A pocket depth of 7 mm in the mid-buccal region along with gingival recession was appreciated along the labial aspect of 11. There was mild tenderness with respect to 11. No signs of gross tooth mobility or crack were seen clinically. Vitality testing gave a negative response to thermal as well as electric pulp tester. Adjacent teeth were vital and asymptomatic. Thus, it appeared likely that periodontal disease extending from the labiogingival groove to periapex, involving periodontium and further resulting in loss of tooth vitality, pulp necrosis had occurred secondary to the deep periodontal defect resulting from the labio-radicular groove.

Preoperative intraoral periapical radiograph (Fig. 1B) revealed a bifurcated root in relation to the upper right central incisor (mesial and distal). Periapical radiolucency of approximately 3 × 3 mm was seen surrounding the roots of the central incisor. To further investigate the extent of the periapical lesion, tooth, and surrounding structures, a 3D-CBCT was advised. The sagittal view (Fig. 2A) showed apical bone loss extending toward the palatal side. The axial section showed two roots (mesial and distal) with separate root canals with buccal and palatal bone loss. No root abnormality like crack, fracture, resorption, etc., was observed on CBCT examination. The axial section (Fig. 2B) shows two root canals with respect to 11 with buccal, palatal, and mesial surface bone loss.

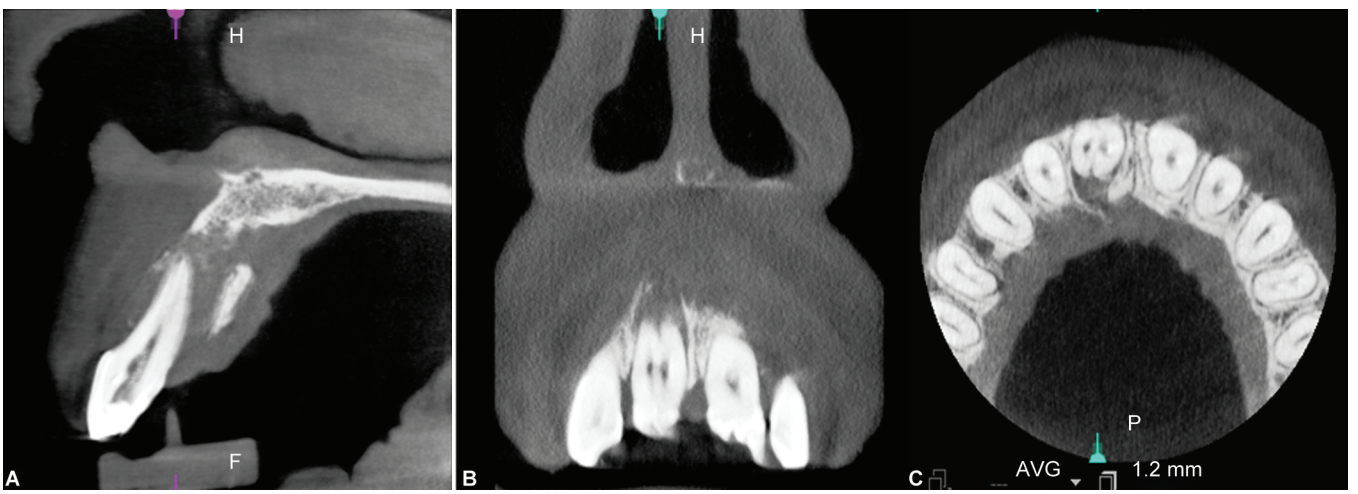
Coronal section (Fig. 2C) reveals bifurcated roots with periapical radiolucency along with external root resorption at the apical one-third. 3D reconstruction image (Figs 3A and B) shows the denudation of marginal and labial bone with respect to 11. Combining clinical and radiographic finding a provisional diagnosis of localized chronic periapical abscess in relation to 11 was made.

Clinical Procedure

The entire treatment procedure was explained and consent was taken from the patient prior to treatment. The treatment plan included endodontic treatment followed by planned periodontal surgical management of the groove and defect restoration with a bioactive material. The patient was scheduled for nonsurgical endodontic treatment in relation to 11. The tooth was anesthetized using 2 mL of 2% lignocaine with 1:80000 epinephrine and isolated under a rubber dam. With sterile No. 2 round bur, palatal access (Fig. 4) was made and enlarged in a triangular shape using a tapered round-ended diamond (Endo Access Bur; Dentsply Maillefer, Tulsa, Oklahoma). Both canals (mesial and distal) were explored with a 10# K-file (Dentsply, Maillefer, Ballaigues, Switzerland) and apical



