Review of Contemporary Philosophy
ISSN: 1841-5261, e-ISSN: 2471-089X
Vol 22 (1), 2023
Pp 5155 - 5163

Dental Development and Associated Anomalies: An Updated Review

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Abstract:

Background: Dental development is a complex biological process governed by genetic and environmental factors, leading to various dental anomalies. These anomalies, such as dens evaginatus, dens invaginatus, amelogenesis imperfecta, and dentinogenesis imperfecta, disrupt normal tooth formation and can cause significant oral health challenges. The pathophysiology of these anomalies is closely linked to developmental disruptions during odontogenesis, resulting in structural and functional tooth defects.

Aim: This review aims to provide an updated overview of the developmental anomalies in dental formation, with a focus on their etiology, pathophysiology, clinical presentation, and management. The review examines the various anomalies, their epidemiology, diagnosis, and treatment options.

Methods: The review synthesizes existing literature on dental anomalies, including articles on dens evaginatus, dens invaginatus, amelogenesis imperfecta, and dentinogenesis imperfecta. It outlines their clinical features, genetic basis, prevalence, and treatment approaches. Data from various epidemiological studies and clinical reports were analyzed to present a comprehensive understanding of these conditions.

Results: The prevalence of these anomalies varies, with dens evaginatus affecting 1% to 6% of the population and amelogenesis imperfecta occurring in approximately 1 in 700 to 1 in 14,000 live births. Treatment strategies for these conditions include a multidisciplinary approach, utilizing radiographic imaging, restorative procedures, and genetic counseling. Early diagnosis and intervention are essential to managing these conditions effectively.

Conclusion: Dental anomalies related to developmental disruptions can present significant challenges in clinical practice. Early detection and personalized management strategies are critical for improving oral health outcomes. Continued research into the genetic basis and effective treatments for these conditions is necessary to enhance patient care.

Keywords: Dental anomalies, dens evaginatus, dens invaginatus, amelogenesis imperfecta, dentinogenesis imperfecta, developmental disorders, tooth formation, genetic factors, oral health management.

Received: 07 October 2023 **Revised**: 22 November 2023 **Accepted**: 06 December 2023

Introduction:

Dental development is a highly orchestrated biological process, progressing through a series of well-defined and tightly regulated stages. Teeth are composed of diverse internal and external structures, each originating from specific developmental and embryological pathways. Disruptions or amplifications in these processes can lead to significant alterations in the structural and functional integrity of teeth. These variations may present as minor anomalies, such as the overexpression of specific tooth structures, or escalate to more profound conditions, including the complete loss of dental tissue during critical developmental phases. The anomalies discussed in this context—dens evaginatus, dens invaginatus, amelogenesis imperfecta, and dentinogenesis imperfecta—are notable examples of such deviations. Each condition represents a unique disruption in the intricate mechanisms of tooth formation, resulting in distinctive clinical presentations and challenges. Dens evaginatus involves the projection of additional enamel and dentin structures, while dens invaginatus is characterized by an enfolding of enamel into the dental tissue. Conversely, amelogenesis imperfecta and dentinogenesis imperfecta reflect hereditary conditions impacting enamel and dentin quality and quantity, respectively. Understanding these anomalies is essential not only for accurate diagnosis but also for formulating effective treatment strategies. Addressing these developmental conditions requires an interdisciplinary approach that integrates advanced diagnostic tools, tailored therapeutic interventions, and patient-specific management plans to mitigate their impact on oral health and functionality.

Etiology

Dens evaginatus, commonly referred to as a talon cusp, is characterized by a developmental tubercle frequently observed on the lingual surface of the tooth, though it may also appear on the occlusal surface. This coronal anomaly typically manifests as an accessory cusp projecting from the cingulum or the cementoenamel junction of anterior teeth [1]. The etiology of dens evaginatus is linked to genetic and environmental factors, including trauma to the developing tooth bud or localized disruptions influencing morphodifferentiation during tooth development [2]. Dens invaginatus, also known as dens in dente, is a dental malformation arising from the inward folding of the developing tooth germ. The condition exhibits a multifactorial etiology, predominantly involving genetic and environmental contributors [3]. Although the precise causative factors remain unclear, this anomaly is attributed to an additional invagination of the inner enamel epithelium into the developing tooth bud's interior aspect before mineralization [4]. Suggested etiological mechanisms range from the rapid proliferation of sections of the inner enamel epithelium into the dental papilla to trauma and the absence of critical signaling molecules required for morphogenesis [5]. Amelogenesis imperfecta represents a genetic developmental disorder impacting both the structural and clinical appearance of some or all teeth. Mutations in the amelogenin gene (AMELX) and enamelin gene (ENAM) have been implicated in the pathogenesis of this condition [6]. Dentinogenesis imperfecta is a developmental anomaly with a genetic basis, attributed to mutations with an autosomal dominant inheritance pattern that disrupts dentin structure. These mutations are primarily located within the genes encoding type 1 collagen (COL1A1 and COL1A2) [7][8].

