

Ectopic teeth with disparate migration: A literature review and new case series

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ABSTRACT

Purpose: Ectopic eruption can be defined as the emergence of a tooth in an abnormal location, where the tooth does not follow its typical eruption pathway. While ectopic eruption within the dentate region is well-documented in the literature, ectopic eruption in non-dentate regions is relatively rare. This study aimed to report 6 cases of ectopic teeth and present a systematic review of the English-language literature on ectopic teeth, emphasizing demographic characteristics, radiographic features, potential complications, and treatment options.

Materials and Methods: A literature search was conducted using the PubMed, Medline, Web of Science, and Cochrane databases. The demographic data and radiographic findings of patients presenting with ectopic teeth were recorded.

Results: The literature review yielded 61 cases of ectopic teeth, with patients ranging in age from 3 to 74 years. The findings from these previously reported cases demonstrated that the most common location for ectopic teeth was the maxillary sinus, which is consistent with this case series. The Pearson chi-square test was performed to evaluate the correlation between age and location of ectopic teeth, and the results were found to be statistically significant ($P < 0.05$). However, no statistically significant relationship was observed between sex and the location of ectopic teeth.

Conclusion: The distinct features of these cases warrant reporting. This study presents the first case of supernumerary teeth in the condyle without any associated pathosis. Another notable characteristic is the pre-eruptive resorption of 2 inverted supernumerary teeth ectopically located in the palate, which predisposes to sinus opacification. (*Imaging Sci Dent* 2023; 53: 229-38)

KEY WORDS: Cone-Beam Computed Tomography; Maxillary Sinus; Mandibular Condyle; Tooth Eruption, Ectopic

Introduction

The term “ectopic tooth” refers to an impacted tooth that is found in an unusual anatomical position or has been displaced far from its normal location.¹ The exact cause of ectopic eruption remains unknown, but suggested factors include embryological and genetic influences, pathological processes, or iatrogenic activities. Ectopic teeth have been reported in various locations, such as the mandibular

condyle and subcondylar region, coronoid process, nasal cavity, orbit, palate, and maxillary sinus.^{2,3} These teeth may be asymptomatic for an extended period and discovered incidentally on routine radiographs, or they may be associated with pain, swelling, restricted mouth opening, or headaches.⁴ The management of an ectopic tooth can range from monitoring to removal in symptomatic individuals.¹ Although panoramic radiographs are sufficient for diagnosing ectopic teeth, cone-beam computed tomography (CBCT) may be a more effective tool for precisely determining their location, assessing any associated pathosis, and planning treatment.¹

This study aimed to present 6 previously unreported cases of ectopic teeth and to review the current literature.

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Demographic data, clinical information, and radiographic findings of 6 patients were recorded. The patients had an average age of 50, with 4 women and 2 men. Ectopic teeth were located in various locations: 2 in the maxillary sinus, 1 in the mandibular condyle, 1 in the soft tissue buccal to the maxillary tuberosity, 1 in the pterygoid plate, and 2 in the hard palate with intracoronal resorption. Due to the lack of comprehensive reviews on this condition, this study aimed to review the literature from the past 42 years to assess potential variations in clinical and/or radiographic presentations. This review of 61 cases found that the maxillary sinus was the most frequently involved region, followed by the condyle. Ectopic intranasal teeth were found in 8.06% of the cases, with a higher occurrence on the left side than on the right. Only 2 cases were observed in the coronoid and 1 in the mandibular canal. Third molars were the most commonly reported ectopic teeth, often located in the condylar region.

Materials and Methods

This article presents 6 previously unreported cases of ectopic teeth in distinct heterotopic locations. Demographic data, clinical, and radiographic findings were documented. The image quality of the cases was considered diagnostically acceptable. In addition to the case reports, electronic literature searches from 1980–2022 were conducted to identify literature related to ectopic teeth, with a focus on location, imaging modality used, radiological findings, and treatment provided by the authors (Table 1). The searches were carried out using Medical Subject Headings (MeSH terms) and keywords in the MEDLINE database (PubMed), Web of Science, and Cochrane database. Search terms included: “ectopic,” “teeth,” “sinus,” “maxillary,” “condyle,” and “mandible.” The titles and abstracts of the retrieved papers were manually screened.