Figs 1A and B: (A) Preoperative view; (B) Intraoperative view



Figs 2A to C: (A) CBCT (sagittal view); (B) CBCT (coronal view); (C) CBCT (axial view)

patency were established with the same file. The length of the canal was confirmed both clinically (Root Zx Apex Locator, J. Morita, Irvine, California) and radiographically (Fig. 5A). Canal orifices were enlarged using ProTaper SX rotary instrument and Glyde™ File Prep (Dentsply Maillefer, Ballaigues, Switzerland) as lubricant followed by further shaping till F3 rotary instrument. Canals were copiously irrigated with 2.5% sodium hypochlorite (NaOCl) to flush out debris and infected tissue. Canals were dried using absorbent points (Meta Biomed), and an intracanal medicament (ApexCal, Ivoclar Vivadent) was placed for 1 week. Pus discharge was noticed along the labial gingiva of 11 during the next visit. However, the patient was asymptomatic. Canals were re-entered and irrigated copiously with 2.5% NaOCl for 5 minutes, followed by saline irrigation for 1 minute. 5 mL of 17% ethylenediaminetetraacetic acid liquid was also used as an irrigant for 1 minute. Both irrigants were agitated with manual dynamic activation with an F3 gutta-percha cone with 100 strokes per minute. Canals were dried, and calcium hydroxide dressing was placed. After 2 weeks, complete healing of the sinus was seen, and there was an absence of discharge from the canals. The cold lateral obturation method (Figs 5B and C) was done using F3 GP as the master cone and Sealapex (SybronEndo, Orange, California) sealer. The access cavity was restored using high-strength glass ionomer cement (3M/ESPE, Seefeld, Germany).

After 2 weeks, the patient was scheduled for periodontal surgical management of the labiodental groove. A full thickness mucoperiosteal flap was raised under local anesthesia along the labial aspect to visualize the extent of the groove and the defect. Labial dehiscence was seen along with a groove that extends to

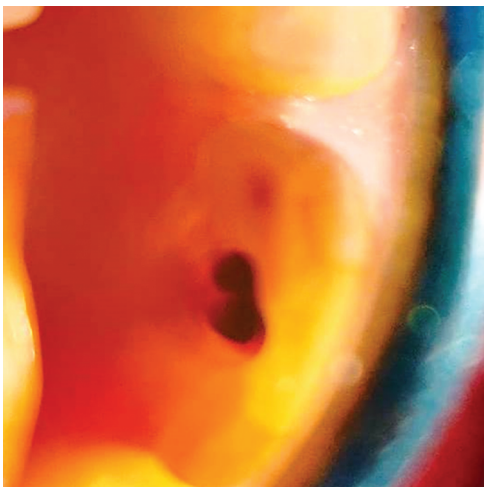
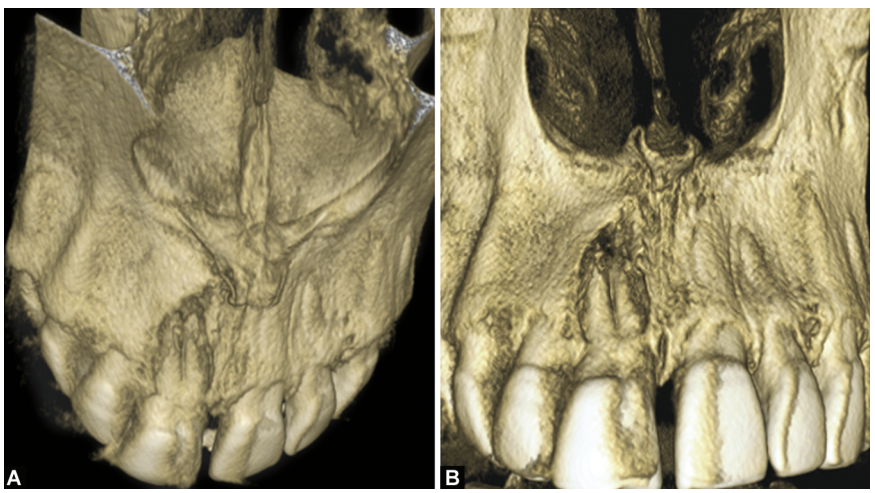
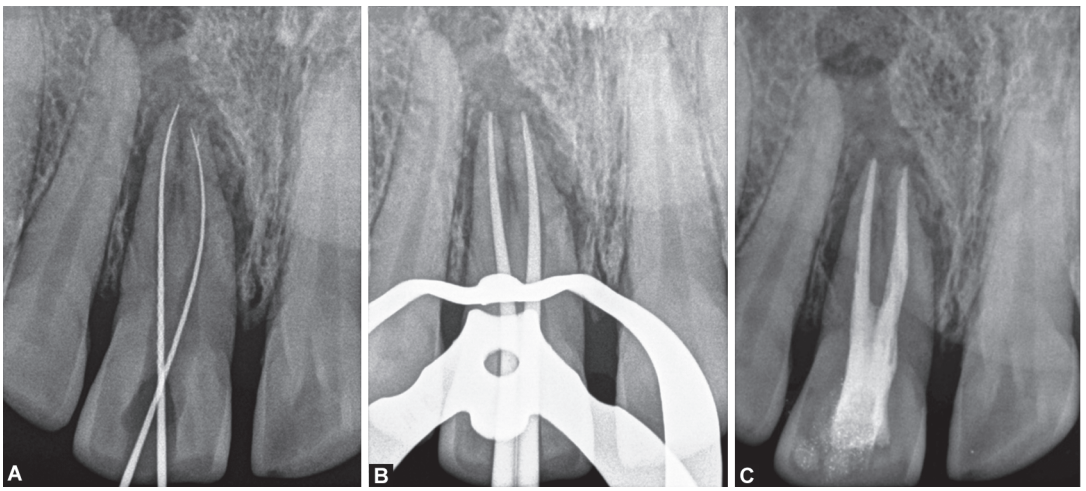