Epidemiology

Dens evaginatus, also known as talon cusps, has an estimated prevalence of 1% to 6%, primarily affecting the permanent dentition. This condition is commonly found in the maxillary incisors and is often diagnosed as an incidental finding during routine dental examinations. Dens invaginatus, which demonstrates no

significant gender preference, has a prevalence ranging from 0.3% to 10%, depending on the specific population under study [9]. This anomaly predominantly affects the maxillary lateral incisors, followed by the maxillary central incisors, with less frequent occurrences in other teeth such as the canines and premolars [10]. Amelogenesis imperfecta, a hereditary condition affecting enamel formation, shows considerable variability in its prevalence, largely influenced by the genetic mutations involved. The incidence of amelogenesis imperfecta has been reported to range from 1 in 700 to 1 in 14,000 live births, with differences observed across diverse populations and geographic regions [11][6]. In contrast, dentinogenesis imperfecta, a genetic disorder that impacts the formation of dentin, occurs in approximately 1 in 6,000 to 1 in 8,000 live births in the United States, with no observed gender preference [12]. These conditions, though rare, can lead to significant clinical challenges in dental practice and necessitate early detection and intervention to prevent further complications.

Pathophysiology

The morphological alterations associated with dens evaginatus are believed to emerge during the early stages of odontogenesis, specifically during the morphodifferentiation phase of tooth development [13]. The proliferation and subsequent outward projection of the inner enamel epithelium and odontogenic mesenchyme into the enamel organ are proposed mechanisms underlying the formation of the "talon cusp" [14]. Dens invaginatus is attributed to modifications in the tooth structure during the proliferation and morphodifferentiation stages of odontogenesis [4]. Amelogenesis imperfecta is a genetic anomaly that disrupts enamel formation. This condition arises from mutations in various genes, which encode enamel-related proteins—both structural and enzymatic—along with transcription factors, cellular components, and calcium transport proteins [15]. Depending on the interplay of genetic mutations, the condition may affect a single tooth or the entire dentition. Dentinogenesis imperfecta is similarly a genetic anomaly affecting dentin formation. Dentinogenesis involves the creation of an organic predentin matrix, which is calcified through odontoblast signaling. During this intricate process, mutations in genes encoding for dentin-specific proteins result in hereditary defects that disrupt dentin structure and influence other dental tissues [8].

Histopathology

Histological examination of dens evaginatus reveals normal dental tissues, but with reduced levels of enamel and dentin. The extent of the evagination in the affected tooth bud may vary, and in some cases, pulpal tissue may be present within the evaginated structure, while in others, it may be absent [16]. Dens invaginatus, on the other hand, demonstrates normal dental tissues, but with a distinctive inward folding of enamel and dentin, creating a characteristic morphological alteration. In cases of amelogenesis imperfecta, histological analysis shows normal dentin encased in enamel that may be either thinned or entirely absent, reflecting the defective enamel formation characteristic of this condition. In dentinogenesis imperfecta, histopathology reveals degenerated dentin that is surrounded by otherwise intact enamel. This abnormal dentin, which may exhibit a more fragile or malformed structure, is the hallmark of dentinogenesis imperfecta, contributing to the overall clinical presentation of the disorder. These histological features provide valuable insights into the underlying pathophysiology of these developmental anomalies, assisting in diagnosis and management.

History and Physical

Dens evaginatus, commonly referred to as a "talon cusp," manifests as an outgrowth of typical tooth structure, frequently affecting the lingual aspect of maxillary anterior teeth. Talon cusps are categorized into three distinct clinical types. Type 1 talon cusps are well-defined accessory cusps that extend halfway from the cementoenamel junction (CEJ) to the incisal edge. Type 2, or "semi-talon," cusps are at least one millimeter in size and extend partially from the CEJ to the incisal edge, often merging with the crown's surface. Type 3, known as "trace talons," present as prominent or enlarged cingula, which may appear conical, bifid, or tuberculate in form [17]. Dens invaginatus exhibits varying clinical manifestations depending on the degree of inward folding or the morphodifferentiation stage during which the invagination occurred. Oehlers' classification is the most widely employed system to delineate its extent. In

Type 1, the invagination terminates as a blind sac confined to the coronal region. Type 2 features invagination extending beyond the CEJ into the main root canal. Type 3 involves invagination penetrating the root canal's interior, often reaching the apical third of the root and potentially forming multiple apical foramina [18][19].

