CLINICAL MANAGEMENT OF MANDIBULAR PERMANENT PREMOLARS WITH PERIAPICAL LESION AND BILATERAL SUPERNUMERARY TEETH: A 7-YEARS FOLLOW-UP CASE REPORT

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Objectifs: This 7-years follow-up case report describes two diversified strategies for the management of bilateral mandibular permanent premolars associated with periapical lesion and unerupted supernumerary teeth.

Case Report: A non-syndromic 9 years-old Asian female patient presented pain and swelling of the 35 in anatomical contiguity with an immature and unerupted supernumerary tooth. Clinical examination revealed an intraoral vestibular sinus tract related to the necrotic 35. Periapical radiography and CBCT showed that the 35 had an immature apex associated with a periapical lesion, and a supernumerary tooth in a lingual direction. Endodontic treatment of the 35 was performed by creating an apical plug with ProRoot MTA, while the supernumerary tooth was monitored radiographically with no intervention. Four years later, the 45 developed the same clinical condition of the left arch. Radiographic examination revealed a periapical lesion with massive periapical bone resorption, and a supernumerary tooth in normal alignment. The second premolar was herein extracted to allow for eruption of the supernumerary tooth.

Outcomes: 3-years follow-up revealed continued root maturation and its spontaneous eruption in the dental arch. Proper healing of both mandibular lesions was monitored after 10 months, 3-years and 7-years revealing no recurrence on both sides.

Keywords: Endodontics; Immature apex; mandibular premolar; MTA apical plug; Periapical disease; Supernumerary tooth

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Conflicts of interest:
The authors declare no conflicts of interest.

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PRISE EN CHARGE CLINIQUE DES PRÉMOLAIRES PERMANENTES MANDIBULAIRES PRÉSENTANT UNE LÉSION PÉRIAPICALE EN PRÉSENCE DE DENTS SURNUMÉRAIRES BILATÉRALES: UN RAPPORT DE CAS DE SUIVI SUR 7 ANS

Objectifs: Ce rapport de cas de suivi sur 7 ans décrit deux stratégies diversifiées pour la prise en charge des prémolaires permanentes mandibulaires bilatérales associées à une lésion périapicale et à des dents surnuméraires non percées.

Présentation du cas: Une patiente asiatique non syndromique de 9 ans présentait une douleur et un gonflement de la 35 en proximité anatomique avec une dent surnuméraire incluse et immature. L'examen clinique a révélé une fistule et gonflement vestibulaire intra-oral lié à la 35 nécrotique. La radiographie périapicale et le CBCT ont montré que la 35 présentait un apex immature associé à une lésion périapicale et une dent surnuméraire dans le sens lingual. Le traitement endodontique de la 35 a été réalisé en créant un bouchon apical avec ProRoot MTA, tandis que la dent surnuméraire a été surveillée radiographiquement sans intervention. Quatre ans plus tard, 45 personnes ont développé le même état clinique de l'arcade gauche. L'examen radiographique a révélé une lésion périapicale avec une résorption osseuse périapicale massive et une dent surnuméraire d'alignement normal. La deuxième prémolaire a été extraite pour permettre l'éruption de la dent surnuméraire.

Résultats: Un suivi de 3 ans a révélé une maturation continue des racines et leur éruption spontanée au niveau de l'arcade dentaire. La bonne cicatrisation des deux lésions mandibulaires a été contrôlée après 10 mois, 3 ans et 7 ans, révélant l'absence de récidive des deux côtés.

Mots clés: Endodontie; Apex immature; prémolaire mandibulaire; Bouchon apical MTA; Maladie périapicale; Dent surnuméraire.

