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Review Article

Impacted Supernumerary Teeth in the Premolar Region

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Abstract

The prevalence of supernumerary teeth, or extra teeth beyond the usual dentition, is around 3% of the population; it is higher in men and some ethnic groups, such the Eastern and African populations. In the premolar region, these teeth are more common in the mandible and are often supplemental or conical. The prevalence ranges from 0.075% to 1%, with most cases being asymptomatic and diagnosed via radiographs.

Etiology involves genetic and environmental factors, with theories suggesting they arise from post permanent dental lamina extensions, potentially representing a third dentition. Genes like Apc and pathways such as Wnt/β-catenin signalling are implicated in their formation, as evidenced in human and experimental models.

Supernumerary teeth may lead to complications like cyst formation, crowding, and transposition. Advances in genetics, tissue engineering, and stem cell research offer insights into their development and potential therapeutic strategies, including tooth regeneration and bioengineering.

Keywords: *Supernumerary Teeth; Hyperdontia; Cleidocranial Dysplasia; Premolar; Impaction*

Introduction

Supernumerary teeth, commonly referred to as hyperdontia, are an intriguing dental anomaly characterized by the development of additional teeth beyond the standard dental formula. These extra teeth can present in both deciduous and permanent dentitions, occurring in various regions of the dental arch, either unilaterally or bilaterally, and can be erupted or unerupted. While their etiology remains complex and multifaceted, involving genetic, epigenetic, and environmental factors, the exact molecular mechanisms governing their formation are not yet fully understood [1,3].

Supernumerary teeth in the premolar region stand out due to their unique epidemiological, morphological, and clinical features compared to other supernumeraries. They are more frequently observed in the mandible and are predominantly of the supplemental

type, although variations like conical shapes are occasionally seen [2]. This condition poses diagnostic challenges, as many supernumerary teeth remain asymptomatic until complications such as crowding, impaction, or cyst formation arise [3].

Despite the prevalence of supernumerary teeth ranging between 0.1% and 6% globally, depending on the population studied, literature addressing these anomalies in the premolar region is sparse. Current evidence suggests that genetic influences, including the involvement of signaling pathways like Wnt, BMP, and Shh, play a critical role in tooth morphogenesis and may contribute to the formation of supernumerary teeth [4].

This review aims to provide an in-depth analysis of supernumerary teeth in the premolar region, focusing on their etiology, genetic basis, clinical implications, and management strategies. By enhancing awareness among dental practitioners, this article seeks to facilitate early diagnosis, appropriate treatment planning, and better outcomes for patients presenting with this anomaly.

Epidemiology and characteristics

A literature search using PubMed and Ovid Medline databases was conducted with keywords “premolar” and “supernumerary”. Relevant publications addressing the prevalence and management of supernumerary premolars were reviewed. Approximately 8 - 9% of all supernumerary teeth occur in the premolar region, making it relatively common [5].

Supernumerary premolars differ from other supernumerary teeth by their higher occurrence in the mandible. Most supernumerary premolars are of the supplemental type, although some appear conical or smaller, especially in the maxillary premolar region [6,7]. These teeth may occur singly or in multiples and can either be erupted or impacted. Around 75% of supernumerary premolars remain unerupted and asymptomatic, emphasizing the importance of follow-up radiographs in orthodontic patients to detect potential impacts during treatment [8].

The mandibular premolar region shows the highest frequency of supernumerary teeth, particularly in nonsyndromic multiple supernumerary cases. Stafne reported that 8.4% of all supernumerary teeth occurred in the premolar region, with 6.6% specifically in the mandible [5]. Similar findings were noted by Nazif., *et al*. who reported an 8.0% occurrence, and Grahnen and Lindahl, who found a prevalence of 9.1% [9].

Geographically, most cases of supernumerary premolars have been documented in populations from Africa and Eastern regions. For instance, in Southern Nigeria, approximately 1% of individuals have supernumerary premolars. Reports from Sweden and other regions reveal a prevalence of 0.24 - 0.29% in general populations, with a slightly higher frequency in orthodontic patients (0.64%) [5].

