Inverted Maxillary Third Molar Impaction within the Maxillary Sinus: A Rare Case Report

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Financial support: None declared
Conflict of interest: None declared

Patient: Male, 48-year-old
Final Diagnosis: Inverted impaction within the maxillary sinus
Symptoms: Asymptomatic
Clinical Procedure: —
Specialty: Dentistry

Objective: Unusual clinical course

Background: The maxillary third molar is considered one of the most impacted teeth and can present in different types based on the direction and depth of the impaction. However, the inverted type of maxillary third molar impaction is a rare condition, with few reported cases in the current literature.

Case Report: We report an extremely rare case of a 48-year-old man with an inverted maxillary third molar situated in the maxillary sinus in direct contact with the posterior wall of the sinus, with a portion of the coronal part perforating the infratemporal fossa. Because of the anatomical and structural complexity of the impaction and because the tooth has never been symptomatic, the case was conservatively managed after weighing the risks and benefits of surgical intervention. A 2-year follow-up was made to ensure no changes in the impaction location, confirming the validity of the conservative approach.

Conclusions: This case is the first reported inverted maxillary third molar impacted in such an anatomical location. This reported case contributes to existing knowledge regarding this rare type of impaction and that this rare impaction location can present congenitally with a non-iatrogenic origin. A thorough dental history and clinical and radiographical examinations will aid dental professionals in their clinical decision making for patients with similar presentations.

Keywords: Dentistry • Maxillary Sinus • Conservative Treatment

Abbreviations: CBCT – cone-beam computed tomography; VCT – volumetric computed tomography; CT – computed tomography

Full-text PDF: https://www.amjcaserep.com/abstract/index/idArt/941859
Background

The failure of a tooth to erupt into its final position in the dental arch within the expected time frame is defined as tooth impaction [1]. The normal process of tooth eruption could be interrupted by an adjacent tooth, dense overlying alveolar bone, thick soft tissue, insufficient space due to inadequate arch length, or genetic abnormalities. Therefore, these unerupted teeth are retained impacted unless surgical interventions are attempted to expose or remove them. Mandibular third molars are reported to be the most frequently impacted teeth, followed by maxillary third molars, maxillary canines, and mandibular premolars. Because third molars are the last teeth to erupt, they tend to be the most impacted teeth due to the inadequate space available for eruption [1].

The impacted maxillary third molar presents radiographically in various angulations and positions within the alveolar bone. In terms of angulation, vertical impaction is counted 63% of the time, while distoangular and mesioangular impactions are counted 25% and 12% of the time, respectively. Some rare positions, such as inverted, transverse, and horizontal, are present in less than 1% of cases [1,2].

The difficulty of surgical removal is determined based on the depth of the impaction compared with the height of the adjacent second molar. Class A impaction occurs when the occlusal surface of the impacted tooth is at the level of the occlusal plane of the second molar. Class B impaction implicates an impacted tooth with an occlusal plane between the occlusal and cervical lines of the adjacent molar. Class C impaction occurs when the occlusal plane of the impacted tooth is lower than the cervical line of the adjacent molar [2].

Third molar impaction removal is the most common surgical operation performed by oral and maxillofacial surgeons. However, the challenge is to decide on the appropriate management rather than the treatment. The decision of whether an impacted third molar should be removed depends on a variety of factors. Clinicians should weigh the risk–benefit ratio of retaining the impaction versus surgical removal to reach a systematic, patient-oriented approach for optimal management [3].

This reported case of the maxillary third molar was an inverted impaction, which is an extremely rare type of impaction [2,4-6]. In addition, the interesting original anatomical location of the tooth within the maxillary sinus makes it the first reported case in such a position with a non-iatrogenic origin.

Case Report

A 48-year-old man presented to the oral and maxillofacial surgery clinic with pain in the upper left posterior teeth for the past 10 days. His past medical, family, and psychological histories were discussed, and there were no relevant findings. The patient’s past dental history included the removal of all third molars except the maxillary left third molar, as it was not present clinically. A dental clinical examination was performed, and an orthopantomogram was obtained. A radiolucent

Figure 1. Orthopantomogram showing the inverted maxillary left third molar.
periapical lesion related to the upper left second molar roots was observed, indicating a periapical infection that was later treated to resolve the infection and relieve the patient’s symptoms (Figure 1).

Upon radiographic examination, an inverted maxillary third molar was observed in the orthopantomogram. Therefore, initial imaging was obtained with cone-beam computed tomography (CBCT; Figure 2). The patient denied any prior attempt to remove this impacted tooth, which excluded tooth displacement due to iatrogenic reasons. This was confirmed by an old orthopantomogram before the extraction of the other third molars over 10 years ago, with the upper left third molar in the same inverted position (Figure 3). Additional volumetric computed tomography (VCT) for facial bones was obtained for the more accurate localization of the impaction (Figure 4). The impacted third molar was congenitally located in the posterior wall of the maxillary sinus, with part of the coronal portion perforating the soft tissue of the infratemporal fossa (Figure 5). Informed consent was obtained from the patient to publish his case and radiographs.