Amelogenesis imperfecta presents with clinical variations based on the specific genetic mutation involved [15]. Type I, or hypoplastic amelogenesis imperfecta, is characterized by localized or generalized enamel thinning. The crowns of affected teeth typically exhibit a yellow or light-brown hue, with surfaces that are pitted or mottled. This subtype is painless but may cause thermal sensitivity [20]. Type II, or hypomature amelogenesis imperfecta, results from defective matrix protein degradation, leading to enamel that is whitish to brown, non-translucent, and prone to breakdown. Radiographic findings often reveal diminished enamel opacity, particularly near the dentino-enamel junction. This is the least severe subtype, with aesthetic concerns predominating [21]. Type III, or hypomineralized amelogenesis imperfecta, is the most severe form due to reduced enamel mineralization. Teeth exhibit heightened sensitivity to temperature and tactile stimuli, with clinical presentations of dark yellow or brown enamel. Radiographically, enamel and dentin may display similar radiodensity [22]. The clinical expression of dentinogenesis imperfecta (DI) varies according to the degree of disruption during dentinogenesis. DI is categorized into three types based on clinical and radiographic findings. Type I DI is associated with syndromic features such as osteogenesis imperfecta, a condition characterized by fragile bones. In such cases, healthcare providers should elicit a detailed medical history, including inquiries about fragile joints, short stature, hearing impairment, joint hyperextensibility, and scleral discoloration (blue hue) [23]. Type II DI can occur independently or alongside other related findings. Clinically and radiographically, it is similar to Type I but presents fewer systemic implications [24]. Type III DI is marked by enlarged pulp chambers, irregularities in tooth size and color, and potential enamel pitting [25].

Evaluation

Dens evaginatus, often referred to as talon cusps, is typically discovered incidentally during routine dental check-ups. In cases where the outgrowth is minimal, patients may remain unaware of its existence. For patients experiencing discomfort or complications related to the additional dental structure, an interdisciplinary treatment approach is recommended. Similarly, dens invaginatus is frequently identified as an incidental finding during regular dental examinations. In mild cases, patients may be unaware of the invagination, while in severe instances, individuals may report pain or heightened sensitivity due to increased vulnerability to trauma. Radiographic imaging, particularly cone-beam computed tomography (CBCT), is essential to assess the extent of the invagination. The severity of the condition determines the appropriate treatment protocol. Amelogenesis imperfecta is commonly diagnosed through clinical evaluation. As this condition is hereditary, a thorough family history, along with an assessment of developmental anomalies, significantly aids in the diagnostic process [6]. Dentinogenesis imperfecta is diagnosed during clinical examinations, characterized by tooth discoloration that may appear amber, brown, blue, or opalescent brown, depending on the severity of the dysplasia. Radiographic evaluations reveal distinctive features such as bulbous crowns, narrowed or obliterated pulp chambers, and slender roots with minimal pulp canals [26, 27].

Treatment and Management

Dens evaginatus, or talon cusps, requires a multidisciplinary approach for effective management. A consensus study by Smail-Faugeron et al. (2016) outlines treatment modalities including complete cusp reduction in a single appointment, gradual or periodic reduction, abstention, or, in severe cases, tooth extraction [1]. Treatment decisions depend on the severity of the cusp, the patient's primary concern (functional, aesthetic, or preventative), and the potential risk of future dental complications. For dens invaginatus, comprehensive radiographic assessment using periapical radiographs or CBCT is critical to evaluate the internal structures of the affected tooth. Management strategies vary depending on the complexity and severity of the invagination. Treatment options range from regular monitoring to advanced surgical interventions. Modern endodontic techniques have largely replaced the previously favored surgical

extractions, thanks to diagnostic advancements like CBCT [5]. The management of amelogenesis imperfecta is dictated by the severity of the condition, which can range from mild to severe. Symptomatic cases or those involving aesthetic concerns are typically addressed through treatment options such as composite fillings, veneers, or full-coverage ceramic restorations, tailored to the patient's needs. Dentinogenesis imperfecta treatment also varies with the condition's severity. Due to significant aesthetic changes in tooth color, anterior teeth often require restorative procedures, including composite resin restorations or porcelain veneers. Enamel pits associated with the condition may necessitate minimally invasive esthetic interventions, such as non-preparation facial composite restorations

