

Case Report

Unveiling hidden root: Surgical success in maxillary central incisor anomaly

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Abstract

Complex variations in the root canal system can significantly impact treatment outcomes and lead to failure. This report describes a case of a 32-year male with an unusual anatomical variation (supernumerary root) in the left maxillary central incisor, with a chronic apical abscess diagnosed by radiographic and cone beam computed tomographic images. The lesion was treated by root canal treatment of tooth #21, followed by apicoectomy of the main root and excision of a supernumerary root. The root canal was sealed with mineral trioxide aggregate (MTA) and the defect was filled with bone graft material. A follow-up of three months, six months, and one year showed normal healing. Identifying root anatomical variations using advanced diagnostic methods significantly enhances the treatment success rate. Dentists must recognise the diverse root canal morphologies to improve clinical diagnosis and treatment prognosis.

Keywords: Supernumerary root, Cone-beam computed tomography (CBCT), Root anatomical variation, Apicoectomy.

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1. Introduction

Understanding anatomical variations in root canal morphology is crucial for achieving successful outcomes in endodontic treatment. According to existing literature, the anatomy of maxillary central incisors predominantly consists of a single-rooted structure with a single canal in nearly 100% of cases.¹⁻² However, variations such as multiple root canals have been reported, with the prevalence of a second root canal reaching up to 2%.³⁻⁵ Additionally, maxillary central incisors with two roots are exceedingly rare, with only a limited number of clinical case reports documented.⁶⁻⁸

A thorough knowledge of root morphology and root canal configurations is a fundamental requirement for effective endodontic therapy.⁹ Failure to identify, instrument, and adequately clean all root canals during root canal treatment (RCT) can lead to treatment failure. Consequently, anatomical variations in root and canal morphology pose a considerable challenge to clinicians performing conventional RCT.¹⁰ Cone beam computed tomography (CBCT) has emerged as an invaluable diagnostic tool in dentistry,

enabling detailed three-dimensional visualisation of root morphology across sagittal, coronal, and axial planes.¹¹

Teeth with pulpal necrosis and periapical pathologies can be managed either conservatively with root canal treatment or surgically through periradicular procedures.¹² Periapical surgery is recommended for cases of persistent apical periodontitis following endodontic therapy, or when symptoms such as pain, swelling, fistula formation, altered sensation, or progressive radiographic translucency are present in a tooth deemed worth preserving.¹³

Mineral trioxide aggregate (MTA) is widely regarded for its superior sealing ability, biocompatibility, bactericidal properties, and its capacity to set in the presence of blood, while also promoting the formation of new cementum.¹⁴ Additionally, bone regeneration after periapical surgery can be significantly improved through the use of bone graft materials, including autografts, allografts, xenografts, and alloplasts, to fill the periapical defect.¹⁵

This case report presents the management of a maxillary left central incisor with an unusual supernumerary root,

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addressing the condition through apicoectomy of the main root and subsequent surgical excision of the supernumerary root.

2. Case Report

A 32-year-old male patient reported to the Department of Conservative Dentistry and Endodontics with a complaint of pain and pus discharge persisting for three months (**Figure 1a**). The pain was severe, throbbing, and aggravated on mastication. Upon detailed examination, the patient reported a history of trauma to the tooth a decade ago, with no associated symptoms for five years. Subsequently, the patient noticed intermittent abscess drainage from the soft tissue related to the affected tooth. Despite medication, the drainage persisted for the last three months. The patient had no significant medical or dental history.

Upon clinical examination, the tooth appeared normal in size and shape, with slight discolouration and compromised periodontium. The tooth was not sensitive to percussion and exhibited Grade-1 mobility. A sinus tract was observed with tooth #21. Tracing the sinus tract with a Gutta Percha point and radiovisiography (RVG) confirmed that the affected tooth was #21. A preoperative radiograph revealed a large periapical lesion with an anatomical variation on the mesial aspect of tooth #21. (**Figure 1b**) Given this unusual anatomy, a CBCT scan was performed, revealing an extra root fused with tooth #21 below the cervical line. (**Figure 1c-d**) Based on clinical and radiographic findings, a diagnosis of chronic apical abscess was made, and treatment was administered.

2.1. Treatment plan

The proposed treatment plan included root canal therapy for the main root, followed by resection of the supernumerary root after reflecting and retracting a full-thickness periodontal flap. The patient was briefed on the proposed treatment plan, and formal written consent was obtained before initiating the procedure.

