

Supernumerary Teeth: A Review on a Critical Endodontic Challenge

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Abstract

Supernumerary teeth are developmental anomalies that might require endodontic treatment for functional and/or esthetic reasons. A review of literature was conducted using appropriate key words (“Supernumerary” OR “Supplemental” OR “Rudimentary” AND “Tooth,” “Mesiodens” OR “Paramolar” OR “Distomolar”) in major endodontic journals (Australian Endodontic Journal, Dental Traumatology, International Endodontic Journal, Journal of Endodontics, and Oral Surgery, Oral Medicine, Oral Pathology) to identify available reports describing the clinical and radiographic landmarks of different forms of supernumerary teeth and discussing the implications of such anatomical variation on root canal treatment procedures. In addition, this article highlights the potential indications of supernumerary teeth for intentional replantation and autotransplantation treatment procedures.

Keywords: Autotransplantation, endodontic treatment, fusion, intentional replantation, supernumerary teeth

INTRODUCTION

A thorough knowledge of tooth morphological variations is a fundamental prerequisite for the successful root canal treatment (RCT).^[1-3] A supernumerary tooth is an additional tooth to the normal series of teeth and may be seen in any quadrant of the jaws in both primary and permanent dentitions.^[4,5] The etiology of supernumerary teeth is not completely understood, but the hyperactivity theory is the most widely accepted theory which suggests that supernumeraries are formed as a result of local, independent hyperactivity of the dental lamina.^[6] The prevalence of this developmental anomaly ranges from 0.1% to >3%.^[6] Heredity may also play a role in its occurrence.^[6]

Supernumerary teeth can be either supplemental or rudimentary depending on their form. Supplemental refers to the supernumerary teeth of normal shape and size, whereas rudimentary refers to the teeth of abnormal shape and smaller size, including conical, tuberculate, and molariform types.^[6] Supernumeraries may also be categorized into three types according to their locations; mesiodens, paramolar, and distomolar.^[6] Owing to the various anatomical variations

and the relation to neighboring teeth, the differentiation from gemination might be difficult, if not impossible.^[7]

Supernumerary teeth may be discovered by the dental practitioner as an accidental finding on a radiograph or as the cause of an impacted tooth and/or esthetic impairment.^[4] Literature indicates that supernumerary teeth may have critical implications in the endodontic practice.^[8-10] As such, the purpose of this paper is to discuss the implications of such anatomy on RCT procedures and clinical outcomes.

LITERATURE SEARCH METHODOLOGY

An electronic search was conducted, from January 1975 to September 2016, to identify papers on supernumerary teeth in the human dentition. Related studies and case reports written in the English language and published in major endodontic journals were included.

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- Journal of Endodontics
- Oral Surgery, Oral Medicine, Oral Pathology (subsequently renamed as Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology until December 2011).

The following keywords were used in the search:

1. “Supernumerary” OR “Supplemental” OR “Rudimentary” AND “Tooth”
2. “Mesiodens” OR “Paramolar” OR “Distomolar.”

TERMINOLOGY

- Mesiodens – it is a typical conical supernumerary tooth located between the upper central incisors. It may be single or multiple; unilateral or bilateral; erupted or impacted; vertical, horizontal, or inverted.^[6]
- Paramolar – it is a supernumerary molar, usually small and rudimentary situated buccally or lingually to one of the molars or in the interproximal space buccal to the second and third molars.^[6]
- Distomolar – it is the one located distal to the molar, usually small and rudimentary, rarely delays or impedes eruption of the normal tooth.^[6]

ENDODONTIC CONSIDERATIONS

Endodontic management of independent supernumerary teeth

As a general rule, the treatment depends on the type and position of the supernumerary tooth and its effect on adjacent teeth. Immediate removal of the supernumerary tooth is indicated if eruption of the adjacent tooth has been delayed or inhibited or the adjacent tooth is displaced.^[6] However, extraction is not always the treatment of choice for independent supernumerary teeth; particularly, if there is no esthetic concerns, no discrepancy on the eruption pattern and the periodontal condition of related teeth is favorable.^[6] Notably, such teeth can be potential candidates for autotransplantation.^[11] RCT of independent supernumerary teeth follows the same principles for normal tooth types. However, the endodontic treatment of some types of supernumerary teeth (particularly distomolar) is challenging because of several reasons such as unusual anatomic size and shape of the crown, difficulty in accessibility, and rubber dam isolation.

Endodontic management of supernumerary teeth fused to normal teeth

A thorough diagnosis is paramount to the formulation of an accurate treatment plan that will lead to a favorable prognosis.^[12] When normal and supernumerary teeth fuse, they show an anomalous broad crown that might appear to be “molten” together with a small groove between them.^[13] This groove can be extended on the root surfaces to various

depths and may result in periodontal disease, which can later lead to pulpal problems.^[14,15] The pulp chambers and root canals might be joined or separated, depending on the stage of development at the time of union. Proper diagnosis afforded by three-dimensional (3D) computed tomography scans (such as cone beam computed tomography [CBCT]) allows proper visualization of the anatomy and its complexities and ensures formulation of a treatment plan with predictable and successful outcomes.^[16-18]

Fusion with no pulp tissue communication

Clinicians should consider the pulp vitality of the supernumerary tooth in instances of fusion where there is no apparent communication between the root canal systems.^[16,17,19] In such cases, the RCT may be performed to the affected tooth only, preserving the vitality of the unaffected counterpart.^[16] Notably, hemisection of the supernumerary tooth has been reported which can be performed without an RCT.^[13,20]

Fusion with pulp tissue communication

Communication between pulp chambers of fused teeth is a common feature [Figure 1].^[10,21-24] Hence, irreversible damage to the pulp of one tooth may involve the pulp of the other tooth. The variability in root canal systems in fused teeth makes it difficult to predict their configuration. These anomalous teeth often require modified access opening to facilitate searching for root canals that are unusually positioned.^[10,23-25]

Clinically, if the canal of the supernumerary tooth is connected with the main pulp chamber near the cervical level, careful examination in the access cavity might reveal the connection.^[22] Communications in the middle third of the root can also be observed via the flow of the irrigation solution from one canal to the other.^[26] However, a communication near the apical level is difficult to identify through the access cavity (especially in para- and disto-molars) unless a 3D imaging is performed. Two separate access cavities are usually prepared (one corresponds to the normal tooth, whereas the second corresponds to the supernumerary tooth). Communication between the two cavities could be observed under the dentin septum, which can be preserved or removed when adequate access to the canals cannot be achieved.^[27,28] Higher concentrations of sodium hypochlorite,^[23,24] different irrigation protocols (such as ultrasonic irrigation procedures), and the use of thermoplasticized gutta-percha are advantageous to enhance tissue dissolution, disinfection, and filling of the root canal system including the fin connecting the two main canals [Figure 1].^[29]

CBCT also aids in the decision-making for hemisection which can be delayed until the pulp chamber is separated, and a precise 3D cutting plane line can be planned to avoid pulp exposure with minimal risk of hypersensitivity or external root resorption.^[30]

Other treatment procedures include direct pulp capping (such as mineral trioxide aggregate) of the exposed pulp communication after sectioning off the supernumerary tooth.^[31]

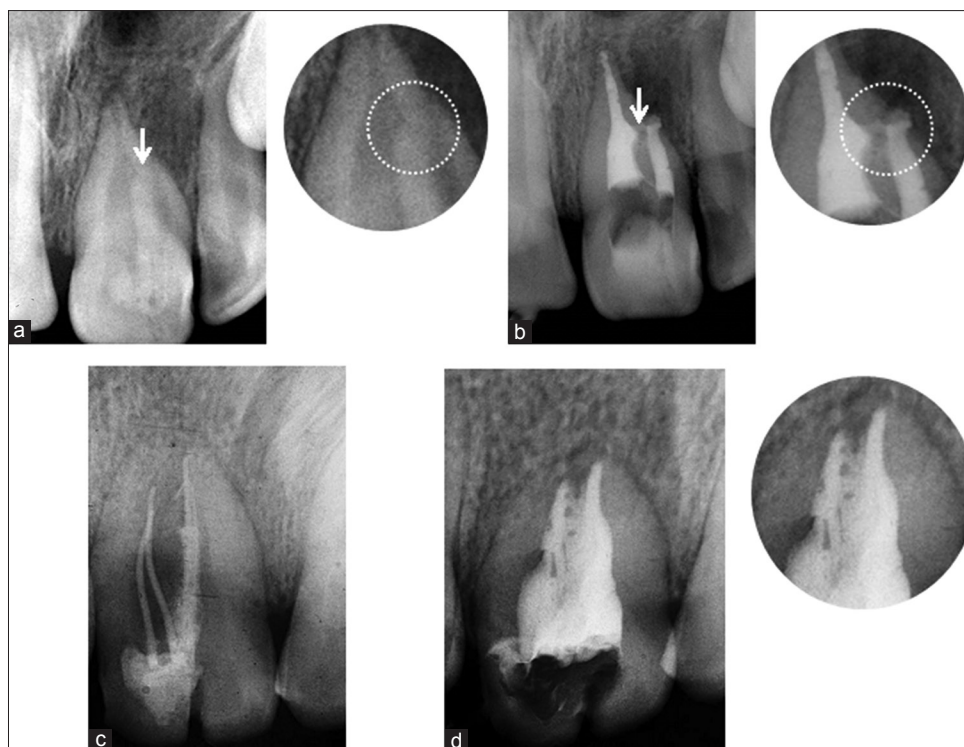


Figure 1: (a) Preoperative radiographic image showing a potential connection between the two pulp spaces of a maxillary central incisor fused with a supernumerary tooth (white arrow). (b) Postobturation radiographic image confirmed the presence of pulp tissue connection (white arrow). (c) Periapical radiographic images showing a defective root canal treatment of a maxillary central incisor fused with a supernumerary tooth. (d) Root canal filling was performed using continuous wave of condensation which shows intercanal connections at the whole length of the fused teeth

After several weeks, orthodontic treatment can be commenced to restore normal alignment. Follow-up is essential to confirm the vitality of the tooth, which can be maintained up to 10 years.^[31] Other treatment options include RCT followed by fiber reinforced post, resin composite core followed by crown for two separate teeth,^[32] or RCT followed by mesiodistal trimming, restoring the labial defects with anterior resin composites followed by orthodontic treatment if necessary.^[33] Other similar treatment approaches have been reported.^[34-36]

Endodontic management of supernumerary teeth with developmental anomalies

Supernumerary teeth with a talon cusp

A talon cusp on a supernumerary tooth can impede the eruption of permanent teeth.^[37] Sachdeva *et al.*^[38] reported successful nonsurgical endodontic management of a mandibular central incisor fused to a supernumerary tooth associated with a talon cusp, which was treated using selective grinding of the cusp followed by resin composite restoration. Another report documented successful management of a similar anatomical variation using a multidisciplinary approach in which the tooth was endodontically treated followed by orthodontic correction, and the fused tooth was esthetically restored with a ceramic crown.^[39]

Supernumerary teeth with dens invaginatus

Supernumerary tooth with dens invaginatus/evaginatus is a rare anatomical variation.^[40-45] A recent study on a

Turkish population has reported that a 0.01% of patients have a dens invaginatus in a mesiodens (9% of all tooth types).^[46] Sousa Neto *et al.*^[47] documented a successful RCT of a supernumerary incisor tooth with a dens invaginatus type I. Holtzman^[48] described a conservative management of a supernumerary maxillary incisor tooth with a dens invaginatus type II in which the invagination space was cleaned and filled with no endodontic treatment intervention of the offending tooth to maintain pulp vitality. Kremeier *et al.*^[49] presented a rare case of a central incisor fused to a mesiodens with dens invaginatus in which conventional RCT was performed with a clinical success on a 4-year recall. In some cases, the definitive diagnosis of the anomaly can be rather challenging.^[50]

Other treatment options and potential applications

Intentional replantation

Intentional replantation primarily aims to resolve endodontic pathosis that is impossible to treat through conventional endodontic therapy and has contraindications for apical surgery.^[51,52] The application of this treatment approach to maxillary anterior teeth fused to supernumerary teeth has been reported.^[52,53] Extraoral resection of the fused tooth makes accurate control of the smoothness of the margins and of the odontoplasty without sacrificing the periodontal ligament, thus improving prognosis.^[52] Tsurumachi and Kuno^[53] described treating a maxillary incisor fused to a supernumerary with connections between the root canals. The

treatment plan consisted of RCT using a thermoplasticized gutta-percha to properly seal the intercanal connection, followed by extraction and extraoral hemisection of half of the fused tooth, replantation of the remaining part, and finally, orthodontic treatment. Three-year recall examination showed clinical and radiographic evidence of healing and regaining of satisfactory teeth alignment. A similar report has been documented in which the RCT of the fused teeth was performed extraorally.^[52] Six-year follow-up showed favorable clinical outcomes.

Notably, the complete separation of the fused tooth may, however, causes a loss of periodontal tissues in the root area affected by the resection, with potential periodontal problems in the long term.^[52,53] Damage to the periodontal ligament can be associated with root resorption and/or ankyloses.^[52,53]

Autotransplantation

Autotransplantation involves the transplantation of embedded, impacted, or erupted tooth from one site to another in the same individual.^[11] The recipient site may be either an extraction site or a surgically prepared alveolus. Tooth autotransplantation has several benefits.^[8,9,11,54,55] First, the procedure can be accomplished in a single visit. Second, when the transplantation is successful, normal periodontal healing is achieved, and proprioceptive function, natural chewing feeling, and natural biological response are restored. Furthermore, the transplanted tooth can serve as a bridge abutment or as an orthodontic anchorage. Tooth autotransplantation can also allow continued alveolar bone induction in growing children. It is also the fastest and most economically feasible treatment option.^[11]

One report documented using a supernumerary maxillary central incisor with an immature apex as a replacement for a fused maxillary incisor.^[11] At 18-month recall examination, the root apex was closed and had no evidence of postoperative complications.^[11] One study investigated the clinical outcome of autotransplantation (including supernumerary teeth) to the anterior maxillary region, and the results showed a success rate of 80.5%.^[55] Two recent reports documented successful autotransplantation of mesiodens teeth with complete root formation to replace a badly broken and missing maxillary central and lateral incisor.^[8,9] In both reports, the RCT was performed 2 weeks after the autotransplantation to avoid the development of pulpal infection and subsequent periapical inflammation and root resorption.

As a general rule, the donor supernumerary incisor is extracted after the extraction of the offending tooth to minimize the extraoral time. CBCT can also be used to minimize extraoral time and damage to the root when autotransplantation is planned for a missing tooth. The donor tooth can be fabricated from CBCT scans and used as a surgical template for the preparation of a tooth socket at the recipient site.^[9]

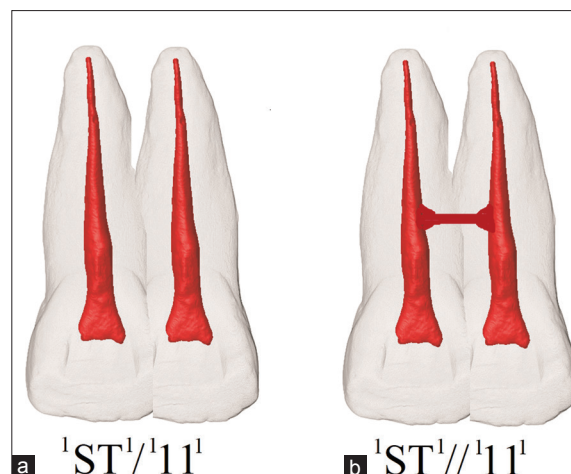


Figure 2: The application of the new system for classifying canal anomalies. (a) $1ST^1/11^1$ describes a single-rooted maxillary right central incisor (11) having a canal configuration type 1 fused to a single-rooted supernumerary tooth (ST) with a canal configuration type 1 with no intercanal communication. (other abbreviations can be used such as MeD for Mesiodens). (b) Tooth fusion with intercanal communication with the code of $1ST^1//11^1$ (one slash [/] with no intercanal communications and two slashes [/] with intercanal communications)

The success rate of autotransplantation is influenced by many factors including surgical trauma during donor removal, storage of donor tooth, manipulation of the root and socket, and proper stabilization of the donor tooth.^[9,55] Root resorptions have been reported as the most common cause of failure.^[55]

Inclusion of supernumerary teeth in a new system for classifying root and canal morphology

Recently, a new system for classifying the tooth, root, canal morphology, as well as anomalies, has been introduced.^[56-59] This new system is able to describe the root and canal morphology of any given supernumerary tooth. In addition, the new system can define the fusion of a supernumerary tooth (if present) to any given tooth type (with and without intercanal communications) [Figure 2, from Ahmed *et al.*,^[58] reproduced with permission from Wiley].

CONCLUSIONS

Supernumerary teeth present an endodontic challenge because of the wide anatomical variations including fusion with neighboring teeth with or without root canal connections, as well as the occasion of developmental anomalies in their crown and root components. Consultation with various dental specialists (such as orthodontists) is recommended when a multidisciplinary approach is required, depending on the complexity of the case. Intentional replantation of a resected normal tooth fused to a supernumerary tooth may serve as a reasonable treatment option. Supernumerary teeth are potential candidates for autotransplantation.

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Conflicts of interest

There are no conflicts of interest.

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