Differential Diagnosis

Differential diagnoses for dens evaginatus, commonly known as talon cusp, include conditions such as gemination, fusion, and enamel hyperplasia. Gemination involves the incomplete division of a tooth bud, resulting in a tooth with a larger crown but only one root. Fusion refers to the union of two tooth buds, leading to a larger tooth with two roots, while enamel hyperplasia pertains to an overproduction of enamel, often resulting in a thickened crown but without the typical evagination seen in dens evaginatus. For dens invaginatus, differential diagnoses include fusion, enamel hypoplasia, and gemination. Fusion and gemination can both lead to structural anomalies in the crown that may resemble the characteristic invagination of dens invaginatus, while enamel hypoplasia, which is characterized by a defect in enamel formation, may be confused with the inward folding of enamel and dentin observed in dens invaginatus. In the case of amelogenesis imperfecta, differential diagnoses include dental fluorosis, chronological enamel hypoplasia, and molar-incisal hypomineralization (MIH). Dental fluorosis results from excessive fluoride exposure during tooth development, leading to discolored and hypoplastic enamel, whereas chronological enamel hypoplasia is a developmental defect due to disturbances during the tooth formation process. MIH affects the molar and incisal teeth, causing enamel defects that may be confused with the appearance of amelogenesis imperfecta. Lastly, dentinogenesis imperfecta can be differentiated from dentin dysplasia, osteogenesis imperfecta, and amelogenesis imperfecta, all of which present with enamel and dentin abnormalities that may share similar clinical and radiographic features.

Prognosis

Dens evaginatus, commonly referred to as talon cusps, has a favorable prognosis when managed appropriately. Patients with less severe presentations may remain unaware of the condition, whereas more severe cases may necessitate invasive interventions. When restorative or endodontic protocols are followed meticulously, the prognosis for teeth affected by dens evaginatus is generally positive. Similarly, dens invaginatus also exhibits a good prognosis under proper management. Due to its altered tooth structure, regular monitoring for early signs of caries is essential to prevent the need for more invasive dental procedures. Both amelogenesis imperfecta and dentinogenesis imperfecta demonstrate favorable prognoses with adequate management. Asymptomatic patients or those without aesthetic concerns often maintain a good quality of life with minimal or no treatment. However, more complex cases may require multidisciplinary and invasive interventions, potentially influencing the overall prognosis.

Complications

Dens evaginatus or talon cusps may involve additional pulpal tissue, depending on the timing and extent of the developmental disturbance during odontogenesis. Without proper endodontic management, the restorative prognosis could be compromised. Furthermore, these cusps are susceptible to traumatic fractures due to their unfavorable location within the occlusal plane. Traumatic fractures exposing the pulp often necessitate endodontic therapy. Teeth with dens invaginatus are predisposed to caries due to their funnel-like shape, which facilitates the deeper accumulation of food debris and bacteria [28]. Routine monitoring for early carious lesions is critical, and patients should be educated on proper oral hygiene practices to mitigate the risk of caries both in these teeth and across the dentition. Amelogenesis imperfecta, characterized by diverse clinical presentations, frequently requires an interdisciplinary approach to treatment. The generalized form of this condition is often associated with systemic syndromes such as regional odontodysplasia. In such cases, genetic counseling or a genetic workup may be warranted to

manage underlying syndromic associations effectively [29]. Dentinogenesis imperfecta, particularly Type II, poses challenges during restorative treatments due to the presence of larger pulpal tissue. This condition increases the risk of pulpal exposure during restorative interventions and may also result from parafunctional habits.

Patient Education

Given that the aforementioned conditions are genetic or developmental in origin, prevention is not feasible. Patients presenting with generalized developmental defects across the dentition should undergo evaluation for potential underlying syndromes. The treatment of these conditions is typically driven by symptomatic or aesthetic concerns. Patients should be encouraged to self-monitor for new or worsening symptoms and seek timely evaluation and management by dental professionals.