Introduction

A supernumerary tooth, or *hyperdontia*, is an odontogenic anomaly characterized by the presence of an additional tooth beyond the normal dental formula. These aberrant structures can manifest in various locations within the dental arch, exhibiting variations in size and morphology [1]. Developmental irregularities in tooth development can result from environmental influences (pathological, general, and local factors) or hereditary factors at any developmental stage. These irregularities encompass issues related to eruption, number, size, shape, position, colour, and structure of teeth [2]. *Hyperdontia*, characterized by an excess number of teeth, occurs more frequently in the permanent dentition (1% to 3.5%), with 98% of cases observed in the anterior part of the maxilla, predominantly mesiodens in 75% of cases [3]. The prevalence varies by type and location, with upper lateral incisors representing 50%, mesiodens 36%, upper central incisors 11%, and premolars 3%. Single supernumerary teeth constitute 76-86% of cases, double supernumerary teeth account for 12-23%, and four supernumerary molars or distomolars make up 18% of cases, while multiple supernumerary teeth are rare, representing less than 1% of all cases [4, 5]. Regarding ethnicity, hyperdontia has been reported to be 1.5% to 3.5% in the permanent dentition of Caucasians [6], while in Asian populations, it is relatively higher (2.7-11.2%) [7, 8]. Etiologically, supernumerary teeth result from a multifactorial interplay of environmental and genetic factors, as reported by Rao and Chidzonga [9]. The mechanisms by which the supernumerary teeth are formed are various, but more frequently the dental lamina provides an additional follicle that gives rise to a supernumerary tooth before permanent tooth development [10]. Supernumerary teeth often remain asymptomatic and are only diagnosed incidentally during routine radiographs. Nevertheless, supernumerary teeth may also manifest within the oral cavity following a spontaneous eruption [5]. In terms of sagittal position, the predominant location for supernumerary teeth was found to be palatal/lingual (68%), followed by within the arch (25%), and buccal/labial position (7%) [5]. Supernumerary teeth can induce various complications like dentigerous cyst formation, root resorption, eruption failure, rotation, or displacement of the adjacent teeth, dilacerations, crowding and malocclusion, delayed or abnormal root development of permanent teeth [2]. Treatment may involve surgical removal if the supernumerary tooth interferes with normal tooth development or causes other dental problems. The timing of surgical removal appears to be controversial: removal of unerupted supernumeraries involves the risk of damage to adjacent structures, and the decision should be made whether to remove or monitor them with an appropriate clinical and radiographic follow-up [10]. They represent a therapeutic challenge for pedodontists, orthodontists and oral surgeons alike and therefore, interdisciplinary treatments are needed for the benefit of the patient [11]. This clinical article addresses the complexities arising from the bilateral contiguity of supernumerary teeth and the presence of a periapical lesion in immature teeth. The primary objective is to present a long-term follow-up on the diverse management of mandibular permanent premolars exhibiting periapical lesions alongside associated supernumerary teeth.

Case Report

This clinical case presents the treatment of two supernumerary mandibular premolars in a non-syndromic 9-years-old female patient of Asian origin. A signed informed consent was obtained from child parents for each procedure.

Clinical procedures were performed by a single trained operator as follows:

Tooth number 35

A sinus tract on the vestibular mucosa in area 35-36 was present with spontaneous pain and swelling concerning the mandibular left arch. By clinical examination, the tooth 35 did not respond to the thermal sensibility test, a sinus tract was noticeable and pulp necrosis was presumed. Pre-operative periapical radiographic investigation with parallel technique showed the presence of a periapical lesion located in correspondence of 35 root presenting an immature apex and a unerupted supernumerary tooth between 35 and 34. A pre-operative small FOV CBCT (Planmeca, Helsinki, Finland) was visualized with 3D Endo software (Dentsply Sirona, USA) to investigate the relation of the supernumerary with the surrounding structures. The presence of a supernumerary premolar was confirmed, with a development stage of complete crown formation only, between first and second premolar, the latter presenting an open apex associated to a large periapical radiolucency (Figures 1 and 2).