Using a snowballing approach, the results of this literature search were used as the basis for new searches, employing the citation’s bibliography, authors’ names, and “related articles” as search options, as appropriate. Papers that met the following inclusion criteria were selected for the final analysis: only studies written in English were included; only human studies were considered, without any age limitation; studies assessing patients with foreign bodies, such as dental implants, and those with poor-quality images were excluded from this review. A total of 61 papers met the inclusion criteria and were selected for this study.

The project protocol was approved by the Texas A&M

University Institutional Review Board (protocol number: IRB2022-0522). All procedures adhered to the tenets of the Declaration of Helsinki.

Descriptive statistics for the case series and literature review were calculated using IBM SPSS Statistics for Windows, version 29.0 (IBM Corp., Armonk, NY, USA). The Pearson Chi-square test was employed for statistical analysis in the literature review to determine the correlation between ectopic tooth location, age, and sex. A *P*-value of <0.05 was considered significant.

Results

Case series

Case 1. A 45-year-old woman with an unremarkable medical history presented for prosthodontic treatment. Clinical examination revealed completely edentulous maxillary and mandibular arches. A CBCT scan was performed using a dedicated maxillofacial unit (Galileos; Sirona Dental Systems, Germany) with settings of 98 kVp, 6 mA, 4.9 seconds exposure time, 0.2 mm voxel size, and a 15 cm × 15 cm field of view (FOV). Axial, coronal, and sagittal CBCT images showed a tooth-like mass in the superior third of the left maxillary sinus, with no evidence of associated mucosal thickening. In the axial view, the mass was positioned horizontally, with its crown abutting the posteromedial border of the sinus, while the sinus border remained intact. The patient was asymptomatic, and the aforementioned radiographic finding was discovered incidentally (Fig. 1).

Case 2. A 61-year-old woman presented with mild, intermittent pain at the site of the maxillary left third molar, which increased while chewing food. The patient did not report any history of trauma, surgery, or developmental anomalies. A CBCT study was obtained (iCAT™; Imaging Sciences International, Hatfield, PA, USA) at 120 kVp, 5 mA, 20-second exposure time, 0.3 mm voxel size, and 16 cm × 13 cm FOV. CBCT imaging in the axial, coronal, and sagittal planes revealed the absence of the maxillary left third molar in the alveolar bone. However, a tooth-like density was observed in the soft tissue buccal to the left maxillary tuberosity and adjacent to the lateral pterygoid plate. The buccal cortical plate remained intact. The tooth was horizontally oriented, with the crown facing outward in the axial and coronal views. The root of the tooth was not fully developed, which was a notable feature in this case; nevertheless, the tooth erupted into the oral cavity (Fig. 2).

Case 3. A 28-year-old man presented for extraction of

Table 1. A summary of the literature on ectopic teeth, presenting their location and radiographic features