Fig. 4: Access opening



Figs 3A and B: Three-dimensional (3D) reconstruction



Figs 5A to C: (A) Working length; (B) Master cone; (C) Obturation

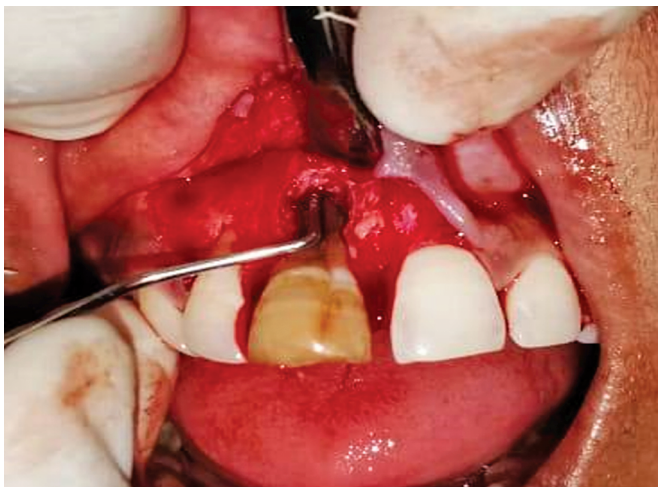


Fig. 6: Root bifurcation curettage

Fig. 7: Root end restoration

Fig. 8: Biodentine placement

Fig. 9: Bone graft placement

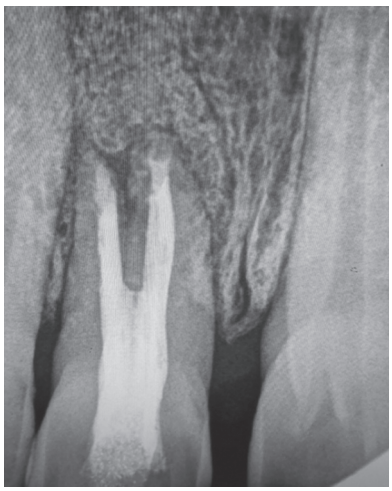


Fig. 10: Postoperative 12 months follow-up

the middle third of the root. Granulation tissue was seen between the roots and around the apices of the roots. Soft tissue was curetted (Fig. 6) and sent for histopathological examination. After hemorrhage control, root apices were resected and retrograde restoration was done with biodentine (Fig. 7). Odontoplasty (saucerization) of the groove area was done with a tapered bur to full length and restored with biodentine (Fig. 8). To encourage osseous healing of the bony defect, hydroxyapatite bone graft (Bio-Oss Graft, Fig. 9) was used. Root surfaces were etched with 10% polyacrylic acid and finally covered with guided tissue regeneration (GTR) membrane (ColoGide) of size 10 × 15 mm. The flap was readapted and secured with vicryl 3–0 resorbable sutures. A periodontal dressing (was used to cover the denuded root surface. Postoperative instructions included a cold application for 24 hours, a soft diet, soft brushing, and medicated oral rinse. Antibiotics and analgesics were given for 5 days to reduce the postoperative discomfort. At the recall visit, after 1-week Co-Pak dressing was removed, and the site was irrigated with betadine. The patient was further recalled for follow-up after 1 week and then after the 1st, 3rd, and 6th months up to 1 year (Fig. 10) postoperatively for follow-up. During these visits, clinical and radiographic examinations were made to evaluate endodontic and periodontal status. After 3 months, the pocket depth was reduced from 7 to 3.0 mm. Mobility was reduced to within physiological limits. The 3-month follow-up radiograph shows remarkable bone healing of the osseous defect.