A periapical radiograph was captured on the contralateral mandibular arch, revealing the

presence of an unerupted supernumerary tooth between first and second premolar, without signs and symptoms of pathosis. Subsequent procedures involved assessing both the radicular length and the dimensions of the remaining radicular and coronal walls of the 35, while also considering potential treatment modalities. Following a comprehensive evaluation, the decision to execute the root canal treatment of first premolar was made, with the aim to promote periradicular structure healing,

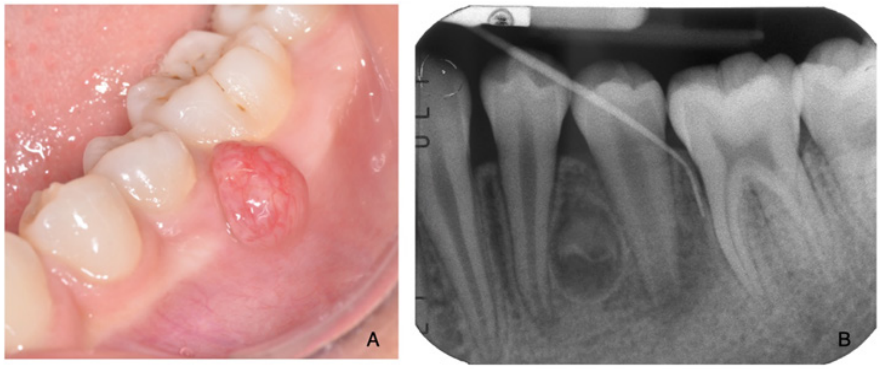

Figure 1. Preoperative intraoral photograph, showing the initial presentation of the sinus tract corresponding to 35 (A). Preoperative periapical radiograph showcasing both the supernumerary premolar and the extent of the periapical lesion before any intervention. A gutta-percha cone indicates the sinus tract (B).

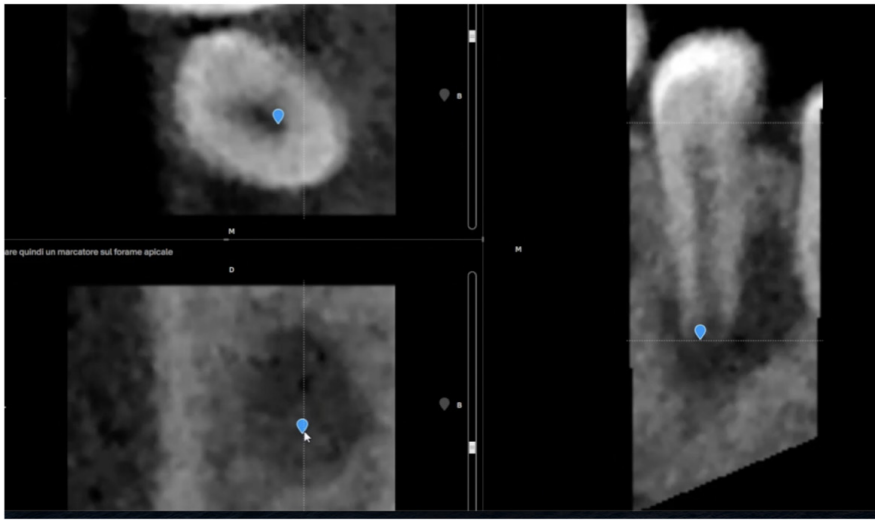

Figure 2. Small FOV preoperative Cone Beam Computed Tomography (CBCT) featuring a three-dimensional perspective of the periapical region and associated structures, including the supernumerary premolar. Supernumerary tooth associated periapical lesion and concomitant impaction of adjacent tooth in mandible.