2.2. Initial root canal treatment

Under a rubber dam, the upper left central incisor was isolated, and the access cavity was refined. Patency of the main canal was checked with an ISO size 15 K-file. The working length was determined using an apex locator (Root ZX, Morita, Tokyo, Japan) and confirmed with an RVG radiograph. Cleaning and shaping were performed using nickel-titanium (NiTi) rotary ProTaper files (Dentsply Maillefer, Konstanz, Germany) in the crown-down technique, up to the F3 file. The root canal was irrigated with 5.25% sodium hypochlorite (Prime Dental Products, Thane, India), normal saline, 17% ethylene diamine tetraacetic acid (EDTA, Pulpdent Corporation, Watertown, MA, USA), followed by 2% chlorhexidine gluconate (Endo-CHX, Prime Dental Product, Thane, India) used as the final irrigant. The canal was dried with absorbent points (Dentsply Maillefer), and calcium hydroxide (RC Cal, Prime Dental Products) was placed as an intracanal medicament. The access cavity was sealed with intermediate restorative material (IRM) cement (Dentsply DeTrey GmbH, Konstanz, Germany). The patient was recalled after one week. At the second appointment, the IRM cement was removed, and the canal was irrigated with normal saline. The canal was dried again with absorbent paper points (Dentsply Maillefer).

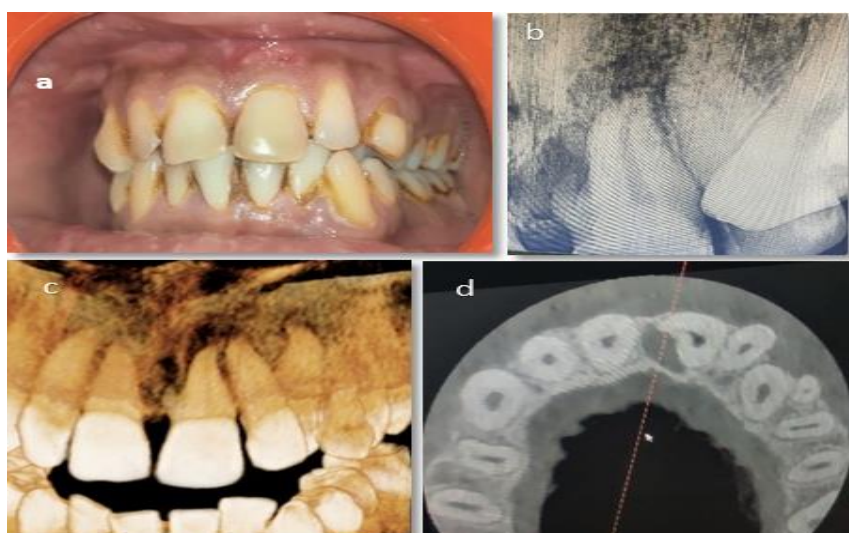


Figure 1: Preoperative **a**): intra-oral photograph; **b**): intra-oral radiograph; **c**): Cone beam computed tomography (CBCT) showing the left maxillary central incisor with supernumerary root attached near the cemento-enamel junction at mesial aspect of tooth; **d**): Axial image of cone-beam computed tomography scan showing the presence of radiolucency on mesial aspect of left maxillary central incisor.

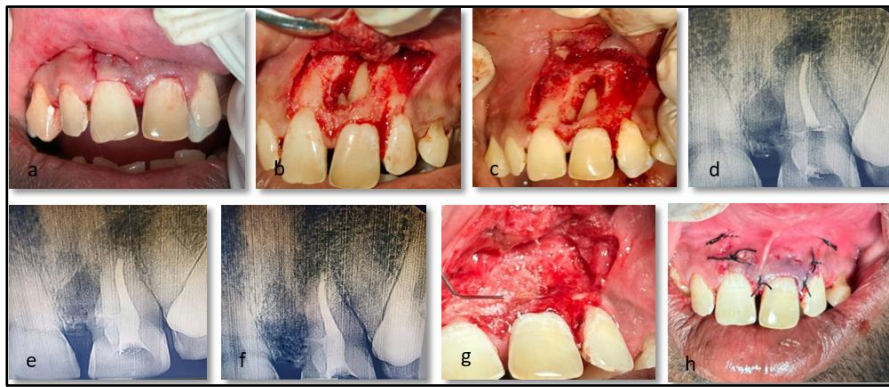


Figure 2: a): Incision; b): Full thickness mucoperiosteal flap reflection and curettage of lesion [after which the supernumerary root attached to the tooth below the cemento enamel junction was revealed]; c): Resection of supernumerary root; d): Sectional obturation upto the level of communication between the main canal and the resected root; e): Remaining canal filled with putty MTA; f): Apicoectomy done followed by retrograde MTA placement; g): Bone cavity filled with the bone graft; h): Simple interrupted suture given.