Clinical Management

The surgical procedure to remove the inverted impaction through transinusal access was proposed. However, considering the patient age, asymptomatic history of the impacted tooth, and the possible surgical complications due to the impaction position and location, the patient and the clinician opted to keep the tooth in situ. A 2-year follow-up was made to rule out changes in the impaction location by comparing the images obtained by CBCT with the partial comparison analysis.
program 3-matic Research 13.0 (Materialise NV, Belgium) software tool (Figure 6). The comparison revealed no changes in the location of the impaction over 2 years.

Discussion

The inverted presentation of the maxillary third molar is very rare, with few reported cases in the current literature [2-16] (Table 1). An inverted impaction is discovered radiographically when the crown of the third molar faces up toward the maxillary sinus, while the apex of the root points down toward the crest of the alveolar ridge [3-5]. The etiology of the inverted position is unclear. Abnormal or atypical odontogenic epithelium proliferation before the development of a tooth germ can cause tooth inversion [17]. Impactions of this type remain in their positions for years without manifesting clinically [4]. Rarely, that could lead to resorption of the adjacent tooth or cause serious complications, such as an ectopic eruption into the nasal floor or the development of a pathological lesion [6]. The location of the inverted impaction challenges surgical manipulation and removal, as there is a chance that the tooth will be dislodged into the maxillary sinus floor, orbital floor, infratemporal fossa, or temporal space, which complicates the surgical procedure [2].

The exact etiology of impacted teeth in the maxillary sinus is also unclear. Any interruption of the tooth development process, developmental anomalies, crowding of dentition, trauma, or iatrogenic predispositions can cause the impaction in the maxillary sinus. In some cases, the impaction has an idiopathic etiology [18].

This rare form of impaction is the first reported case of maxillary third molar impaction in such an inverted, rare anatomical position with an idiopathic origin. The inverted maxillary third molar impaction is congenitally located in the thick posterior wall of the maxillary sinus, with part of the coronal portion perforating into the infratemporal fossa.

The posterior wall of the maxillary sinus is formed by the body of the superior portion of the maxilla and contains the alveolar canal, which transmits the posterior superior alveolar vessels and nerves to the posterior teeth. The infratemporal fossa lies behind the posterior wall of the maxillary sinus [19].

In a systemic research study conducted by Mavriqi et al, a total of 34 cases were reported for third molars located in the maxillary sinus, with associated symptoms such as headache, sinusitis, facial pain, or totally asymptomatic. They reported the most common locations of the maxillary third molar in the maxillary sinus as presented at the posterior wall.
Figure 6. A 2-year follow-up scans for locational change. (A) Initial tooth location, (B) tooth location after 2 years, and (C) part comparison analysis showing complete superimposition of the 2 scans.

Table 1. Reported cases of inverted maxillary third molar impactions in the current literature.

<table>
<thead>
<tr>
<th>Authors</th>
<th>Year</th>
<th>Number of reported cases</th>
<th>Management of inverted maxillary impaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold J and Demby N</td>
<td>1973</td>
<td>Single case - First reported</td>
<td>Surgical removal of the impaction and the attached dentigerous cyst</td>
</tr>
<tr>
<td>Held HW</td>
<td>1979</td>
<td>Single case</td>
<td>Surgical removal</td>
</tr>
<tr>
<td>AlShamrani SM</td>
<td>2001</td>
<td>Two cases</td>
<td>Conservatively managed</td>
</tr>
<tr>
<td>Pai V, et al</td>
<td>2008</td>
<td>Single case</td>
<td>Conservatively managed</td>
</tr>
<tr>
<td>Yuvaraj and Agarwal GD</td>
<td>2011</td>
<td>Single case</td>
<td>Trans-alveolar surgical extraction</td>
</tr>
<tr>
<td>Chhabra S, et al</td>
<td>2012</td>
<td>Single case</td>
<td>Removal by lateral transposition method</td>
</tr>
<tr>
<td>Togoo RA</td>
<td>2013</td>
<td>Single case</td>
<td>No treatment</td>
</tr>
<tr>
<td>Ching-Yi C, et al</td>
<td>2014</td>
<td>Single case</td>
<td>Trans-alveolar surgical extraction</td>
</tr>
<tr>
<td>Kaur S and Singh R</td>
<td>2018</td>
<td>Single case</td>
<td>Conservatively managed</td>
</tr>
<tr>
<td>Agarwal P, et al</td>
<td>2019</td>
<td>Five cases</td>
<td>Two managed surgically – three conservatively managed</td>
</tr>
<tr>
<td>Faraz A, et al</td>
<td>2020</td>
<td>Single case</td>
<td>Trans-alveolar surgical extraction</td>
</tr>
</tbody>
</table>
(24.13%), lateral wall (22.41%), medial wall (18.96%), inferior wall (17.24%), orbital floor (15.51%), and rarely at the anterior wall (1.72%) of the sinus [20].

