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Supernumerary Teeth: Current Concepts and Clinical Implications

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ABSTRACT

Supernumerary teeth are developmental anomalies characterized by the presence of teeth in excess of the normal dentition, occurring in both primary and permanent dentitions. They are most commonly observed in the maxillary anterior region as mesiodens and may lead to various complications such as delayed eruption, crowding, midline diastema, and impaction of adjacent teeth. The etiology is considered multifactorial, with the dental lamina hyperactivity theory being the most widely accepted, along with genetic and syndromic associations. Advances in diagnostic techniques, particularly cone-beam computed tomography, have significantly improved the localization and assessment of these teeth, facilitating precise treatment planning. Management strategies range from periodic observation to surgical removal, often followed by orthodontic intervention, with the timing of extraction remaining a subject of ongoing debate. This review aims to provide a comprehensive and updated overview of the etiology, classification, clinical features, diagnosis, and management of supernumerary teeth, with emphasis on recent advances and their clinical implications

Introduction

Tooth development is a complex and highly regulated biological process that begins during the prenatal period and continues into early adulthood. It involves a series of well-coordinated interactions between epithelial and ectomesenchymal tissues, leading to the formation of the primary and permanent dentitions [1]. Humans exhibit a diphyodont pattern, characterized by a primary dentition of 20 teeth followed by a permanent dentition of 32 teeth. Any disturbance during these developmental stages may result in anomalies affecting the number, size, shape, or position of teeth [2].

Among these anomalies, hyperdontia, or the presence of supernumerary teeth, represents an important clinical condition in dental practice [3]. Supernumerary teeth may occur in both primary and permanent dentitions, with a higher prevalence in the permanent dentition, particularly in the maxillary anterior region. Although often asymptomatic, they can lead to complications such as delayed eruption, crowding, displacement, and impaction of adjacent teeth, thereby affecting both esthetics and function [4,5].

The etiology of supernumerary teeth remains unclear; however, several theories have been proposed, including dichotomy of the tooth germ and hyperactivity of the dental lamina, the latter being the most widely accepted. These teeth may present as isolated findings or be associated with various syndromes [6]. Advances in diagnostic imaging, especially cone-beam computed tomography, have improved

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their detection and management.

Despite extensive literature, variations in classification, terminology, and management approaches still exist. Therefore, this review aims to provide an updated overview of supernumerary teeth with emphasis on their aetiology, classification, clinical features, diagnosis, and management, highlighting current concepts and clinical implications.

Aetiology of Supernumerary Teeth: The aetiology of supernumerary teeth is not completely understood and is considered to be multifactorial in origin. Several theories have been proposed to explain their development, including atavism, dichotomy of the tooth germ, and hyperactivity of the dental lamina. Among these, the hyperactivity of the dental lamina is the most widely accepted theory, suggesting that localized and excessive proliferation of the dental lamina leads to the formation of additional tooth buds. Genetic factors are also believed to play a significant role, as evidenced by familial occurrence and association with various syndromes. However, no single theory can fully explain all cases of supernumerary teeth, and it is likely that a combination of genetic and environmental influences contributes to their development [7-9].

Genetic Basis of Supernumerary Teeth: The development of supernumerary teeth is strongly influenced by genetic factors, with growing evidence supporting a hereditary basis. Various patterns of inheritance, including autosomal dominant, autosomal recessive, and X-linked transmission, have been suggested. Supernumerary teeth are frequently associated with genetic syndromes such as cleidocranial dysplasia and Gardner's syndrome, further emphasizing their genetic origin. These conditions are often linked to mutations affecting key regulatory pathways involved in odontogenesis. Additionally, disturbances in gene expression controlling dental lamina activity may lead to the formation of additional tooth buds. Although environmental factors may contribute, current evidence indicates that genetic predisposition plays a central role in the occurrence of supernumerary teeth [10].

Prevalence of Supernumerary Teeth: The prevalence of supernumerary teeth varies widely across different populations and study designs. Globally, the reported prevalence ranges from 0.1% to 3.8% in the permanent dentition, while it is considerably lower in the primary dentition, as reported by Rajab and Hamdan [5,11]. [1] In the Indian population, prevalence rates have been reported between 0.8% and 2.8%, reflecting regional variations and differences in study methodologies [5,12]. Singh et al. reported a prevalence of 1.87% among school-going children in Jharkhand, India, while studies by Syriac et al. and Anegundi et al. from South India have documented rates ranging from 1.1% to 1.24% [13,14]. Additionally, studies conducted in North India have reported lower prevalence values of approximately 0.8%–1.2% [12]. Globally, higher prevalence rates of up to 2.14%–2.8% have been observed in studies by Demiriz et al. and Goswami et al. [15,16] These variations may be attributed to genetic, environmental, and ethnic differences, as well as variations in age groups and diagnostic methods used. Overall, supernumerary teeth are more frequently observed in males and are predominantly located in the maxillary anterior region.

Clinical Features of Supernumerary teeth: Supernumerary teeth are often asymptomatic and are frequently detected incidentally during routine clinical or radiographic examination. However, they may present with a variety of clinical manifestations depending on their location, morphology, and orientation. The most common findings include delayed eruption and impaction of permanent teeth, as well as displacement, rotation, and crowding of adjacent teeth. Midline diastema is commonly associated with mesiodens in the maxillary anterior region.

In addition to these, supernumerary teeth may lead to failure of eruption or delayed root development of adjacent teeth. They can also interfere with normal occlusion and orthodontic treatment, resulting in malalignment and spacing issues. Periodontal problems such as plaque accumulation and gingival inflammation may occur due to difficulty in maintaining oral hygiene. In certain cases, ectopic eruption into unusual locations, including the nasal cavity, has been reported.