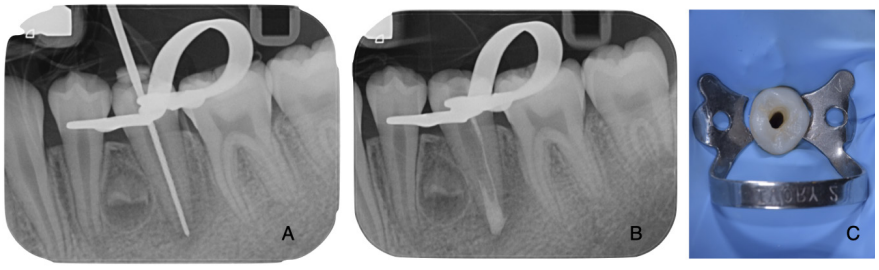

Figure 3. Series of intraoperative periapical radiographs documenting the working length confirmed radiographically (A), the apexification procedure with Mineral Trioxide Aggregate (MTA) apical plug, with a clear view of the supernumerary premolar (B). Proper isolation of the field with rubber dam is visible (C).

thereby deferring the extraction of the supernumerary tooth. After rubber dam isolation, cavity test by opening the pulp chamber with a diamond bur was negative. Canal was gently instrumented with manual k files and rotary Nickel Titanium files and continuously irrigated with 5 mL of 5% NaOCl (Niclor 5, Ogna, Muggio, Italy) and dried with sterile paper points. Working length was electronically established with an electronic apex locator (Root ZX, Morita, Tokyo, Japan) and confirmed by an intra-operative periapical radiograph. Access cavity was temporized with Coltosol (Coltene/Whaledent, Altstatten, Switzerland). At the second appointment, after 10 days, the sinus tract had healed. Manual apical gauging with stainless steel k-file was set at #100. Final irrigation protocol was as follows: 3 min 5% NaOCl, 3 min 10% EDTA (Tubuliclean, Ogna), 3 min 5% NaOCl and a final rinse with saline solution. Sterile paper points were used to reduce excess of moisture. A 3 mm apical plug (ProRoot MTA, Dentsply) was placed using MAP (Micro Apical Placement) System (Produit Dentaires SA, Vevey, Switzerland) syringe and then adapted with Thermafil plastic carriers (Denstply Sirona, Ballaigues, Switzerland) pre-calibrated at 1-2-3 mm from the WL. The quality of the filling was assessed with an intra-operative X ray and access cavities were temporized with Coltosol (Coltene/Whaledent) (Figure 3).

The mid and coronal portions of the canal were filled after 7 days with AH-Plus and a warm gutta-percha and the coronal access was definitively restored with composite resins. A signed informed consent was obtained from child parents for each procedure. Pre-, intra- and postoperative periapical radiographs were captured using the paralleling technique and exposure standardized for each tooth type to minimize radiation dose. A 10-month clinical and radiographic examination of tooth showed complete regression of periapical lesion with no signs and symptoms (Figure 4).

A post-operative CBCT was required by the surgeon to evaluate the development stage and eventually plan the extraction of the supernumerary tooth, due to its

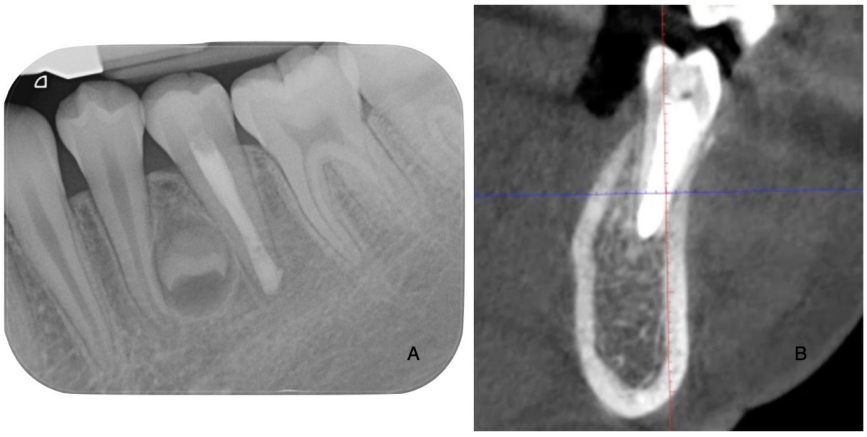

Figure 4. Follow-up periapical radiograph (A) after 10 months and representative CBCT image (B) exhibiting locations of supernumerary tooth highlighting the successful resolution of the periapical lesion, demonstrating the effectiveness of the treatment over time.