Enhancing Healthcare Team Outcomes

Developmental disturbances in tooth formation, leading to structural abnormalities, are routinely identified during clinical examinations. Any member of the healthcare team can recognize such conditions, necessitating proper referrals for genetic counseling and dental care. Patients exhibiting generalized developmental disturbances should receive comprehensive evaluations and subsequent management for any symptomatic or aesthetic concerns. Effective interdisciplinary collaboration among healthcare professionals ensures optimal outcomes for these patients.

Dentist interventions:

Dentist interventions are pivotal in managing dental anomalies and ensuring optimal oral health outcomes. Such interventions require a multifaceted approach tailored to the nature and severity of the dental condition. These strategies involve comprehensive assessments, the application of advanced diagnostic techniques, and the execution of appropriate therapeutic modalities to address both functional and aesthetic concerns.

One of the primary interventions by dentists is the diagnostic evaluation of dental anomalies. A thorough clinical examination, supplemented by radiographic imaging, is essential for identifying structural and developmental dental defects. For example, conditions such as dens evaginatus and dens invaginatus necessitate the use of advanced imaging modalities, including cone-beam computed tomography (CBCT), to evaluate the extent of anomalies. This precise assessment enables dentists to formulate individualized treatment plans aimed at preserving tooth structure and preventing complications such as caries and pulpal involvement. Restorative interventions form a significant aspect of dental treatment. In cases of dens evaginatus, dentists may perform cuspal reduction or apply sealants to mitigate occlusal interference and reduce the risk of trauma. When pulpal exposure is present, endodontic therapy may be required to ensure the longevity of the affected tooth. For dens invaginatus, restorative procedures often include sealing the invaginated areas to prevent bacterial ingress and subsequent caries formation. In more complex cases involving extensive invaginations, endodontic therapy or surgical intervention may be necessary to preserve tooth integrity and function.

Aesthetic rehabilitation is another critical area where dentist interventions are indispensable. Conditions such as amelogenesis imperfecta and dentinogenesis imperfecta often result in discolored or structurally compromised teeth. Dentists employ various cosmetic techniques, including composite resin restorations, veneers, and full-coverage ceramic crowns, to restore the aesthetic appearance and functional integrity of the dentition. The choice of intervention is dictated by the severity of the condition and the patient's specific concerns, with a focus on achieving long-lasting results. Preventive interventions are integral to maintaining oral health in patients with dental anomalies. Regular monitoring and early detection of potential complications, such as caries or fractures, are crucial. Dentists play a vital role in educating patients about proper oral hygiene practices, including effective brushing techniques and the use of fluoride-based products to enhance enamel strength. Patients with conditions like dens invaginatus are counseled on dietary modifications and advised on the importance of routine dental check-ups to prevent the progression of caries or other complications.

Interdisciplinary collaboration further enhances the effectiveness of dentist interventions. Complex cases, particularly those involving systemic conditions such as osteogenesis imperfecta or syndromic forms of amelogenesis imperfecta, benefit from a team-based approach. Dentists work closely with geneticists, orthodontists, and oral surgeons to provide holistic care. This multidisciplinary strategy ensures that both the dental and systemic aspects of the patient's condition are addressed comprehensively. In conclusion, dentist interventions encompass a broad spectrum of diagnostic, restorative, aesthetic, and preventive measures aimed at managing dental anomalies and promoting oral health. By leveraging advanced diagnostic tools, employing evidence-based treatment modalities, and fostering interdisciplinary collaboration, dentists play a critical role in improving the quality of life for patients with complex dental conditions. These interventions not only address immediate concerns but also contribute to the long-term maintenance of oral health and functionality.

Conclusion:

Dental anomalies, such as dens evaginatus, dens invaginatus, amelogenesis imperfecta, and dentinogenesis imperfecta, represent a range of conditions resulting from disturbances in the normal process of odontogenesis. These anomalies can vary significantly in terms of their clinical presentations, from mild cosmetic issues to severe structural defects. The underlying etiologies are multifactorial, often involving genetic mutations that disrupt normal enamel or dentin formation. As these conditions are rare, they may not always be immediately diagnosed, making early detection crucial for effective management. Dens evaginatus, or talon cusp, is characterized by an additional enamel and dentin projection, usually on the lingual surface of maxillary incisors. This condition, though often asymptomatic, may lead to aesthetic or functional concerns, especially if the cusp is large or causes occlusal interference. The treatment approach varies depending on the severity and impact on the patient's oral health, ranging from simple observation to restorative procedures, including cusp reduction or even extraction in severe cases. Dens invaginatus, on the other hand, is characterized by inward folding of the enamel, leading to a variety of clinical presentations. It is most often found in the maxillary lateral incisors, and radiographic imaging plays a key role in assessing the severity of the condition. Management can involve routine monitoring, endodontic treatment, or surgical interventions, depending on the extent of the invagination. Amelogenesis imperfecta, a hereditary condition affecting enamel formation, presents a broad spectrum of clinical features, from mild hypoplasia to severe enamel hypomineralization. The management of amelogenesis imperfecta focuses on addressing both functional and aesthetic concerns. Restorative options such as composite fillings, veneers, and crowns are commonly employed to restore function and appearance. Similarly, dentinogenesis imperfecta, which impacts dentin formation, often requires restorative treatment for the anterior teeth due to the aesthetic changes and the increased fragility of the dentin. The treatment for dentinogenesis imperfecta must be tailored to the severity of the condition, with options ranging from cosmetic interventions to full coverage restorations. In conclusion, these developmental anomalies necessitate a multidisciplinary approach for effective management, including clinical evaluation, genetic counseling, and personalized treatment plans. Early diagnosis and intervention can mitigate the functional and aesthetic challenges posed by these conditions, improving the quality of life for affected individuals. Further research is required to better understand the genetic underpinnings of these anomalies and to develop more effective diagnostic and therapeutic strategies.

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التطور السني والعيوب المرتبطة به: مراجعة محدثة

الملخص:

الخلفية :يعد تطور الأسنان عملية بيولوجية معقدة تحكمها العوامل الوراثية والبيئية، مما يؤدي إلى حدوث العديد من العيوب السنية. تشمل هذه العيوب مثل "الدنس إيفاجيناتوس" و"الدنس إنفاجيناتوس" و"الأميلوجينيسيس إمبريفكتا" و"الدنتينوجينيسيس إمبريفكتا"، والتي تعطل تكوين الأسنان الطبيعي ويمكن أن تسبب تحديات كبيرة في صحة الفم. يرتبط الفيزيولوجيا المرضية لهذه العيوب ارتباطًا وثيقًا بالاضطرابات التطورية أثناء تكوين الأسنان، مما يؤدي إلى حدوث عيوب هيكلية ووظيفية في الأسنان.

الهدف :تهدف هذه المراجعة إلى تقديم نظرة محدثة عن العيوب التطورية في تكوين الأسنان، مع التركيز على أسبابها، والفيزيولوجيا المرضية، والعرض السريري، والإدارة. تستعرض المراجعة العيوب المختلفة، ووبائياتها، وتشخيصها، وخيارات علاجها.

الطرق :تقوم المراجعة بتلخيص الأدبيات الحالية حول العيوب السنية، بما في ذلك المقالات المتعلقة بـ"الدنس إيفاجيناتوس" و"الدنس إنفاجيناتوس" و"الأميلوجينيسيس إمبريفكتا" و"الدنتينوجينيسيس إمبريفكتا". كما توضح الخصائص السريرية لها، والأساس الوراثي، والانتشار، وطرق العلاج. تم تحليل البيانات من الدراسات الوبائية المختلفة والتقارير السريرية لتقديم فهم شامل لهذه الحالات.

النتائج :يختلف انتشار هذه العيوب، حيث تؤثر "الدنس إيفاجيناتوس" على 1% إلى 6% من السكان، وتحدث "الأميلوجينيسيس إمبريفكتا" في حوالي 1 من بين 700 إلى 1 من بين 14,000 ولادة حية. تشمل استراتيجيات العلاج لهذه الحالات نهجًا متعدد التخصصات، باستخدام التصوير الشعاعي، والإجراءات الترميمية، والإرشاد الوراثي. يعد التشخيص المبكر والتدخل ضروريين لإدارة هذه الحالات بشكل فعال.

الاستنتاج :يمكن أن تقدم العيوب السنية المرتبطة بالاضطرابات التطورية تحديات كبيرة في الممارسة السريرية. إن الكشف المبكر واستراتيجيات الإدارة الشخصية أمران حاسمان لتحسين نتائج صحة الفم. لا بد من مواصلة البحث في الأساس الوراثي والعلاجات الفعالة لهذه الحالات من أجل تعزيز رعاية المرضى.

الكلمات المفتاحية :العيوب السنية، الدنس إيفاجيناتوس، الدنس إنفاجيناتوس، الأميلوجينيسيس إمبريفكتا، الدنتينوجينيسيس إمبريفكتا، الاضطرابات التطورية، تكوين الأسنان، العوامل الوراثية، إدارة صحة الفم.