Despite the treatment, a persistent sinus tract was observed, suspected to be due to supernumerary root infection. Consequently, surgical intervention was planned as follows:

2.3. Surgical Procedure

After mouth preparation with povidone-iodine rinse and swab, local anaesthesia (2% lidocaine with 1:100,000 epinephrine) was administered. A sharp incision was made deep into the bone using a 15c blade and a Bard Parker handle. A sulcular incision, along with two vertical releasing incisions, was made to raise a full-thickness mucoperiosteal flap. The surgical steps were as follows:

After Flap design markings and incision, full-thickness mucoperiosteal flap was raised and curettage was performed (**Figure 2a-b**). Supernumerary root was resected (**Figure 2c**) and sectional obturation in the main canal up to the communication with the help of AH Plus sealer (Dentsply Sirona, Maillefer, Switzerland (**Figure 2d**)). The communication closed with putty MTA (BioStructure, SafeEndo, India) in the remaining canal (**Figure 2e**). Thereafter, apicoectomy was performed, and retrograde cavity preparation and filling with putty MTA was done (**Figure 2f**). Bone graft (Advanced Biotech Osseograft DMBM, Chennai, India) was placed in the bone defect (**Figure 2g**) and GBR collagen membrane (HEALIGUIDE® - Advanced Biotech, Chennai, India) was placed over the exposed root surface and lesion. The Flap was seamlessly repositioned with simple interrupted suturing performed (**Figure 2h**).

Upon elevating the flap and inspection, a breach in the cortical bone was located. A round carbide bur was used

under constant irrigation to enlarge the bony defect, creating a buccal window to access the periapical lesion and root end. Curettes were employed to remove soft granulation tissue, aiding in visualization of the root apex. Hemostasis was achieved with sterile gauzes. The supernumerary root was resected at its attachment to the main root in a labio-palatal direction, using a tapered fissure bur in a high-speed handpiece under constant irrigation. The apical end of 3mm was resected at an acute 10-degree angle to the long axis of the tooth. A retrograde cavity of 3mm was prepared with the help of ultrasonic surgical JetTips (B&L Biotech USA Inc., Fairfax, VA, USA). The cavity was filled with MTA, placed apically up to 3–4mm using Dovgan's carrier and plugger to ensure dense filling with minimal voids. A bone graft was placed in the defect to promote bone regeneration. Adaptation of the filling material was confirmed via radiograph. Thorough irrigation with normal saline ensured complete debridement of the surgical field, removing hemostatic agents, root-end filling material, and debris. The flap was repositioned, and six simple interrupted sutures were applied.

2.4. Post-surgical care

The patient was advised to apply cold compresses with an ice pack for 4–6 hours post-surgery, followed by mouth rinses to maintain oral hygiene. Antibiotics and analgesics were prescribed for five days. The patient was re-examined after three days to assess the surgical site for healing and to check for pain or the presence of a sinus tract. Sutures were removed after seven days, and post-operative restoration with composite resin was completed the same day. The patient was subsequently scheduled for follow-up visits at 3 months, 6 months, and 1 year to monitor clinical and radiographic signs of healing. (**Figure 3a-d**)

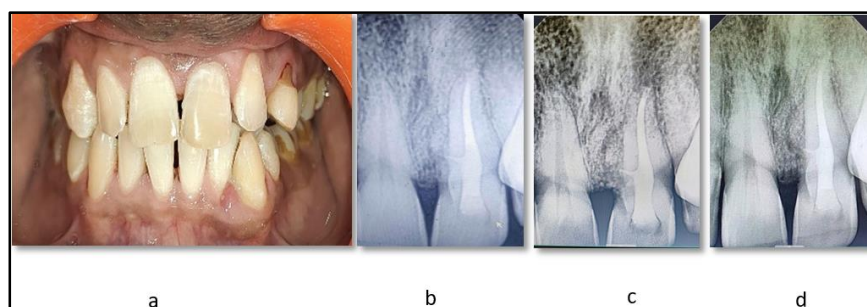


Figure 3: Postoperative a) intra-oral picture; b) Follow up radiograph- 3 months; c) 6 months; d) one-year