The risk-benefit ratio was assessed before making a decision about the management of this case. Although maxillary impacted tooth displacement into the maxillary sinus or infratemporal fossa is rare [21], this case displayed a considerable risk of tooth displacement into these spaces due to its position within the sinus. The high position and complex relationship of this impacted third molar with the posterior wall of the maxillary sinus complicates the surgical procedure, and the accessibility to the tooth in such an inverted position is very challenging, with high morbidity [22]. The procedure comprises a significant number of complications: displacement of the tooth into the sinus, sinus membrane perforation, and bleeding are possibly encountered intraoperatively. Postoperative complications can include the risk of infection spreading due to the existing sinusitis, which can prolong the healing process [23].

The displacement of the inverted impacted tooth into the infratemporal fossa or temporal fossa is another reported potential complication [21]. The infratemporal fossa is bordered anteriorly by the thin maxillary cortex that constitutes the posterior border of the maxillary sinus. Later, the infratemporal fossa communicates with the pterygopalatine fossa. It contains many vital structures, such as the maxillary artery, the sphenopalatine nerve, the venous pterygoid plexus, and the pterygoid muscles. In addition to the anatomical and structural complexity of the infratemporal fossa, the deep location makes tooth displacement and retrieval a major hazard, with possible hemorrhaging and nerve injury. Guégan et al conducted a systematic review of clinical cases dating from 1977 to 2020. They surveyed the iatrogenic displacement of the maxillary third molar into the infratemporal fossa or the temporal fossa reported in the literature and reported a total of 27 clinical cases of projected teeth, in which 22 teeth were projected into the infratemporal fossa and 5 teeth were projected into the temporal fossa. They concluded that these complications should be managed carefully, following a structured decision-making process; otherwise, they can lead to further complications [22].

Different surgical approaches for the removal of impacted teeth from the maxillary sinus have been proposed. The Caldwell-Luc technique, trans-nasal endoscopic, and transsinusal approaches are used in such cases. The Caldwell-Luc procedure provides high visibility into the sinus. However, it is associated with more morbidities than is the trans-nasal endoscopic approach. The Caldwell-Luc procedure requires a large opening in the anterior maxillary sinus wall to access the impacted tooth with higher risk of complications. The trans-nasal endoscopic technique is a minimally invasive technique used mainly for teeth presented in the paranasal cavities. It has the advantage of visualization of orbital floor defects. The transsinusal approach is more invasive but the visibility is significantly better than the endoscopic-assisted approach [20,24]. The suggested surgical intervention in the present case was the transsinusal approach, because of the inverted position and the location of the impaction at the posterior wall of the sinus, which presents a high risk of displacement of the tooth into the maxillary sinus. However, the conservative approach was adopted in this case.

Precisely locating the tooth is crucial to avoid possible complications and to aid in the decision-making process. Computed tomography (CT) is an elemental diagnostic tool for managing these clinical situations, as orthopantomogram is a less accurate, unreliable X-ray and is limited by distortion and superimposition of anatomical structures. Therefore, use of orthopantomogram can lead to improper diagnosis and management [20]. In this case, we used CBCT to precisely locate the original site of the impaction. Cross-sectional imaging provides more accurate localization, and therefore, more reliable diagnosis and treatment planning can be achieved [18].

CBCT and medical CT or VCT can both be used for dental imaging. However, VCT has higher contrast resolution, highlighting the discrimination between different tissue types [25]. Hence, an additional VCT was made for the purpose of case reporting after obtaining the patient’s consent.

There is no conclusive treatment procedure to remove inverted and impacted maxillary third molars. The conservative approach is considered the safest option, as long as the tooth is asymptomatic and has no related pathological manifestations [11]. Therefore, the clinician and the patient opted to retain the impacted tooth in this case, and an annual clinical and radiological examination was planned to detect any positional or pathological alterations. A 2-year follow-up was done, and CBCT images were assessed for pathological changes and were superimposed using part comparison analysis to validate the location of the tooth, with no changes detected over 2 years (Figure 6). This validates the conservative treatment approach followed in this case.

This case highlights the extremely uncommon nature of such impactions and underscores the importance of proper diagnosis and management in similar situations. By documenting and reporting this case, we aim to contribute to the existing knowledge regarding this rare type of impaction, ultimately aiding dental professionals in their clinical decision making for patients with similar presentations.
Conclusions

Inverted maxillary third molar impaction is a rare condition that requires careful clinical and radiographic appraisal for effective management. It is crucial to assess the location of the impaction using advanced radiographic imaging techniques to develop a patient-oriented surgical plan. Conservative management is generally the preferred approach, especially when the patient is asymptomatic. This involves closely monitoring the impaction without immediate surgical intervention. Regular follow-ups and periodic imaging can help evaluate changes in the condition over time. However, if symptoms or complications arise, surgical intervention should be considered after a thorough evaluation of the potential risks. By following these guidelines, dental professionals can effectively manage similar conditions and ensure optimal patient outcomes. In this case, we followed a systematic approach for the clinical management. Because of the anatomical and structural complexity of the impaction and the asymptomatic history of the tooth, conservative management and regular follow-ups were applied.

Acknowledgments

The author wishes to thank Dr. Mohammed Hassan Al Kabany for his valuable assistance and contribution in generating the presented radiographic images.

Declaration of Figures’ Authenticity

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References: