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Tooth Eruption Disorders: Literature Review and Clinical Case Reports

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Abstract

Introduction and purpose: Tooth eruption disorders are complex issues that can affect both primary and permanent teeth. The process of tooth eruption is a natural stage of development, but it can sometimes be disrupted. Common eruption disorders include delayed eruption, tooth

impaction, premature eruption, and abnormalities in the location and direction of eruption. In each case, consultation with a specialist is required, along with early diagnosis and subsequent planning of appropriate treatment.

State of knowledge: Impacted teeth are a common occurrence in dentistry and they occur in 0.8–3.6% of the general population The most frequently impacted teeth, in decreasing order of prevalence, are third molars, maxillary canines, mandibular premolars, and maxillary central incisors. Factors contributing to tooth impaction can be general, local, or genetic. Impacted teeth and difficulties with eruption may be associated with complications such as follicular cysts and a variant of these cysts known as eruption cysts.

Summary: Tooth eruption disorders require an individualized diagnostic and therapeutic approach. Depending on the issue, treatment may involve observation, orthodontic interventions, and in some cases, surgical procedures. Early diagnosis and appropriate treatment are crucial to prevent complications such as malocclusion, damage to adjacent teeth, or unsatisfactory aesthetics. Radiographs can help confirm the presence of impacted teeth or in some cases, CBCT may be used for more detailed imaging.

Keywords: tooth, impacted, tooth, unerupted, odontogenic cysts.

Introduction

Tooth impaction is often asymptomatic, which leads to only a small number of patients actively seeking treatment. In most cases, impaction is identified incidentally by general dentists or orthodontists during routine check-ups. This highlights the need to raise awareness among dental practitioners about the frequency of this condition in everyday clinical practice, as well as the importance of early detection and timely intervention to prevent potential complications. Patients diagnosed with impacted teeth should be referred to both orthodontists and dental surgeons for further consultation and treatment. An interdisciplinary approach involving orthodontists, dental surgeons, and sometimes periodontists is essential for the effective management of impacted teeth. [1] Impacted teeth are characterized by fully formed

roots that remain completely surrounded by either hard or soft tissues of the maxilla or mandible, often with two years having passed since the expected eruption time. [2] Impaction can lead to complications such as cyst formation and inflammation, frequently necessitating surgical or orthodontic intervention. One such complication is the eruption cyst (EC), an odontogenic cyst appearing as a bluish or bluish-black swelling of the mucosa over the emerging tooth. This cyst most commonly occurs with erupting primary or permanent teeth, potentially inhibiting their eruption process. [3] Although EC typically progresses asymptomatically and often resolves on its own, it can, in some cases, lead to delayed or impacted eruption, necessitating surgical intervention. Early diagnosis of an eruptive cyst in routine dental practice helps ensure the proper progression of tooth eruption. This article aims to discuss the main issues related to tooth eruption disorders by reviewing current knowledge on the frequency, etiology, and treatment methods, as well as analyzing these topics based on specific clinical cases. They emphasize the importance of early detection, interdisciplinary treatment, and understanding potential complications.

Literature Review

The search for relevant scientific literature was conducted on PubMed, in medical textbooks, and in scientific journals on July 27 and July 30, 2024. The review encompassed publications from 2014 to 2024, utilizing keywords such as "impacted teeth," which resulted in 3,711 articles. Out of these, 1,902 were excluded due to restricted access, and additional papers were discarded for not being pertinent to the research topic. Subsequent searches with keywords like "impacted wisdom teeth" (1,807 results) and "dental eruption cysts" (147 results) were limited to freely accessible articles. To ensure comprehensive coverage, guidelines from sources such as Dentistry of Developmental Age by Dorota Olczak-Kowalczyk, An Outline of Modern Orthodontics by Irena Karłowska, and Cysts of the Maxillofacial Area by Tomasz Kaczmarzyk were also reviewed. A total of 23 articles formed the basis of this work.

Impacted teeth

Tooth impaction is a common dental condition, affecting 0.8% to 3.6% of the general population. [4] A tooth typically erupts when it has developed half to three-quarters of its final root length. [2] The most commonly impacted teeth are the third molars, maxillary canines, maxillary central incisors, and mandibular premolars. (Tab. 1) [4]

Table 1. Prevalence of impacted permanent teeth across different tooth groups. [4]

Affected Teeth	Prevalence of impacted permanent teeth (%)
Third molar	16,7 - 68,6
Maxillary canine	0,8 - 2,8
Maxillary central incisors	2 - 2,6

Most studies have not shown a sexual predilection for the impaction of the third molar. However, some studies have indicated that the prevalence of this condition is higher in women than in men. The upper molars can be impacted in various positions: palatal, buccal, or in line with the dental arch. The most common type is palatal impaction. The prevalence of palatally impacted canines compared to buccally impacted canines is 85% to 15%, respectively. [5] The etiology of tooth impaction is multifactorial. In the literature, the most commonly reported etiological factors related to tooth impaction can be divided into three groups: systemic, local, and genetic. [1] Systemic factors include endocrine deficiencies such as hypothyroidism, radiation therapy, cleidocranial dysostosis, and amelogenesis imperfecta. Local factors encompass failure of deciduous tooth resorption, premature loss of a deciduous tooth, prolonged retention of a deciduous tooth, abnormal eruptive path, presence of a supernumerary tooth or teeth, dental crowding and space loss, early extraction of a deciduous tooth, an enlarged dental follicle or dentigerous cyst, other forms of soft tissue pathology such as neoplasms, thickened mucosa post-extraction or post-trauma, dental trauma, odontoma, anomaly in the position of a tooth (e.g., tilting, displacement, transmigration), ankylosis of deciduous molars, root dilacerations, and alveolar cleft. Genetic factors include hereditary conditions such as a malposed tooth germ and the presence of an alveolar cleft. [4]

Impacted wisdom teeth

Third molars, commonly known as wisdom teeth, are the last teeth to erupt during a person's lifetime, making them the most prone to impaction among all human teeth. [6] They are

associated with various oral pathologies, including pericoronitis, caries, alveolar bone resorption, root resorption, cysts, and tumors. Consequently, it is a common practice to remove impacted third molars when the tooth itself is diseased or poses a significant risk to the health of adjacent teeth and tissues. [7,8,9] Despite the risks and challenges associated with surgical extraction, there is clinical consensus that (potentially) problematically impacted third molars should be removed at a young age, provided that the patient's local and general conditions permit. Prophylactic removal of third molars (M3M) remains a contentious issue. The extraction of M3Ms can still pose risks, with the most significant being the potential for neurological damage. [10] As a result, some researchers have found limited evidence supporting the necessity of removing asymptomatic M3Ms, while others have suggested that prophylactic removal should be considered conditionally, and sometimes a mandibular third molar may be removed prematurely (germectomy). [11] Therefore, it is recommended to conduct studies to assess the risk of third molars causing pathologies and then make informed decisions about their removal. These pathologies include pericoronitis, distal caries of second molars (M2Ms), and distal periodontal diseases of M2Ms. Shallowly impacted wisdom teeth have a higher risk of pericoronitis due to their contact with the oral environment, which facilitates the accumulation of bacteria and biofilm between the soft tissue and the tooth surface. [12-14] Distal caries in M2Ms and periodontal diseases observed in older patients suggest that these conditions develop over a long period when M3Ms are in inadequate positions and angulations. [15] The depth of impaction and angulation of M3Ms have been linked to distal caries in M2Ms. [16] The incidence of distal caries in M2Ms was highest in mesio-angularly impacted teeth. [17] Previous studies have shown that M2Ms develop more distal caries with mesial angulations ranging from 43° to 73°. [18] Additionally, when the CEJ distance between the distal M2M and mesial M3M ranged from 6 to 15 mm, distal caries in M2Ms occurred more frequently. [17] This was also associated with improper contact points between the two teeth, which increased the difficulty of maintaining oral hygiene. The prevalence and incidence of periodontal pathologies in M2Ms varied significantly depending on whether M3Ms were absent, erupted, soft tissue impacted, or bony impacted. Second molars adjacent to soft tissue impacted third molars had a significantly higher risk of developing periodontal pathologies. Periodontal diseases can lead to external root resorption (ERR) of the second molars, which was primarily associated with mesio-angular and horizontally impacted M3Ms. [19-21]

Treatment

The treatment of impacted teeth requires an interdisciplinary approach. Management of impacted teeth typically involves one of three approaches: 1) extracting the impacted tooth, 2) extracting an adjacent tooth, or 3) non-extraction treatment, which includes orthodontic space opening and surgical exposure. Non-extraction treatment usually begins with orthodontics to align teeth and create space for the impacted tooth, followed by surgery to remove any obstructions and expose the tooth. An attachment is then placed on the impacted tooth, often with an orthodontist present to ensure proper bonding and force application. The goal is to position the tooth correctly within the dental arch. Common surgical techniques for managing impacted teeth include the open eruption technique, the apically repositioned flap, and the closed eruption technique. [4] Surgical open exposure of palatally impacted canines can be performed either free-hand method or with computer -assisted method. In the latter approach are used CBCT imaging, digital impressions, and surgical templates created from virtual planning. Templates made using 3D printing enable navigation and facilitate the localization of retained teeth, thereby reducing trauma to the surgical field and shortening the overall duration of the procedure. [22, 23] If left untreated, impacted teeth can lead to the formation of dentigerous cysts. However, in some cases where the position of the impacted tooth poses a risk to health and may cause significant dysfunction but shows no clinical symptoms, the teeth may sometimes be subjected to observation. [1]

Clinical Case Descriptions.

Case Report 1

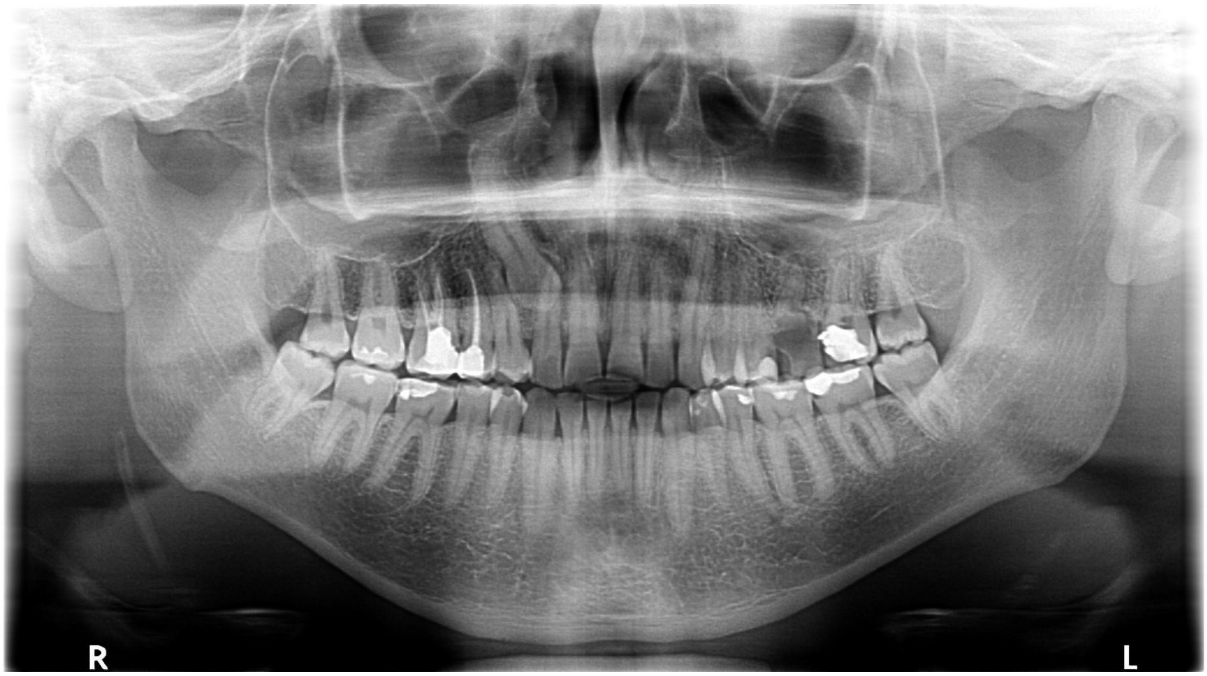
A 19-year-old male patient presented to the dental office due to pain in the area of tooth 47. A panoramic X-ray revealed the impaction of teeth 18, 28, 38, and 48. (Fig. 5) Teeth 38 and 48 were impacted in a mesioangular position, with their roots projected onto the inferior alveolar nerve canal, increasing the risk of neurological complications. The lack of space in both the maxillary and mandibular dental arches prevented their proper eruption. As a result, the patient was referred to an oral surgery specialist for the extraction of the impacted wisdom teeth.

Figure 5. Panoramic radiograph revealing impaction of teeth 18, 28, 38, and 48.

Case Report 1

A 28-year-old female patient presented to the dental office for a routine dental check-up. For more accurate diagnosis, a panoramic X-ray was taken, which revealed an impacted tooth 13. (Fig. 6) The patient did not report any pain or other symptoms in the past. To assess the exact position of the impacted tooth and the possible presence of inflammation or cysts, the patient was referred for CBCT imaging. Additionally, a consultation with an oral surgery specialist was recommended to determine the next steps, including the potential need for extraction of the impacted tooth.

Figure 6. Panoramic radiograph revealing impaction of tooth 13.



Clinical Analysis.

Tooth impaction, as demonstrated by the cases of the patients described above, is a common phenomenon that requires an interdisciplinary approach, combining orthodontics and oral surgery. The literature indicates that the most frequently impacted teeth are the third molars, which was confirmed in the 19-year-old patient, where teeth 18, 28, 38, and 48 were impacted. These teeth were positioned in a way that could lead to serious complications, such as neuralgia or the risk of inferior alveolar nerve damage during extraction. The literature also suggests that a lack of space in the dental arch and the mesioangular position of the teeth further increase the risk of complications, such as root resorption of adjacent teeth. Therefore, in this case, the patient was referred to an oral surgery specialist for extraction. In the case of the 28-year-old female patient, the impaction of tooth 13 did not cause clinical symptoms, which is also supported by the literature, where it is suggested that some impacted teeth can remain asymptomatic for a long time. Nevertheless, according to the literature, impacted maxillary canines can lead to serious complications, such as the formation of dentigerous cysts or damage to neighboring teeth. Therefore, the patient was referred for additional CBCT imaging and a surgical consultation. These clinical cases highlight the importance of an

individualized approach for each patient and the need for advanced imaging diagnostics to predict potential complications and choose the optimal treatment method.

Eruption cyst

An eruption cyst (EC) clinically presents as a bluish or bluish-black swelling of the mucous membrane over an erupting tooth. [3] The lesion is filled with blood or a clear fluid. It is a cyst located in the soft tissues without involving the underlying bone, which is why performing an X-ray has limited significance in the diagnosis of EC. [24] It may accompany erupting primary or permanent teeth but most commonly appears in the permanent dentition. It is more frequently found in the maxilla than the mandible, mainly involving incisors and molars. [4]

Epidemiology

An eruption cyst is a relatively rarely diagnosed cyst, and it should be noted that the number of cases is underestimated due to the cyst spontaneously resolving after the capsule ruptures. It occurs mostly in the first decade of life, primarily between the ages of 4-7 years, and is twice as common in boys than in girls. [4] Studies have also shown the occurrence of EC in newborns. [25]

Treatment

In most cases, an eruption cyst resolves spontaneously and does not require surgical intervention. Strict observation and monitoring of tooth eruption and the condition of surrounding tissues are necessary. [24] In cases where surgical treatment is needed, marsupialization is performed. This involves the removal of the soft tissue flap covering the tooth crown. [24,4] Differential diagnosis is also important, particularly distinguishing it from melanoma, ameloblastoma, hemangioma, Bohn's nodules, and performing histopathological examination if there are doubts. [4] In the treatment of EC in newborns, extraction of primary teeth may sometimes be considered if they show increased mobility or interfere with breastfeeding. In other cases, regular clinical check-ups and observation are sufficient. [25] A diode laser can also be used in the treatment of eruption cysts. Its use offers several benefits both during and after the procedure. During the procedure, it provides better visibility of the surgical field due to reduced bleeding compared to conventional surgical techniques. An additional advantage is that sutures are not necessary. Postoperatively, there is less pain and swelling at the treatment site. [26]

Clinical Case Descriptions.

A 9-year-old patient presented to the clinic with his parents due to concerning symptoms in the oral cavity that had been noticed over the past few days. The patient's mother reported that the lesion had been gradually increasing in size for about three days. Intraoral examination revealed a 1.5 cm x 2 cm lesion on the mucous membrane in the space between teeth 32 and 34, along with the absence of primary tooth 73. The lesion was soft, smooth, painless, bluish in color, and prone to bleeding (Fig. 7). The patient was referred for a dental radiograph of the affected area. The radiograph showed an erupting permanent tooth 33 and no pathological changes involving the alveolar bone. The lesion was left for clinical observation, and a follow-up visit was scheduled for the following week.

Figure 7. Mucosal lesion identified during the initial examination.

At the follow-up visit after a week, a slight increase in the lesion was observed in the buccolingual dimension and height. (Fig.8) A color change from bluish to raspberry was also noted. Upon palpation, the hard tissues of the erupting tooth were felt.

Figure 8. Mucosal lesion after one week of observation.

Clinical Analysis:

In the case of an eruption cyst (EC) in a 9-year-old patient, the observed changes in the oral mucosa and their development are consistent with the typical clinical features described in the literature. An eruption cyst often presents as a bluish or bluish-black swelling of the mucous membrane over an erupting tooth, which is confirmed by the described case. Similar to the studies mentioned, the lesion was painless. The treatment applied, consisting of clinical observation without immediate surgical intervention, aligns with standard practice recommended in cases where the cyst's capsule ruptures. Continued observation and monitoring of the lesion's development are advised. Alternative treatment methods, such as marsupialization, may be considered if the cyst's capsule does not rupture and if there is progressive inflammation.

General Discussion:

Tooth impaction, particularly involving third molars, is a prevalent dental issue that is gaining increased relevance due to evolutionary changes in the dental arch structure and the reduced number of teeth resulting from a shift towards a softer diet. Given this trend, it is essential to understand and manage impacted tooth cases effectively to prevent serious complications and ensure high-quality care. Contemporary management of impacted teeth necessitates close

collaboration among various dental specialists, including orthodontists and oral surgeons. An interdisciplinary approach is critical for accurate diagnosis, effective treatment planning, and managing potential complications such as nerve damage or cyst formation. Each case requires a tailored approach that takes into account the specific nature of the tooth impaction and the associated risk of complications.

Summary:

In clinical practice, cases of impacted teeth are frequently encountered. They are often identified incidentally during radiographic examinations. Therefore, it is crucial to raise awareness among dentists regarding the management of patients with such disorders. They should be educated about treatment options that they can offer themselves or, in more complex cases, the need for a multidisciplinary approach involving a team of specialists, such as orthodontists, surgeons, and even periodontists. Early detection of the disorder and initiation of appropriate therapy are important to ensure better treatment outcomes and prevent complications, which pose additional therapeutic challenges and prolong the treatment process.

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