A small study involving 4,000 patient records found a male-to-female ratio of 5:1 for supernumerary mandibular premolars, with most cases reported among non-white individuals. These findings underscore the demographic and racial variability in the occurrence of supernumerary premolars.

Etiology and pathogenesis

Several theories have been proposed to explain the development of supernumerary teeth, including both genetic and environmental factors [10,11]. It has been suggested that supernumerary premolars belong to a third series (post permanent), originating from extensions of the dental lamina [5,8,12,13].

Price and Hoggins [11] noted that the development of supernumerary premolars, based on their own cases and previous studies, occurred 7 to 10 years later than the normal premolars. They attributed the varying stages of development seen in some cases [5] to a new generation of premolars-the post permanent and post-post permanent dentitions, with a 5-year difference between them. Similar

timeframes for the development of supernumerary premolars were reported by Bowden [13] (7.5 to 11 years after the normal series) and Rubenstein., *et al*. [14] (approximately 7 - 11 years after normal development).

Case reports show that supernumerary teeth in the mandibular premolar region became visible around the ages of 9, 12, 12.5, 13.5, and 14 years [12].

However, pinpointing the exact onset of supernumerary tooth formation is challenging because they are often located in the lingual position and may not be visible on routine radiographs. The timing of root development for supernumerary premolars remains debated. Oehlers [12] reported continued root formation of a supernumerary premolar in a 23-year-old man.

Ranta and Ylipaavalniemi [15] documented two cases of supernumerary mandibular premolars developing after jaw fractures, one of which was observed over 11 years.

At age 11.1 years, no supernumerary teeth were detected, but by age 15, three supernumerary teeth were present in the mandible, with mineralization stages varying from crown completion to one-fourth to three-fourths completed. By age 16.7, the mineralization was closer to 6-7 years of age, and by age 22, the supernumerary teeth had nearly complete root formation, with an approximate age of 13 - 14 years. Similar findings of late-developing supernumerary premolars have been reported in other studies.

Bowden [13] also documented three cases of tuberculate maxillary supernumerary teeth, alongside supernumerary premolars. These tuberculate teeth are often found near the upper central incisors, positioned palatally, and develop more slowly than both the permanent central incisors and conical supernumerary teeth. Eruption failure of adjacent teeth is common. These findings suggest that different types of supernumerary teeth, such as the tuberculate maxillary and premolar types, develop not only in relation to the normal series in their respective regions but also in relation to each other. This supports the theory that both types of supernumerary teeth are part of a new generation of teeth, the post permanent dentition.

Genetics in supernumerary tooth

The development of teeth is regulated by various signaling pathways and genetic factors. Genes such as Wnt, FGF, BMP, and Shh play a crucial role in tooth morphogenesis, controlling the initiation, patterning, and development of dental tissues. These pathways interact with environmental factors to determine tooth number, size, shape, and eruption. Supernumerary teeth may arise due to disruptions in these pathways, but the exact molecular mechanisms remain unclear [16].

Supernumerary teeth can be linked to several genetic syndromes, including cleidocranial dysplasia, where additional teeth may form as part of a third dentition, commonly observed as supplemental teeth. These conditions may be caused by mutations in genes that regulate bone and dental development. Supernumerary teeth in the context of these syndromes may present complications such as impaction, delayed eruption, and malocclusion [17].

Hyperdontia, the condition of having extra teeth, can be inherited in various ways. It has been reported to follow autosomal dominant, autosomal recessive, and even X-linked patterns with incomplete penetrance. Studies have shown that supernumerary teeth are more likely to appear in individuals with a family history, suggesting a genetic predisposition to this condition. Inherited factors contribute to the frequency and expression of hyperdontia in affected families [18].

