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RESEARCH ARTICLE

A COMPOUND ODONTOME CAUSING IMPACTION OF MAXILLARY CENTRAL INCISOR: AN ORTHODONTIC CASE REPORT

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ABSTRACT

Impaction of a permanent maxillary central incisor is rare and often presents a significant esthetic and functional concern, especially in growing individuals. This case report highlights a unique presentation of an impacted maxillary central incisor associated with a compound odontome, which impeded the normal eruption pathway. Clinical and radiographic examinations confirmed the diagnosis. Surgical removal of the odontome followed by orthodontic traction of the impacted incisor was planned and executed successfully. This report emphasizes the importance of early diagnosis and multidisciplinary management to achieve optimal esthetic and functional outcomes.

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INTRODUCTION

Odontomes are benign odontogenic tumors [(1)] originating from fully differentiated epithelial and mesenchymal cells—namely ameloblasts and odontoblasts—which are responsible for the formation of enamel and dentin. These lesions are often asymptomatic and, as a result, frequently remain undiagnosed during routine clinical examinations. Odontomes are chiefly composed of enamel and dentin, with variable contributions of cementum and pulp tissue. Despite their typically limited size, they can occasionally induce expansion of the surrounding bone. Despite their non-aggressive nature, they may alter the eruption pathway of permanent teeth, potentially causing impaction or displacement. [(1,2,3)] Odontomes are broadly classified into two types: complex and compound. Complex odontomes are commonly found in the posterior region of the mandible, whereas compound odontomes tend to occur more frequently in the anterior maxilla. [(4)] Radiographically, compound odontomes are characterized by the presence of multiple, small, tooth-like structures that may appear solitary or clustered in an irregular arrangement.

Complex Odontome [(5)]

- A complex odontome is characterized by an irregular mass of hard and soft dental tissues that bear no morphological resemblance to a normal tooth.
- Clinically, it presents as a hard, painless swelling, commonly observed in young individuals. Radiographically, when fully calcified, it appears as a radiopaque, irregular mass with densely radiopaque areas indicative of enamel.
- Histologically, the dental tissues are arranged in a disorganized manner, often forming a radial pattern. Multiple branches of the pulp may be present, creating a sponge-like appearance.

Compound Odontome [(5)]

- Compound odontomes are thought to arise from localized multiple budding of the dental lamina, leading to the formation of numerous tooth germs. They consist of multiple small, tooth-like structures (denticles) and commonly present as a painless swelling in the anterior jaw region.

- On radiographic examination, they appear as separate, densely calcified structures. Histologically, the denticles are embedded within a fibrous connective tissue matrix, enclosed by a fibrous capsule.

CASE REPORT

An 18-year-old girl patient presented to the outpatient department of dentistry in Medinipur medical college and hospital on 27th December 2023 with chief complaint of aesthetically unpleasant appearance because of delayed permanent tooth eruption in the left maxillary anterior region with retained deciduous teeth (61).

History of trauma: Patient has a history of trauma that occurred 15 years ago.

Intraoral examination: A case of retained deciduous incisor (61) sinch childhood (Figure 1A).

Figure 1A: (Intraoral)

Figure 1B (RVG).

Figure 1C (RVG)

Advised for radiographical evaluations {radiovisiography} (Figure 1B & 1C). RVG reveals presence of complex odontome with impacted central incisor (21).

Provisional diagnosis: Therefore, the patient was diagnosed with impacted maxillary left central incisor (21) with compound odontome and retained deciduous maxillary central incisor (61). **Investigation:** Advised to do routine blood investigation with orthopantomogram (Figure 1D) and lateral cephalogram (1:1) (Figure 1E).

Figure 1D. Orthopantomogram

Figure 1E. Lateral cephalogram 1:1.

Cephalometric evaluation: Steiner analysis (Figure 1F) was performed as part of the diagnostic and treatment planning process. The findings indicated that both skeletal and dental parameters were generally within normal limits.

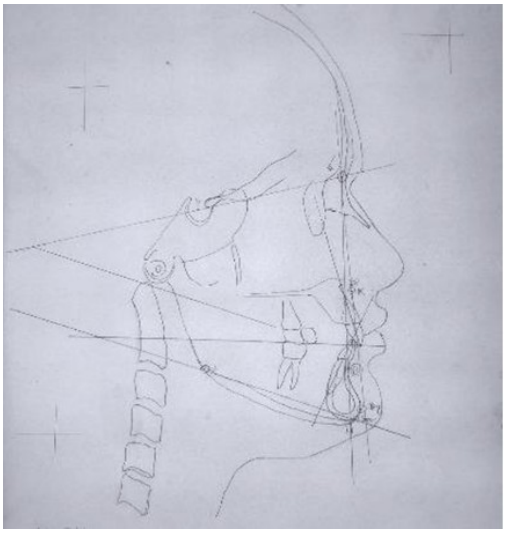

Figure 1F. Steiner analysis

Treatment Objectives

- Create space for the impacted maxillary central incisor.
- Apply orthodontic traction to guide eruption.
- Achieve a functional and esthetic occlusion.