Authors and year	Imaging modality	Location and radiographic findings
Burton and Scheffer 1980 ¹⁶	Panoramic	Third molar associated with a dentigerous cyst in the subcondylar region
Golden et al. 1981 ¹⁷	Panoramic	Molar teeth in the maxillary sinus
Choung 1984 ¹⁸	Panoramic	Molar teeth in the maxillary sinus
Srivastava and Sing 1982 ¹⁹	Panoramic	Inverted third molar in the condyle
Freedland and Henneman 1987 ²⁰	Waters'	A high-density entity associated with a dentigerous cyst in the maxillary sinus
Chongruk et al. 1991 ²¹	Panoramic	Ectopic tooth in the left coronoid with no pathosis
Bux and Lisco 1994 ²²	Panoramic	Displaced third molar associated with dentigerous cyst in the condyle
Vele et al. 1996 ²⁴	Panoramic	Dentigerous cyst associated with supernumerary tooth in the maxillary sinus
Erkmen et al. 1998 ²⁵	Panoramic, Waters'	Supernumerary tooth in the floor of the left maxillary sinus
Alexandrakis et al. 2000 ²⁶	CT	Two teeth within the right inferior meatus compressing the nasolacrimal duct
Medici et al. 2001 ²³	Panoramic	Displaced third molar associated with dentigerous cyst in condyle
Goh 2001 ²⁷	Waters'	Ectopic molar in the anterosuperior aspect of the right maxillary sinus
Kamei et al. 2001 ²⁸	Panoramic	Bony ossicle containing an ectopic molar in the left maxillary sinus
Tümer et al. 2002 ²⁹	Panoramic, lateral	Impacted molar associated with a dentigerous cyst in the subcondylar area
Wassouf et al. 2003 ³⁰	Panoramic, CT	Rotated crown in condyle with a lucent cystic lesion with buccal perforation
Suarez-Cunquero et al. 2003 ³¹	Panoramic, CT	Inverted molar in the condyle with an osteolytic lesion in the ascending ramus
Büyükkurt et al. 2005 ³²	Panoramic, CT	Circular opacity resembling a tooth enclosed by soft tissue mass in the left sinus
Srinivasa Prasad et al. 2007 ³³	CT	Perforation of medial and posterior walls of the sinus
Altun et al. 2007 ³⁴	CT	A high-density area in the lateral wall of the maxillary sinus
Avitia et al. 2007 ³⁵	CT	Dentigerous cyst in the maxillary sinus associated with an ectopic molar
Salmeron et al. 2008 ³⁶	Panoramic, CT	Third molar associated with a cyst in the subcondylar region
Litvin et al. 2008 ³⁷	CT	Dentigerous cyst of maxilla displacing tooth into the orbital floor
Wang et al. 2008 ³⁸	Panoramic, CT	Downward and outward crown position in proximity to the cortex of the ramus
Sembronio et al. 2009 ⁴⁰	Panoramic, CT	Third molar with multilocular odontogenic keratocyst expansion of the cortical bones
Lamb et al. 2009 ⁵⁶	CT	Ectopic molar in the roof of maxillary sinus associated with mucocele
Buyukkurt et al. 2010 ³⁹	CBCT	Third molar along the roof of the left sinus associated with a cyst
	CT	Ectopic canine along the roof of the left sinus
	CBCT	Third molar with a soft tissue mass
Gadre and Waknis 2010 ⁴¹	Panoramic	Inverted molar with an osteolytic lesion in the left condyle
Saleem et al. 2010 ⁴²	CT	Opacification of the left maxillary sinus, high-density body in the center of the antrum
Bortoluzzi and Manfro 2010 ⁴³	Panoramic	Third molar in the right condyle with a lytic lesion
Pace et al. 2010 ⁴⁴	Panoramic, CT	Inverted molar with lucent lesion surrounding the crown in the condylar region
Iglesias-Martin et al. 2012 ⁴⁵		
Nisa and Giger 2011 ⁴⁷	CT	Mucocele in the osteomeatal complex
Beriat et al. 2011 ⁴⁸	CT	High attenuation along the floor and posterior wall of the maxillary sinus
Kim 2011 ⁴⁹	CBCT	High attenuation along the floor and posterior wall of the maxillary sinus
Mohan et al. 2012 ⁴⁶	Panoramic	Third molar at superomedial aspect of right maxillary antrum
Kasat et al. 2012 ⁵⁰	Panoramic, CT	Cystic lesion surrounding the crown of impacted molar in the maxillary sinus
Shivashankra et al. 2012 ⁵¹	Panoramic	Impacted molar with a radiolucency surrounding the crown in the condylar region
Clementini et al. 2012 ⁵²	Panoramic, CT	Radiopaque entity in maxillary sinus and floor
Rai et al. 2013 ⁵³	CT	Ectopic molar posteroinferior to the floor of the orbit
Lai et al. 2013 ⁵⁴	CT	Ectopic tooth in the posterolateral wall of the sinus with cusps pointing laterally
Guruprasad et al. 2013 ⁵⁵	CT	Ectopic molar along the floor of right sinus associated with dentigerous cyst
Ramanojam et al. 2013 ⁵⁷	Panoramic	Ectopic teeth associated with cystic lesions occupying the entire maxillary sinus
Lambade et al. 2013 ³	Lateral oblique	Ectopic tooth in condyle with osteomyelitic changes
Kashyap et al. 2014 ⁵⁹	CT	Ectopic tooth in the maxillary sinus associated with an oroantral fistula
Mermod et al. 2014 ⁶⁰	Panoramic, CT	Hyperdense entity in the floor of the sinus consistent with an ectopic molar
Agarwal et al. 2014 ⁶¹	CT	Radio-opaque mass located in the left nasal cavity in the inferior turbinate
Kayabasoglu et al. 2015 ⁵⁸	CT	Complete opacification of right maxillary sinus associated by an ectopic molar
Soğur et al. 2015 ⁶³	CBCT	Ectopic tooth in the roof of the right sinus associated with a dentigerous cyst
Aydi et al. 2016 ⁶²	CT	Ectopic tooth along the inferior portion of the left sinus with an osteoma
Farhangi et al. 2017 ⁶⁴	CT	Impacted canine, in the left inferior turbinate with deviation of the nasal septum
Elmorsy et al. 2020 ⁶⁵	CBCT	Hyperdense lesion surrounding the crown in the maxillary sinus
Akbas et al. 2022 ⁶⁶	Panoramic, CBCT	Ectopic premolar teeth located in the mandibular canal