While genetics plays a significant role in the development of supernumerary teeth, environmental and epigenetic factors also contribute. The interaction between genes and environmental influences (such as trauma, infection, or hormonal changes during tooth development) may trigger the formation of extra teeth. Disruptions in the dental lamina (either by hyperactivity or dichotomy) are believed to be key contributors to supernumerary tooth formation, influenced by both genetic susceptibility and environmental factors [19].

Diagnosis

Early diagnosis of supernumerary teeth in the premolar region is crucial for effective management, as these teeth often remain unerupted and asymptomatic, making their presence difficult to detect without proper radiological assessment.

Supernumerary teeth in this region frequently develop late, and may appear after the commencement of orthodontic treatment, or they may reappear after removal, highlighting the need for continued vigilance [20].

A thorough history should be obtained to identify any genetic or familial tendencies for hyperdontia, as well as the presence of any other related dental anomalies. As supernumerary teeth in the premolar region often do not manifest clinically, this part of the examination can be inconclusive. However, the practitioner should still look for signs like delayed eruption, crowding, or spacing, which may hint at the presence of supernumerary teeth.

The most reliable method for diagnosing supernumerary teeth in the premolar region is through radiographic imaging. A panoramic radiograph is the first step in identifying any anomalies in tooth number. It should be supplemented with periapical radiographs if necessary.

Early diagnosis is crucial as these teeth usually develop lingually and apically to the normal series of teeth, which may be difficult to detect without radiographs. Regular radiographs are essential during orthodontic treatment to monitor the development of supernumerary teeth and prevent any adverse effects, such as interference with orthodontic progress or iatrogenic damage [21].

Figure

Management options

Extraction vs. retention: Once diagnosed, the decision whether to extract or retain supernumerary premolar teeth depends on their eruption status and alignment. If the supernumerary tooth is in a reasonable alignment without causing any occlusal issues, it may be left *in situ*. If the tooth is erupting and there is insufficient space or it causes occlusal discrepancies, early extraction should be performed to avoid crowding or occlusal problems [10]. Most supernumerary premolars remain unerupted. Early removal is often recommended before orthodontic treatment to avoid complications during treatment. However, some practitioners recommend delaying removal until the tooth has developed further or until the full permanent dentition is established to reduce the risk of iatrogenic damage [22].

In cases where supernumerary teeth appear later during or after orthodontic treatment, the management approach may differ: If the supernumerary tooth is discovered before or during the early stages of orthodontic treatment and is likely to interfere with treatment, it should be extracted. Post-Orthodontic Appearance: If the tooth emerges at the end of orthodontic treatment and does not interfere with occlusion, monitoring may be preferred.

Clinicians need to discuss all possible treatment options with the patient and/or their guardian, including the risks and benefits of each approach. In some cases, the patient or guardian may choose to leave an unerupted supernumerary tooth in place, especially if it is not causing immediate issues. In such cases, periodic monitoring is vital to detect any potential future problems. Even if the decision is made to leave a supernumerary tooth in place, regular follow-ups with radiographs are necessary to detect any iatrogenic effects or complications that may arise in the future.

Early identification and management of supernumerary teeth in the premolar region are essential for minimizing potential complications during orthodontic treatment. Regular radiological assessments, clear communication with patients, and careful decision-making regarding extraction or retention will help in achieving optimal outcomes [23].

Clinical implication of impacted supernumerary tooth

Impacted supernumerary teeth often contribute to space constraints in the dental arch, leading to misalignment of adjacent teeth. Their presence may interfere with the normal eruption of permanent teeth, resulting in displacement, rotation, or delayed eruption [24]. Crowding can further cause functional and aesthetic concerns, necessitating orthodontic intervention. Studies indicate that mesiodens, the most frequently encountered type, is responsible for midline diastema and maxillary anterior crowding in many cases [25].

Supernumerary teeth positioned close to permanent teeth can exert pressure on their roots, leading to external root resorption. This pathological process weakens the affected tooth, potentially leading to premature loss or compromised structural integrity. The risk of resorption increases when the supernumerary tooth is near the developing roots of adjacent teeth. Cone-beam computed tomography (CBCT) imaging is often recommended for accurate assessment of such cases [26].

Impacted supernumerary teeth can pose significant challenges for periodontal health and orthodontic treatment. Their presence may lead to: Gingival inflammation and pocket formation due to difficulty in maintaining oral hygiene in crowded areas. Interference with orthodontic mechanics, requiring additional interventions such as extraction or space redistribution before initiating treatment [27].

Midline shifts, occlusal discrepancies, and an extended orthodontic treatment period are all results of altered eruption patterns. Studies suggest that early intervention, including surgical removal of impacted supernumerary teeth, can prevent periodontal compromise and facilitate proper tooth alignment [23].

Management and treatment protocols

Surgical extraction is the preferred treatment for impacted supernumerary teeth that interfere with normal occlusion, delay the eruption of permanent teeth, or cause pathological conditions such as root resorption and infections. Unlike simple extractions, surgical removal involves a more detailed approach, including soft tissue incision, bone removal, and sometimes tooth sectioning to minimize trauma. The choice of technique depends on the location, depth of impaction, and proximity to critical anatomical structures. Advances in imaging, such as CBCT, aid in precise surgical planning, reducing complications and improving post-operative outcomes [28]. Simple extraction used for erupted or minimally impacted supernumerary teeth that are easily accessible.

Better access for impacted teeth is made possible by surgical removal with flap design and elevation of the mucoperiosteal flap. Osteotomy, which exposes badly affected teeth by removing minimal bone. Tooth sectioning: In cases of large or complex supernumerary teeth to minimize trauma. Postoperative care: Includes antibiotics (if necessary), analgesics, and follow-up for healing and eruption monitoring [29].

Non-surgical management is a conservative approach for impacted supernumerary teeth that are asymptomatic and do not interfere with normal dental development. This strategy involves regular monitoring through clinical and radiographic evaluations to assess eruption patterns and potential complications. Asymptomatic supernumerary teeth that do not interfere with adjacent structures can be monitored with periodic radiographs [26]. In cases where premature extraction leads to space loss, space maintainers or interceptive orthodontics are used.

The management of impacted supernumerary teeth often requires a collaborative approach involving multiple dental specialties to achieve the best functional and aesthetic outcomes. Since these teeth can cause orthodontic disturbances, periodontal issues, and surgical challenges, a well-coordinated treatment plan is essential. The interdisciplinary approach ensures comprehensive care by integrating the expertise of oral surgeons for surgical removal, orthodontists for space management and alignment, pediatric dentists for early diagnosis and intervention, and periodontists for maintaining soft tissue and bone health. This collaborative strategy helps minimize complications, optimize eruption patterns, and enhance long-term oral health.

Advances in research and future direction

Recent advancements in imaging, such as CBCT and AI-assisted diagnostics, have improved the early detection and precise localization of impacted supernumerary teeth. Minimally invasive surgical techniques, guided navigation systems, and regenerative approaches, including platelet-rich fibrin (PRF) and bone grafts, enhance post-operative healing and treatment outcomes. The future of management may involve AI-driven predictive models, bioengineered tooth regeneration, and robotic-assisted surgeries for greater precision. Additionally, 3D-printed surgical guides and customized orthodontic solutions are expected to revolutionize treatment planning, ensuring a more efficient and patient-centered approach to managing supernumerary teeth [30].

Conclusion

The management of impacted supernumerary teeth requires a careful and individualized approach, balancing the need for surgical intervention with conservative monitoring when appropriate. Advances in diagnostic imaging, minimally invasive techniques, and interdisciplinary collaboration have significantly improved treatment outcomes. As technology continues to evolve, AI-driven diagnostics, 3D printing, and regenerative therapies may further refine management strategies, reducing complications and enhancing patient care. A multidisciplinary approach remains essential in ensuring optimal functional and aesthetic results, paving the way for more precise, efficient, and patient-friendly treatment options in the future.

Conflict of Interest

Nil.

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