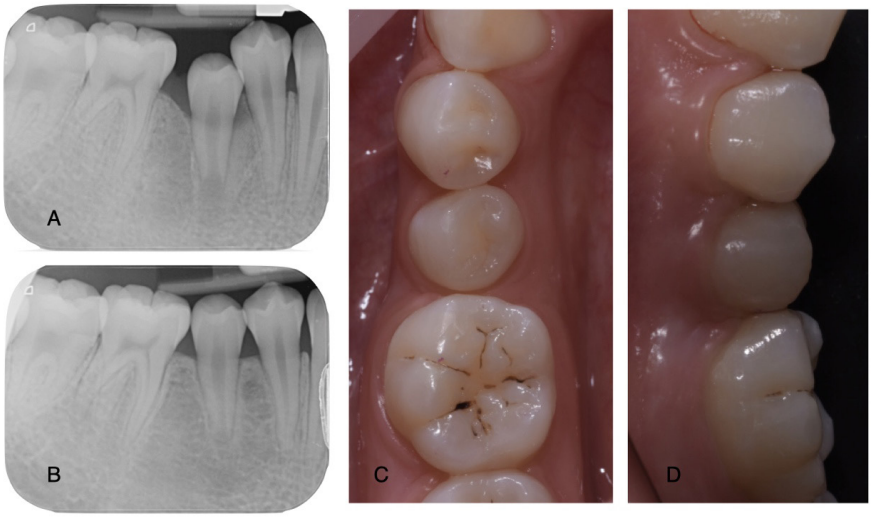

Figure 5. Follow-up periapical radiographs after 5 (A) and 7 years (B), showcasing the long-term outcomes of the apexification procedure, assessing the healing of the periapical lesion, and noting the development of the supernumerary premolar. Intraoral photographs confirming the clinical healing of the sinus tract (C, D).

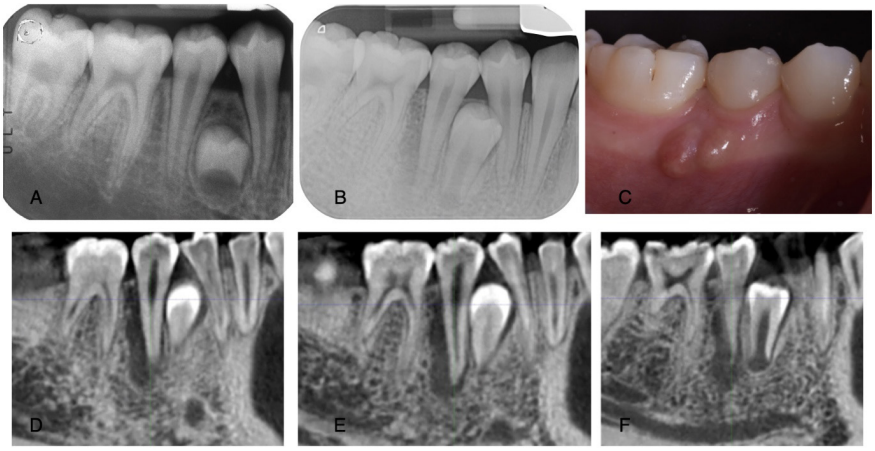

Figure 6. Preoperative periapical radiographs illustrating the contralateral premolar 45.

lingual position.After highlighting the potential complications associated with the supernumerary tooth extraction, the parents of the patient decided to maintain the teeth *in situ* with a 'wait and see' approach as a solution.

After 7-years, the periapical radiograph confirmed complete periapical healing of 35 with continued root development and an increased length and thickness of the unerupted supernumerary tooth was observed (Figure 5).