CT: computed tomography, CBCT: cone-beam computed tomography

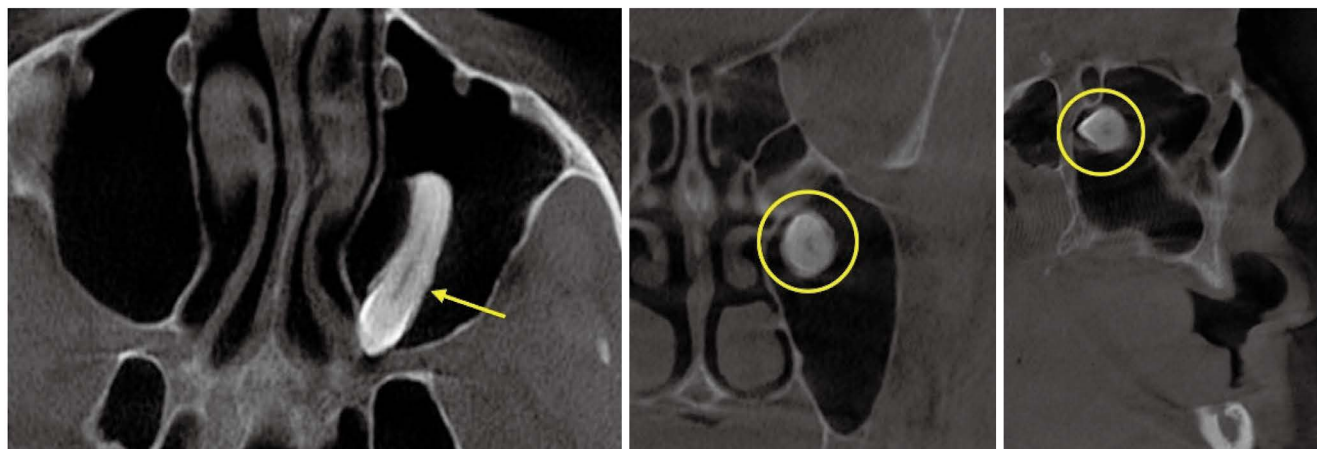


Fig. 1. Axial, coronal, and sagittal cone-beam computed tomographic images demonstrate an ectopic tooth in the superior portion of the left maxillary sinus.

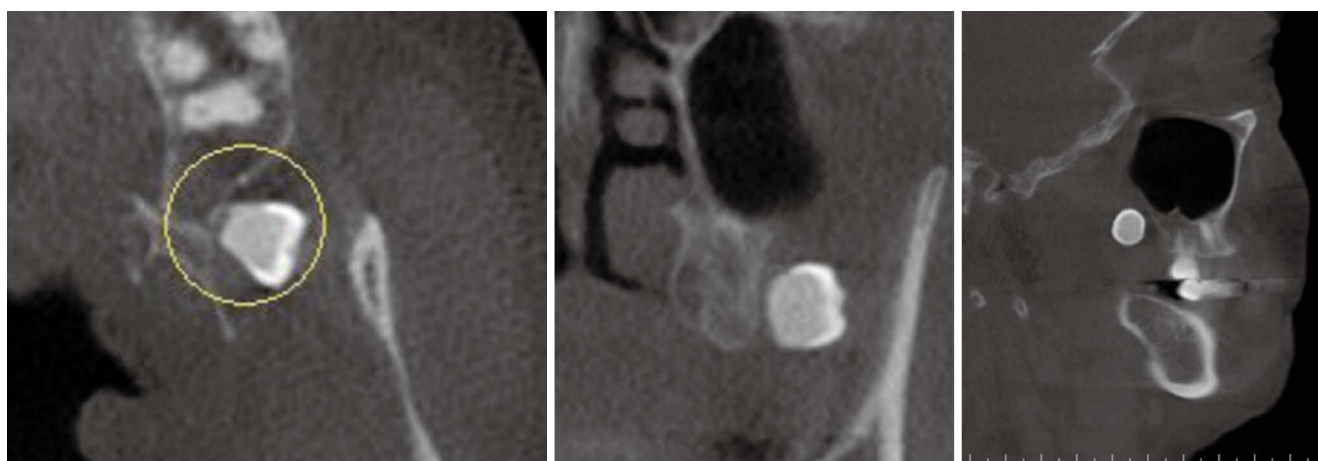


Fig. 2. Axial, coronal, and sagittal cone-beam computed tomographic images depict an ectopic left maxillary third molar buccal to the maxillary tuberosity.

his mandibular left second molar. A panoramic radiograph revealed an incidental finding of a tooth-like radiopacity in the left mandibular condyle, with no evidence of cystic pathology. The tooth was aligned along the long axis of the condylar neck, with its crown oriented towards the condylar head. The borders of the condyle remained intact. The patient had a full complement of teeth, except for the mandibular left third molar. However, the ectopic tooth's morphology and size differed from that of the third molar. Instead, it resembled a premolar in morphology, suggesting a supernumerary tooth (Fig. 3).

Case 4. A 66-year-old man presented with pain in the left temporomandibular joint (TMJ) opening and a decreased range of motion. Clinical findings warranted further investigation through a CBCT imaging study.

A CBCT scan was conducted using a Sirona ORTHOPHOS® XG 3D unit (Bensheim, Germany) at 85 kVp, 6 mA, with a 14-second exposure time, 0.16 mm voxel size, and an 81 mm × 81 mm FOV. Axial, coronal, and sagittal CBCT images revealed an impacted microdont maxillary left third molar, which appeared ectopic without any evidence of cystic pathology. In the axial view, the tooth was positioned obliquely, with its crown facing posteriorly and medially. The crown and coronal middle-third of the root were situated almost in the superior portion of the pterygoid body. The third molar's root was dilacerated, and the apical third of the root aligned along the floor of the maxillary sinus. The tooth appeared to be passing through the greater palatine canal (Fig. 4).

Case 5. A 50-year-old woman presented for prosthodon-

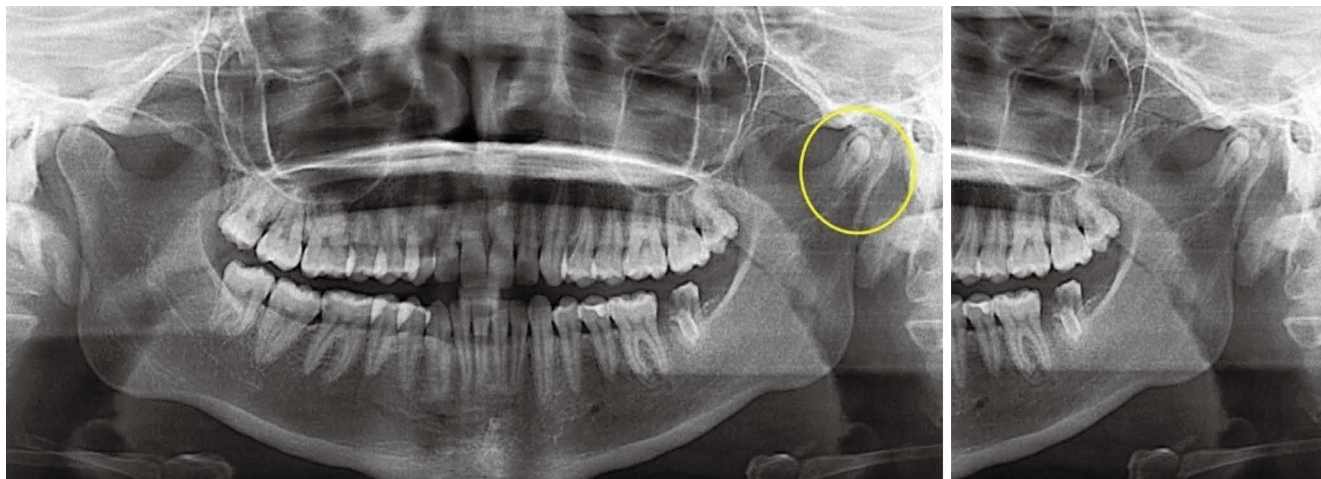


Fig. 3. Panoramic image reveals an ectopic supernumerary in the left mandibular condyle.