Although less common, pathological complications such as dentigerous cyst formation and, rarely, root resorption of adjacent teeth may be observed. Supernumerary teeth may also cause aesthetic concerns, particularly in the anterior region, affecting the psychological well-being of pediatric patients. Overall, these clinical features highlight the importance of early diagnosis and timely intervention to prevent complications and ensure optimal dental development [11,17].

Classification of Supernumerary Teeth: Supernumerary teeth are classified based on their morphology and location, which aids in understanding their clinical behavior and management. Morphologically, they are divided into supplemental (eumorphic) and rudimentary (dysmorphic) types. Supplemental teeth resemble the normal teeth in size and shape and are commonly seen as additional incisors or premolars. In contrast, rudimentary teeth are smaller and exhibit abnormal morphology, and are further classified into conical, tuberculate, and molariform types. Conical supernumerary teeth are peg-shaped and are the most common, particularly in the anterior maxilla as mesiodens. Tuberculate types are barrel-shaped with multiple cusps and are often associated with delayed eruption, whereas

molariform teeth resemble premolars or molars and are relatively rare.

Based on location, supernumerary teeth are categorized as mesiodens, paramolars, distomolars (distodens), and parapremolars. Mesiodens are located between the maxillary central incisors and represent the most frequently encountered type. Paramolars are situated buccally or lingually adjacent to molars, while distomolars are found distal to the third molars. Parapremolars occur in the premolar region and are less commonly reported [18].

Diagnosis of Supernumerary Teeth: Early diagnosis of supernumerary teeth is essential to prevent complications and ensure appropriate management. Clinical examination plays a vital role, with common indicators including delayed eruption of permanent teeth, retention of primary teeth, midline diastema, crowding, and displacement of adjacent teeth. In many cases, supernumerary teeth are asymptomatic and are discovered incidentally during routine examination.

Radiographic evaluation is fundamental for confirming the presence, number, and position of supernumerary teeth. Conventional imaging techniques such as intraoral periapical radiographs, occlusal radiographs, and panoramic radiographs are commonly used. Localization of the tooth can be achieved using techniques such as the parallax method or Clark's rule (SLOB rule) to determine its buccolingual position. In recent years, cone-beam computed tomography (CBCT) has emerged as a valuable tool, providing three-dimensional visualization and accurate localization, thereby improving diagnosis and treatment planning [19-21].

Management of Supernumerary Teeth: The management of supernumerary teeth depends on their type, position, and associated complications, as well as their impact on adjacent structures. Broadly, management can be divided into active intervention, including surgical removal or treatment, and conservative observation. The choice of approach should be individualized based on clinical and radiographic findings [21,22].

Surgical removal is the most commonly adopted treatment, particularly when supernumerary teeth interfere with normal dental development or function [23]. Extraction is indicated in the presence of associated pathology such as cyst formation or infection, delayed or failed eruption of permanent teeth, and displacement or rotation of adjacent teeth. Additionally, removal is recommended when there is an increased risk of dental caries due to difficulty in maintaining oral hygiene, when orthodontic treatment is required, or when esthetic and functional concerns are present. Supernumerary teeth may also need to be removed if they interfere with procedures such as alveolar bone grafting or implant placement. Early intervention in such cases helps prevent further complications and facilitates normal eruption and alignment of teeth.

Surgical removal should be carried out with caution to avoid iatrogenic damage. Particular care must be taken to prevent injury to adjacent permanent teeth, which may result in ankylosis or eruption disturbances. The clinician should also avoid damage to surrounding anatomical structures, including nerves and blood vessels, and minimize the risk of complications such as perforation of the maxillary sinus or involvement of adjacent spaces. In some cases, supernumerary teeth may be fused with adjacent teeth, making extraction more challenging. Therefore, thorough radiographic assessment, including the use of cone-beam computed tomography in complex cases, is essential for accurate localization and treatment planning [24, 25].

Conservative management with periodic observation may be considered in cases where the supernumerary tooth is asymptomatic, not associated with pathology, and does not interfere with eruption, function, or esthetics. In such situations, regular follow-up is necessary to monitor any changes, including the development of complications or eruption disturbances.

In selected cases where supernumerary teeth are retained and functional, endodontic or restorative treatment may be required to maintain their integrity and prevent caries. The timing of intervention remains an important clinical consideration. Early removal is generally recommended when complications are anticipated or when eruption is affected, whereas delayed intervention may be preferred to minimize the risk of damage to developing permanent teeth. Overall, management should be tailored to each individual case, balancing the benefits of intervention against potential risks. [25,26,27]

Conclusion

Supernumerary teeth represent a significant developmental anomaly with diverse clinical presentations and implications. Current evidence suggests that their etiology is multifactorial, with a strong genetic basis involving complex interactions between molecular signaling pathways that regulate odontogenesis. Variations in prevalence across different populations further support the role of genetic and environmental influences in their development. Early diagnosis through clinical and radiographic evaluation is essential to prevent potential complications such as delayed eruption, malocclusion, and associated pathology. Advances in imaging techniques and a better understanding of genetic mechanisms have improved the accuracy of diagnosis and treatment planning. Management should be individualized, ranging from careful observation to surgical intervention, depending on the presence of symptoms and associated complications. A comprehensive understanding

of the genetic factors underlying supernumerary teeth may contribute to improved diagnostic approaches, early risk prediction, and the development of targeted treatment strategies. Further research focusing on molecular pathways and gene regulation is required to enhance clinical outcomes and advance personalized dental care.

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