Tooth number 45

Four years after the treatment of the 35, the patient referred pain and swelling on the contralateral second mandibular premolar, the 45. A sinus tract was present on the vestibular mucosa in correspondence of the second right premolar. A digital preoperative periapical radiograph of the tooth was captured with paralleling technique, revealing a periapical lesion on the 45 and a unerupted supernumerary not fully developed tooth impacted between the two premolars. The supernumerary tooth presented a partial root formation, with an increased length and thickness compared to previous radiograph and a normal orientation. A CBCT assessment with small FOV was accomplished to evaluate the proximity of the supernumerary tooth to the adjacent relevant anatomical structures (Figure 6).

The radiographs capture the preoperative status, revealing the absence (A) and the presence (B) of a periapical lesion developed after 4 years. Intraoral photograph revealing the presence of a sinus tract (C). Series of preoperative CBCT scans showing the presence and the extension of periradicular lesion and the proximity of the supernumerary tooth (D-F). To manage the periapical lesion and to minimize the complications due to the impaction of the supernumerary tooth against both permanent premolars, the treatment plan aimed in this case

to facilitate the development and eruption of the supernumerary premolar by planning the extraction of the permanent diseased tooth. Local anaesthesia was administered using 2% mepivacaine with 1:50,000 epinephrine (Carboplyina, Molteni, Scandicci, Italy) to contribute vasoconstriction for haemostasis and to extend the duration of the anaesthetic effect, enhancing procedural efficacy. After atraumatic extraction of the second premolar with minimal hard- and soft-tissue damaging, the surgical procedure employed absorbable sutures Vicryl 5.0 (Ethicon, Jhonson & Jhonson USA), emphasizing a biocompatible closure approach and eliminating the need for suture removal and minimizing patient discomfort postoperatively (Figure 7).

Radiographic evidence of continued root development was noticed 6 months after initial evaluation and progressive root development was observed 10 months after initial treatment. Radiographic 3-year follow-up revealed that the supernumerary immature tooth was healthy with an increased root development and clinically, it resulted erupted and correctly positioned in the arch (Figure 8).

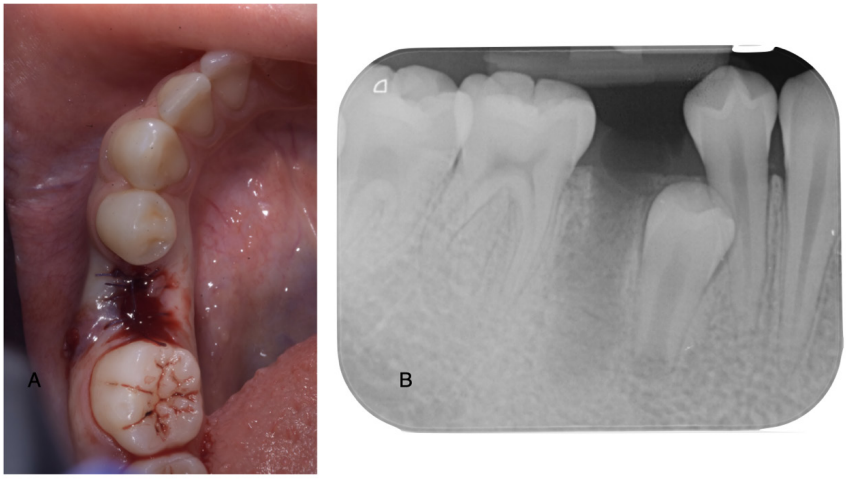

Figure 7. Immediate postoperative photograph (A) and postoperative periapical radiograph confirming the successful surgical extraction of the contralateral premolar (B). Precision and atraumatic techniques were employed to minimize tissue trauma and ensure optimal healing.