3. Discussion

The occurrence of supernumerary roots has been a topic of interest among researchers, with several hypotheses proposed regarding their development.¹⁶ Kelly JR attributed bifurcated roots to an ingrowth of Hertwig's Epithelial Root Sheath (HERS).¹⁷ Other studies have suggested that the clinical presentation of supernumerary roots may be associated with fusion or gemination.¹⁸ Neville BW et al. defined supernumerary roots as the presence of additional roots in a tooth compared to the typical dental anatomy.¹⁹ In the present case, it is hypothesized that during the formation of the epithelial diaphragm, an incident might have triggered the development of a horizontal flap in the HERS, which later fused, leading to the formation of a supernumerary root.¹⁶

Typically, maxillary central incisors have a single root and canal, with nearly 100% of cases reflecting this morphology.²⁰ According to a study by da Silva et al., 98% of maxillary anterior teeth consistently displayed a single canal in their root canal morphology.²¹ Iqbal et al. reported a 97.89% prevalence of Vertucci's Type I root canal configuration.²² However, variations such as maxillary central incisors with two roots have been observed in populations with diverse ethnic backgrounds. Factors such as ethnicity, gender, age, developmental anomalies, and dental trauma—particularly intrusive luxation of deciduous teeth—have been suggested as contributors to these anomalies. Dental trauma may result in cervical loop division, leading to the formation of two roots in the mesiodistal plane of the successor tooth.²³⁻²⁶

Preoperative clinical evaluation is crucial in identifying accessory roots or canals. Deviations in crown morphology may indicate root canal variations, although maxillary central incisors with multiple roots or canals can exhibit normal crown morphology. Hence, radiographic assessment is essential for identifying root structure variations.²⁷ Modern diagnostic methods, such as three-dimensional imaging (CBCT), are particularly beneficial for accurately detecting anatomical variations, avoiding issues like superimpositions and distortions.²⁷

In the present case, inflammation persisted in the supernumerary root after treating the main root canal, as the supernumerary root canal was inaccessible through the main

canal's access opening. Consequently, the sinus tract did not resolve despite endodontic treatment.

In cases of chronic periapical abscess, conventional root canal treatment with obturation and subsequent coronal restoration typically eliminates pathogenic microorganisms.¹² However, certain cases fail to heal or worsen, indicating the persistence of microorganisms within the canal system. In such instances, surgical interventions like apicoectomy are preferred and well-documented in the literature as effective solutions for preserving affected teeth.¹²

Apical surgery, an invasive but standardized procedure, is employed when conservative endodontic treatments fail. The objective is to preserve the affected tooth in the dental arch by surgically removing the infected tissue around the root and sealing the root end with retrograde restoration.²⁷⁻²⁹

In this case, the supernumerary root was surgically excised, and the communication between the main canal and the supernumerary root canal was sealed using mineral trioxide aggregate (MTA).

MTA is renowned for its excellent sealing capabilities and its ability to stimulate osteoblast activity, making it a highly effective root-end filling material.³⁰ Animal studies have demonstrated MTA's low inflammatory potential and its ability to promote cementogenesis, with cementum bridges forming directly over MTA root-end fillings.³¹

To support healing, bone graft material (Osseograft®) was used as a filler in the defect. It served as a scaffold for the overlying guided tissue regeneration (GTR) membrane, preventing its collapse and encouraging new bone formation through osteoconductive and osteoinductive mechanisms.³² This bioabsorbable matrix allowed the integration of bone-forming cells and blood vessels, facilitating the repair of the osseous defect.

To the best of the authors' knowledge, no clinical reports have detailed the management of a central incisor with unusual anatomy using radisection of a supernumerary root combined with apicoectomy of the main root, followed by long-term evaluation. In this case, after one year, the follow-up outcomes were satisfactory, with no signs of failure, and the patient expressed gratitude for the successful result.

4. Conclusion

In conclusion, the successful management of atypical cases in contemporary endodontics hinges on two critical factors:

1. A thorough understanding of root canal anatomy, including the potential for variations, even in seemingly straightforward cases.
2. The adoption of advanced technologies such as dental operating microscopes, three-dimensional imaging systems, ultrasonic instruments, and electronic apex locators to accurately identify and address these complexities.

This is the first documented case in the Indian population showcasing an anatomical variation in the maxillary central incisor, which was effectively managed through surgical intervention facilitated by CBCT imaging.

5. Declaration of Patient Consent

The authors confirm obtaining all necessary patient consent forms. Patients consented to the use of their images and clinical information in the journal, understanding their names and initials will remain unpublished. Efforts will be made to conceal identities, though anonymity is not guaranteed.

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7. Conflicts of Interest

There are no conflicts of interest.

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