Treatment Options

- Orthodontic space creation, surgical exposure with odontome removal, followed by traction of the impacted incisor.
- Extraction of the impacted incisor with temporary prosthetic replacement; definitive restoration (implant or bridge) planned post-growth.
- Extraction followed by orthodontic space closure; lateral incisor reshaped and repositioned to replace the central incisor, with prosthetic refinements for esthetics.

Planned Treatment

- Maxillary arch expansion to create adequate space.
- Surgical exposure of the impacted incisor and odontome removal.
- Orthodontic traction of the incisor with emphasis on managing gingival recession.

Presurgical: Oral prophylaxis

Extraoral (Figure 2A & 2B) and Intraoral (Figure 2C; 2D; 2E) photographs were taken. (Pre orthodontic treatment)

Figure 2A: Extraoral

Figure 2B: Extraoral

Figure 2C (Intraoral)

Figure 2D (Intraoral)

Figure 2E (Intraoral)

Pre surgical Orthodontic: Preadjusted Edgewise system (MBT 0.22" slot) was used. Alignment and levelling with 0.016 and 0.018 NiTi were done. Space creating with open coil spring (inner diameter 0.036" and length 12 mm) on 0.018 SS arch wire was used. Begg's vertical slot bracket prepared with ligature wire (pigtail ligature).

Surgical: Necessary blood and serological investigation done before surgery. Surgical Management of Impacted Maxillary Central Incisor Associated with Odontome. A surgical extraction of the deciduous maxillary left central incisor was planned and executed to facilitate access to an underlying odontome. A triangular mucoperiosteal flap was elevated, extending from the disto-proximal aspect of tooth 13 to the mesio-proximal aspect of tooth 23. A vertical releasing incision was placed at the mesio-proximal end of tooth 23. Following this, the odontome was carefully exposed (Figure 3A & 3B) and surgically removed along with the retained deciduous tooth (61) (Figure 3C). The incisal edges of the impacted permanent central incisor were then freed by removing the surrounding interdental and obstructive bone to aid in eruption (Figure 3D). Subsequently, a Begg's bracket was bonded to the exposed crown surface of the impacted central incisor using composite resin. The bracket was secured intraorally to facilitate orthodontic traction and guided eruption of the impacted tooth (Figure 3E).

Figure 3A (surgically exposed odontome)

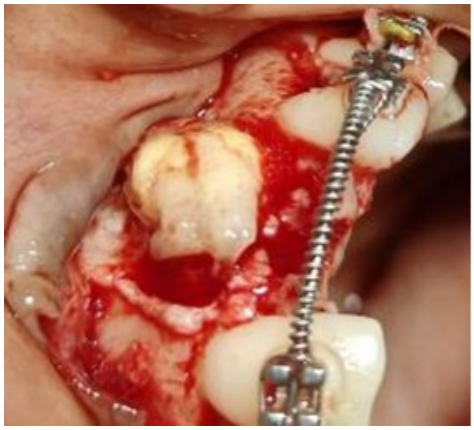

Figure 3B

Figure 3C. Extracted odontome with retained deciduous tooth (61)

Figure 3D. Exposed permanent central incisor (21).

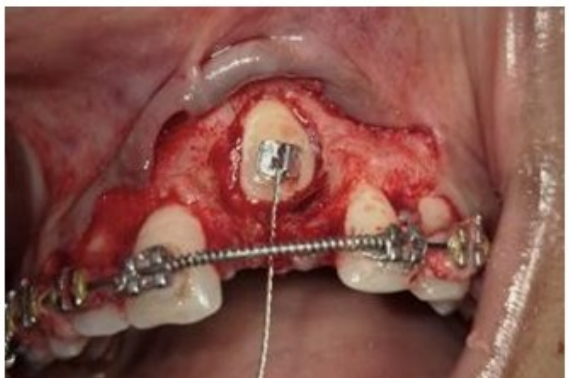

Figure 3E. (Placement of Begg's bracket with pigtail ligature wire)

Figure 3F. Begg's bracket secured intraorally; suture given

Post surgical orthodontic: Pigtail ligature was activated for 3-4 months and Begg's bracket was palpated superficially beneath the attached gingiva. A window was created to expose the bracket by cutting the overlying Gingiva (Figure 4A).

Figure 4A.

Figure 4B.

Figure 4C.

Figure 4D.

Figure 4E.

After 2 weeks, removal of ligature wire was done and placement of Twin arch wire (0.012 NiTi) along with 0.018 SS Base wire with open coil spring. After 2 months, open coil spring was removed and continuous arch wire 17× 25 SS with step bend along with twin arch wire 0.012 NiTi was engaged with the MBT brackets. (Figure 4B). After 4 weeks, removal of the Base arch wire and placement of continuous 0.016 NiTi was done (Figure 4A; 4B; 4C). Around two weeks later, 0.016 NiTi wire was replaced by 0.018 NiTi wire (Figure 4F). Followed by placement of 17×25, HANT and finishing stages is under the process (Figure 4G; 4H; 4I; 4J).

Figure 4F.