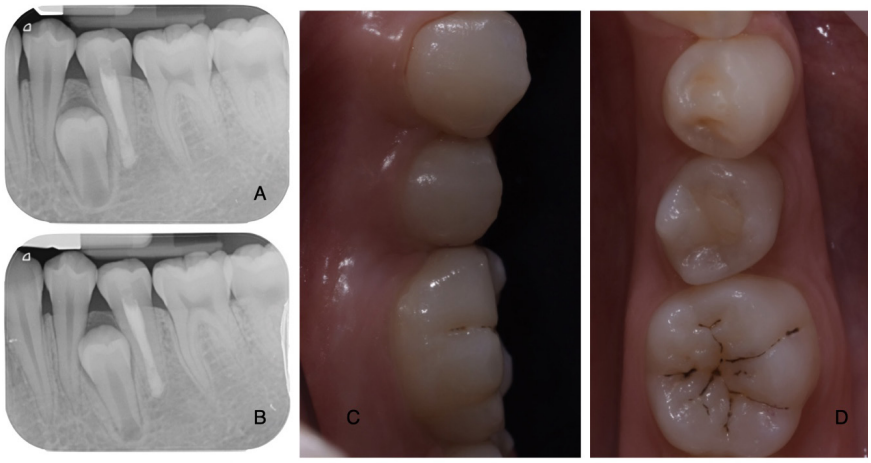

Figure 8. Radiographic evidence indicating ongoing root development at the 6-month follow-up from the initial evaluation (A), with full completion of root development observed after 3 years from the commencement of the initial treatment (B). Clinical 3-year follow-up revealed that the supernumerary immature tooth was healthy with an increased root development and correctly positioned in the arch (C, D).

Discussion

Supernumerary premolars exhibit a threefold higher occurrence in males compared to females, suggesting a potential sex-linked inheritance. The mandibular premolar region possesses the highest frequency of occurrence (74%), establishing itself as the most prevalent location for these supernumerary teeth within the mandibular arch (7%). Notably, their incidence is 1%, a rate significantly higher than previously documented [12]. In contrast, maxillary supernumerary premolars occur at a lower rate (26%) [10].

Concerning the origin of supernumerary premolars, there is an observed excessive reaction of the dental lamina. This is evident from the typical positioning of these teeth on the lingual side of the arch or vertically beneath the regular premolar teeth. This influence appears to have a genetic component, as both supernumerary premolars and premolar hypodontia are frequently observed in the mandibular arch [10]. The literature frequently mentions dentigerous cyst formation and root resorption as common complications linked to supernumerary premolars. While most of the supernumerary teeth often remain asymptomatic and are only incidentally diagnosed during a routine dental visit on radiographs, in the present case report, signs and symptoms were present, making treatment necessary. The strategies for diagnosis supernumerary teeth are by bidimensional periapical radiography, orthopantomography and CBCT scan. The parallel technique allows detection of the supernumerary tooth position in vestibulo-lingual direction [13]. CBCT scan coupled with 3-dimentional reconstruction is