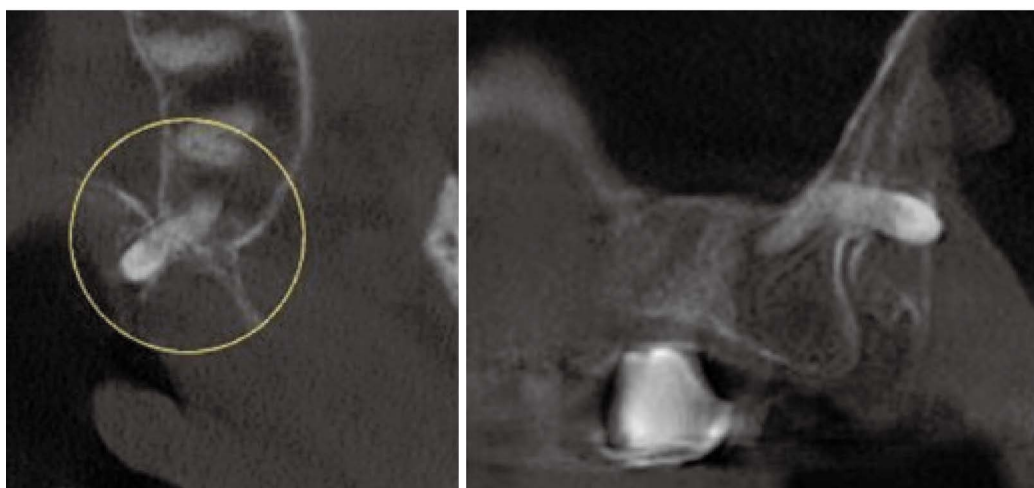


Fig. 4. Axial and sagittal cone-beam computed tomographic images demonstrate an ectopic left maxillary third molar with a dilacerated root.

tic treatment. A CBCT scan was obtained (3D Accuitomo 170 dental CBCT unit; J. Morita, Kyoto, Japan) using a 100 mm × 50 mm FOV at 90 kVp, 8 mA, 30.8-second exposure time, and 0.25 mm voxel size. Axial, coronal, and sagittal CBCT images revealed 2 supernumerary impacted ectopic teeth situated in the right and left sides of the hard palate, aligned along the respective floors of the nasal fossae. These teeth were positioned horizontally, with their long axes parallel to the axial plane, and their crowns facing posteriorly and laterally, abutting the medial walls of the bilateral maxillary sinuses. The roots pointed anteriorly and toward the midsagittal line of the hard palate. Pre-eruptive resorptive defects involving the crown and root structures were evident in both ectopic teeth, with possible communi-

cation with the adjacent sinus. Soft tissue opacification was observed in the right maxillary sinus (Fig. 5). The patient was asymptomatic, and the ectopic teeth were an incidental finding.

Case 6. A 71-year-old woman presented for endodontic treatment. She had no significant medical history. A CBCT scan was obtained (iCAT™; Imaging Sciences International, Hatfield, PA, USA) using the following parameters: 120 kVp, 5 mA, 20-second exposure time, 0.3 mm voxel size, and a FOV of 16 cm × 13 cm. The axial, coronal, and sagittal CBCT images revealed an ectopic microdont right maxillary third molar embedded along the posterolateral wall of the right maxillary sinus, with an intact sinus wall. In the sagittal plane, the tooth was



Fig. 5. Axial and coronal cone-beam computed tomographic images depict 2 supernumerary ectopic teeth (circle) with resorptive defect (arrow).