Discussion

The detailed knowledge of the anatomy of the labiogingival groove aids in the proper diagnosis and treatment planning of periodontal and periapical disease associated with it. Due to the limitation

of the periapical radiographs, it obscures the true nature of the labiogingival groove and the extent of periodontal damage. In our case, the use of CBCT proved to be of great advantage as it revealed groove anatomy in true respect with its communication with the site of bifurcation, and the surrounding bone loss.[5] Due to the abnormal anatomical configuration, the labiogingival groove poses technical difficulties in its clinical management. When no visible communication exists between the groove and the pulp cavity, treating the groove as a separate entity and preserving the vitality of the pulp is a recommended treatment approach. Endodontic treatment was done in this case as the tooth had become nonvital due to the chronic long-standing involvement of the periodontium because of the presence of communicating channels between the groove and the pulp chamber, which might have facilitated bacterial penetration, causing the pulp tissue to undergo inflammation, degenerative changes, and eventual pulp necrosis.

The anatomic morphology of the maxillary central incisor is usually single root and single canal. Nevertheless, anatomic variations are seen and the presence of more than one root and one canal is a rare condition. Such morphological variations can be missed during diagnosis and make the treatment challenging for the dentist. Therefore, a thorough knowledge of pulp chambers, root canal anatomy and its variations, the use of advanced diagnostic aids, and modern method of endodontic treatment protocols help to improve the outcome of endodontic treatment.

Accessory root formation occurs, either by splitting or folding the Hertwig's epithelial root sheath to form a separate root that may have different morphological features. Extra root in maxillary central incisor, if any may occur either in mesiodistal or labiolingual direction. CBCT produces 3D images of individual teeth that aid not only in understanding root morphology but also root canal anatomy, associated hard tissue structures, defects, or any periapical/periodontal diseases. CBCT examination played a major role in avoiding complications such as overpreparation, perforation, and excessive dentin removal further, on CBCT examination we found dehiscence on the labial aspect showing two separate roots of maxillary central incisor mesiodistally. On the axial and sagittal sections, bone loss was present in the buccal as well as palatal aspects.

Previously the cause of this groove was considered to be the trauma of developing tooth buds, but nowadays vertical extension of the mamelon groove[6] can be considered as a more definite etiology. Based on the severity of the groove Mass et al. in 2005 proposed classification[7] based on the severity of the groove:

- A mild subgingival shallow groove below the marginal gingiva that can be diagnosed on probing.
- A moderate groove that can be detected clinically, extending subgingivally as in and additionally supragingival on the labial crown surface, not >2 mm from the marginal gingiva in the incisal direction.
- A severe defect extending supragingival >2 mm from the marginal gingiva on the labial crown surface and further subgingivally.

Study by Vertucci reported a single canal in all the maxillary anterior teeth. However, studies have shown that there can be possible morphological variations of root canals in maxillary anterior teeth too.[8] In one study,[1,9] all these teeth depicted single canal, although one of the surveys reported 3% of maxillary lateral incisors to have two root canals in the form of, gemination or dens invaginatus. In another study, few cases were of maxillary central incisors with two canals having been reported with morphological alteration, such as macrodontia and fusion.[10]

This case report describes the successful management of two rooted maxillary central incisors [Vertucci (type IV)] with a deep labial groove. As the tooth was nonvital, we initiated endodontic therapy which was carried out in multiple visits to encourage faster healing of the lesion. The basic concept behind the surgical management of periodontal defect with labiogingival groove was[1] saucerization of the groove to eliminate retentive area that harbors bacterial plaque,[2] regenerate periodontal attachment and bone and consequently helps reduction in pocket depth.[11]

Bio dentin was used to fill the labiogingival groove as it has added advantages like fast setting time, adequate sealability, good compressive strength (100 MPa in 1 hour), and encouraging epithelial and connective tissue attachment.[12] Regenerative periodontal therapy (GTR) was done in this case as it prevents epithelium attachment,[13] which helped in reducing the pocket depth by 7.0 mm. Bio-Oss bone substitute was used to fill the defect for the periodontal regeneration procedure. According to a histopathological report, the current soft tissue shows collagenous connective tissue with spindle-shaped fibroblasts and moderate lymphocyte infiltration suggestive of periapical granuloma. Thus periodontal surgical approach helped in the removal of this tissue which promoted better periapical healing.

Conclusion

Labiogingival grooves should be routinely evaluated in maxillary anterior teeth as part of a diagnostic checkup to prevent further complications. This study highlights the importance of knowledge, diagnosis, and newer technological aids in understanding anatomical variations of maxillary anterior teeth and the management of complications associated with it. With newer diagnostic aids, clinicians can better understand the characteristics of the anomaly and complications associated with it which further helps in careful management that increases the prognosis of the treatment.

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