used to characterize the detailed location, morphology, orientation of supernumerary teeth, and their relationship with adjacent teeth and neighboring structures [14]. Whenever symptomatic conditions related to supernumerary teeth are diagnosed, single or multiple, treatment options should be reviewed carefully. Treatment of supernumerary premolars basically involves the following options: extraction of the supernumerary premolar or maintenance of the supernumerary *in situ* with appropriate clinical and radiographic follow-up [10], postponing the extraction until the situation get worse [10].The same treatment is also indicated by another study in which the presence of complications associated with the supernumerary premolars necessitated consideration of surgical intervention as a treatment choice for these teeth. Otherwise, they should be kept under observation [15, 16]. Interestingly, in this case report, both therapeutic options were selected for the same patient, due to the different development stages of the supernumerary premolars, as well as the bony support of the affected premolars. The necrotic pulp acts as a nutrient source for pathogenic bacteria, contributing to periapical lesion formation. Root canal treatment aims to eliminate microbial infection from the root canal system by reducing bacterial load, sealing the space with gutta-percha and cement, and promoting periapical tissue restoration [16, 17]. According to the recently published S3-level clinical practice guideline of the European Society of Endodontology (ESE) [18], in patients with immature permanent teeth with pulp necrosis with apical periodontitis, the apical plug technique procedures may be considered in combination with an enhanced protocol (i.e. dental dam, antimicrobial lavage, magnification and use of a hydraulic calcium silicate cement). While this clinical case predates the publication of the S3 guidelines by the ESE, all the suggested clinical steps have been adhered to. Incomplete root development due to pulp necrosis, resulting from trauma or caries, poses challenges in controlling filling materials due to the absence of a natural constriction at the root canal's end. In such cases, where standard root canal treatment is impractical, apexification or root-end closure is recommended. The aim of this treatment is creating an apical plug to obtain a barrier to prevent the passage of toxins and bacteria into periapical tissue, although this barrier is necessary for the compaction of gutta-percha, the root filling material [19]. Recently, Hydraulic cements, such as MTA, are used in Endodontics for various procedures due to their bioactive and biocompatible properties. MTA can create an apical plug to prevent filling material extrusion [20], setting in less than 4 hours in the presence of moisture. In the present case report, MTA was used for the apical plug, reducing treatment time and promoting immediate tooth restoration to prevent fracture risk. MTA's biological properties stimulate tissue repair, evidenced by sinus tract resolution, radiographic periapical healing, and symptom relief, moreover it provides a stable seal against bacterial infiltration, allowing warm gutta-percha obturation in the remainder of the canal [21]. If the supernumerary tooth interferes with normal tooth development or causes other dental problems, treatment may involve surgical removal. The timing of surgical removal appears to be controversial: removal of unerupted supernumeraries involves the risk of damage to adjacent structures, and the decision should be made whether to remove or monitor them with an appropriate clinical and radiographic follow-up [10]. Given their complex nature, supernumerary teeth pose a therapeutic challenge requiring collaborative efforts among pedodontists, orthodontists, and oral surgeons, emphasizing the need for interdisciplinary treatments to ensure the best outcome for the patient. Once the crown of an erupting tooth appears in the oral cavity, it will still take approximately three years before root formation is complete (treatment of immature pulp), and for this reason, in the present 9 years old female patient, the root was incomplete, and the conventional root canal treatment was not possible. When the endodontic treatment is unpredictable, in view of the difficulties involved in the treatment of teeth with immature root and in presence of a supernumerary tooth, extraction was preferred. As described in the present article, the supernumerary tooth could replace the lost premolar, representing an alternative treatment for the supernumerary teeth, even misaligned teeth can be moved into proper position orthodontically.

In the context of managing a supernumerary premolar with an associated periapical lesion of the adjacent tooth, a strategic approach was herein adopted to address the condition. Recognizing the presence of the supernumerary tooth and its impact on the adjacent permanent premolar, the decision was made to facilitate the development and eruption of the supernumerary premolar by planning the extraction of the permanent tooth. This process involved a meticulous evaluation of the periapical region and the surrounding structures to ensure a comprehensive understanding of the anatomical considerations. Subsequently, a tailored extraction plan was in this case implemented, emphasizing precision to minimize any potential disruptions to the adjacent teeth and supporting structures. The extraction was executed with the aim of fostering optimal conditions for the natural growth and maturation of the permanent premolar while concurrently managing the periapical lesion through appropriate dental interventions.

The observation of a recurrence rate of 8% for supernumerary premolars after their surgical removal [22], emphasizes the crucial significance of thorough and vigilant follow-up procedures. For this reason, monitoring and regular check-ups become paramount following the initial extraction, allowing for the detection of any potential reappearance or complications that may arise. This is essential to ensure the long-term success of the intervention, addressing any issues promptly and effectively, and ultimately contributing to the overall oral health of the patient.

In summary, the case report on supernumerary premolars provides a comprehensive exploration of their occurrence, origin, complications, diagnostic strategies, and treatment options. The presented case showcases a nuanced approach involving both extraction and maintenance, addressing different developmental stages of supernumerary premolars. The intricate endodontic challenges, particularly in cases with immature apex, are meticulously addressed through apexification with MTA. The case's success is attributed to the comprehensive interdisciplinary collaboration and a tailored surgical extraction plan to optimize conditions for natural tooth development. The study emphasizes the need for careful follow-up procedures to ensure the long-term success of interventions and overall oral health.

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