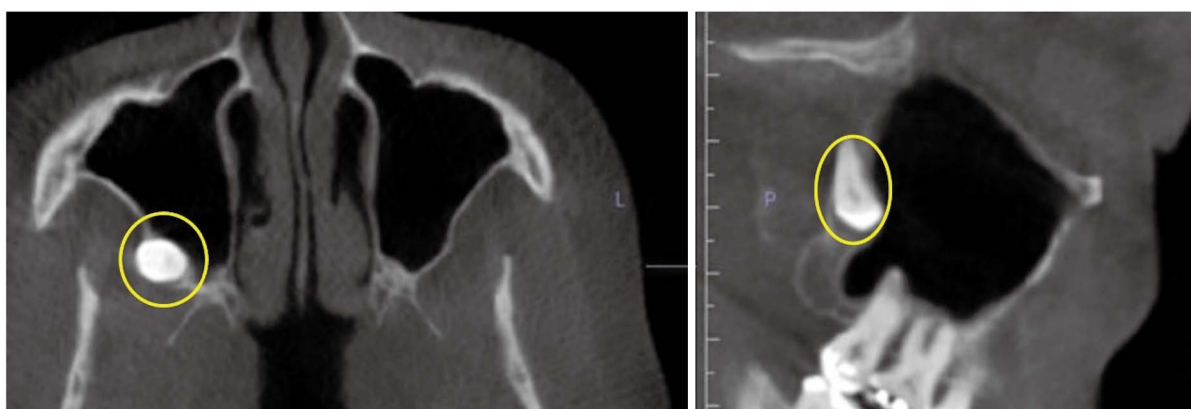


Fig. 6. Axial and sagittal cone-beam computed tomographic images demonstrate an ectopic tooth along the posterior aspect of the right maxillary sinus (circle).

positioned vertically, with the crown facing the occlusal plane (Fig. 6).

The radiographic features in all 6 cases indicated a diagnosis of ectopic teeth, as they exhibited tooth-like densities of enamel, dentin, and pulp tissue. Management options for ectopic teeth can vary, ranging from observation and follow-up evaluations without treatment to extraction in cases with symptoms. The patients were referred to oral surgery for suitable management.

In this case series, the median age of participants was 50 years, with a female predominance of 57.1% (4 females and 2 males). This series was notable for the presence of an ectopic tooth in the condyle, as well as 2 impacted ectopic teeth exhibiting pre-eruptive resorption, a rare complication, in the hard palate.

Literature review

Upon comparing the data gathered from previous literature reviews with that obtained in this series, the following

observations were made. A statistically significant correlation was found between the location of ectopic teeth and age, with a P -value of 0.035 ($P < 0.05$). However, no correlation was identified between sex and the location of the lesions ($P > 0.05$). In the 61 cases with 62 ectopic teeth that were reviewed, 46% were in female patients and 54% were in male patients. This contrasts with the present case series, where there was a higher frequency of female patients. As the number of documented cases in this series is limited, the sex predilection may shift as the number of cases increases.

The age range of the patients spanned from 3 to 74 years, with a median age of 32 years. The largest proportion of diagnoses occurred between the third and fifth decades of life.

Out of 61 cases reviewed, the maxillary sinus was most frequently involved (61.29%; $n = 38$), followed by the condyle (24.19%; $n = 15$), which is consistent with the present case series. Ectopic intranasal teeth were identified in

8.06% (n = 5) of cases; when comparing their positions in the nasal cavity, 4 were in the left and 1 in the right nasal cavity. Only 2 cases were observed in the coronoid (3.22%; n = 2), and 1 in the mandibular canal (1.61%). There was a higher prevalence of ectopic eruption of third molars. In the condylar region, all 15 cases reviewed from the literature involved third molars and were associated with pathosis. Various imaging techniques, including panoramic radiography, Waters' view, computed tomography, and CBCT, were utilized in the cases included in this review.

The radiographic features of ectopic teeth revealed high-density entities suggestive of teeth. Out of the 61 reviewed cases of ectopic teeth, 22 were associated with periapical pathosis, with dentigerous cysts being the most common. One case of odontogenic keratocyst was also observed, with histopathological confirmation. Other complications associated with ectopic teeth were compression of the nasolacrimal duct, opacification of maxillary sinuses, mucocele and osteomyelitis, and perforation of the cortices (Table 1).

Discussion

Advancements in technology have led to the incidental discovery of ectopic teeth in asymptomatic patients, as demonstrated in this case series. The overall incidence rate of ectopic tooth eruption in non-dentate regions is relatively low. Recently, ectopic teeth have been sporadically observed in uncommon locations, such as the maxillary sinus, mandibular condyle, coronoid process, orbital and nasal cavities, and skin.⁵

The etiology of ectopic eruption remains a subject of debate, with various theories proposed by different investigators. Odontogenesis, a complex multistep process involving interactions between the oral epithelium and underlying mesenchymal tissue, can result in ectopic tooth eruption if abnormal tissue interactions occur. Some researchers have suggested that developmental disorders, trauma, infection, pathological disorders, and genetic factors may be probable causes for ectopic eruption of teeth.⁶ In 1962, O'Meara⁷ proposed that insufficient inter-canine and anteroposterior growth of the jaws, or disturbances in the differential growth patterns of an individual, were the most significant contributing factors to ectopic eruption. Another hypothesis, put forth by Anthonappa et al.,⁸ suggests that ectopic eruption of a tooth bud or germ could be due to abnormal migration of neural crest cells. Some cases may develop from aberrant, extra-odontogenic epithelium. Finally, developmental atavism may also contribute to the formation of an ectopic tooth.⁹

Ectopic teeth in the condylar region are relatively uncommon. The majority of cases reported in the literature involve mandibular third molars associated with pathologies such as cysts or tumors.⁶ Findik and Baykul,¹⁰ in their review of 23 articles, found that in their study of 23 articles, all ectopic teeth in the condyle were mandibular third molars associated with radiolucent pathologies. Tooth bud displacement can occur due to pressure from progressive cystic lesions, such as dentigerous cysts, resulting in tooth dislocation. This study presents an intriguing finding—namely, the displacement of a supernumerary tooth in the left condyle without any associated pathologies. In this case, the displacement was idiopathic, with no clear etiology. In their extensive literature review, Törenek and Akgül⁶ reported a case in which a premolar was dislocated in the sigmoid notch without an associated cyst or tumor. However, to date, there has not been a single reported case of a supernumerary ectopic tooth in the condyle without any pathologies, making this case unique.

Pathologic root resorption of permanent teeth is a complex process. Root resorption of adjacent teeth as a result of ectopic teeth is well documented in the literature,¹¹ but resorption of the ectopic teeth themselves is a rare phenomenon. This study reports a case of pre-eruptive resorption in 2 ectopic supernumerary teeth located in the palate. To the best of the authors' knowledge, this specific case may be the first of its kind, involving pre-eruptive resorption in 2 ectopically erupted supernumerary teeth.

An intranasal site of ectopic eruption is an exceedingly rare location with a male predominance. The etiology of ectopic teeth in the ethmoid sinus remains unclear; however, some authors have reported its occurrence during tooth development when the dental sac in the maxilla is inserted into the nasal cavity prior to palatal closure, or due to defects in the migration of neural crest cells.^{12,13}

The diagnosis of ectopic teeth typically relies on clinical observations and relevant radiologic features. Imaging tests, primarily CBCT imaging, provide crucial radiographic characteristics that aid in differential diagnosis. Common considerations in the differential diagnosis of ectopic teeth include foreign bodies, antroliths, odontomas/osteomas, teratomas, and supernumerary tooth germs in ectopic locations.¹⁴ Imaging tests serve not only to confirm the diagnosis but also to evaluate potential associated pathologies, determine the precise position of the ectopic teeth, and inform the most suitable treatment planning. Management strategies depend on the position of the ectopic teeth and possible complications, such as displacement or resorption, malocclusion, related pathoses, and infections. Caldwell Luc

and endoscopic techniques are used to evaluate patients with maxillary sinusitis and rhinological symptoms.^{5,15} In 2021, Calliet et al.⁴ conducted a meta-analysis to identify the preferred surgical method for removing ectopic mandibular third molars. They concluded that the intra-oral approach was generally favored, with the exception of cases involving condylar/subcondylar locations, high positions in the ramus, or the lower border of the mandible. These regions, which are difficult to visualize via the intra-oral approach or present with cutaneous fistula, may necessitate an extra-oral approach. Potential complications of the extra-oral approach include scar formation, damage to the marginal mandibular branch of the facial nerve, or injury to the parotid capsule. A limited visibility approach may also result in nerve damage or an increased risk of mandibular fracture. To prevent fractures in these regions, osteosynthesis with mini plates is recommended. For ectopic teeth located in the condylar region, a preauricular or transmaseteric approach is advised to reduce surgical morbidity. However, caution should be exercised due to the thin bone and increased vulnerability to fracture in the condylar region.¹⁴

The management of ectopic teeth ranges from monitoring to orthodontic tooth repositioning to tooth extraction.¹ Ectopic teeth can be potentially harmful, and if left untreated, they may lead to odontogenic cysts/tumors or infections that could spread to the deep facial spaces. Therefore, early diagnosis and management are crucial for effective treatment. Regular periodic follow-up and observation are essential for asymptomatic ectopic teeth. This report presents a case series of ectopic teeth in various heterotopic positions, showcasing unique findings. Additionally, a literature review is provided to discuss demographics, diagnosis, potential complications, and radiographic findings.

Conflicts of Interest: None

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