Figure 4G.

Figure 4H.

Figure 4I.

Figure 4J.

DISCUSSION

Etiology of Impacted Maxillary Permanent Central Incisors

Odontogenic Epithelial Cells: Odontomes are generally believed to arise from remnants of odontogenic epithelium. [6] When a developing tooth germ undergoes abnormal budding, it may result in multiple, rudimentary tooth-like structures characteristic of compound odontomes. In cases where such division does not occur and the dental tissues form a

Table 1: Pre-treatment Cephalometric Analysis (Steiner's analysis)

Variable	Mean value	Patient's value	Interpretation
SNA angle	82°	83°	Slight maxillary prognathism
SNB angle	80°	80°	Normal mandibular position
ANB angle	2°	3°	Mild skeletal Class I tendency
Occlusal plane angle	14.5°	32°	Steep occlusal plane
Mandibular plane angle	32°	18°	Low mandibular plane angle (horizontal growth pattern)
Upper incisor to NA (angle)	22°	21°	Normal inclination
Upper incisor to NA (linear)	4 mm	1mm	Retruded upper incisors
Lower incisor to NB (angle)	25°	27°	Upright lower incisors
Lower incisor to NB (linear)	4mm	3mm	Upright lower incisors
Interincisal angle	131°	137°	Increased interincisal angle (suggesting more upright incisors)

disorganized mass, a complex odontome develops. The distinction between compound and complex odontomes can be difficult, as both may exhibit overlapping features due to variable degrees of morphological and histological differentiation.

Local factors: Odontome formation has been linked to growth pressures caused by spatial constraints during tooth development. Euler (1939) and Atkinson (1949) [7] suggested that such pressures may contribute to composite odontome formation. Hitchin and Ferguson (1958) [8] further proposed that a large-crowned developing premolar, confined by the roots of its deciduous predecessor, may generate pressure-induced developmental disturbances.

Cellular remnants of the dental lamina: According to Fijerskov, [9] the cell rests of Serres (remnants of the dental lamina) associated with a retained tooth may exhibit two distinct behaviors: some epithelial islands may proliferate, leading to the formation of odontomes, while others may undergo degeneration, resulting in a cystic cavity surrounding the tooth. This process may be driven by a genetic defect in odontogenesis.

Trauma: Intrusive luxation or avulsion of primary teeth can cause odontome-like malformations in permanent successors—a rare but documented outcome of early dental trauma (Andreasen, 1994). [10] Impacted maxillary permanent central incisor often results from physical obstructions such as supernumerary teeth, odontomes, or odontogenic cysts. Supernumerary teeth alone account for 56–60% of cases due to direct interference with eruption. Tooth germ malformations, like dilaceration often caused by trauma to the primary teeth are another contributing factor. A history of early childhood injury is commonly reported in such cases. Additionally, over-retained or ankylosed primary incisors, especially those affected by trauma can impede the eruption of the permanent successor by disrupting normal resorption and eruption pathways. The patient has a history of trauma that occurred 15 years ago.

Sequelae Associated with Impacted Maxillary Central Incisor: Impaction of the maxillary central incisor, although less common compared to other teeth, can lead to a variety of functional, esthetic, and pathological consequences if not identified and managed promptly. The associated sequelae may include:

***Esthetic Implications*:** The absence of a maxillary central incisor in the dental arch can result in noticeable facial asymmetry and midline discrepancies. These esthetic issues often have a significant psychosocial impact, particularly in children and adolescents, affecting self-esteem and social interactions.

***Functional Disturbances*:** An impacted central incisor may interfere with normal oral functions. Patients may experience difficulty in biting, incising, and articulating certain speech sounds, such as fricatives and sibilants, which are dependent on proper anterior dental contact.

***Malocclusion and Space Loss*:** Impaction frequently leads to space loss due to mesial drift and tipping of adjacent teeth. The resultant malocclusion may include midline shifts, rotation or inclination of neighboring teeth, and supra-eruption of the opposing tooth due to the lack of occlusal contact.

***Pathological Complications*:** Impacted teeth are often associated with pathologies such as dentigerous cysts, odontomes, or other odontogenic tumors. Adjacent permanent teeth may exhibit root resorption, and the impacted tooth is at risk of dilaceration.

***Alveolar Bone Compromise*:** Prolonged impaction can result in alveolar bone loss or thinning in the region, potentially complicating future orthodontic movement or prosthetic rehabilitation. The lack of normal eruption may also impair alveolar ridge development.

***Delayed Eruption and Retention of Primary Tooth*:** Impaction commonly leads to the prolonged retention of the primary incisor, which may obstruct or misguide the eruption pathway of the permanent successor. In some cases, eruption may be completely absent without surgical or orthodontic intervention.

***Treatment Challenges*:** Surgical exposure followed by orthodontic traction is often required to guide the impacted tooth into the arch. However, complications such as ankylosis, damage to adjacent teeth, or inadequate crown alignment may be encountered, making treatment complex and prolonged.

Periodontal Status: A significant increase was observed in the mean clinical attachment level (CAL), probing pocket depth (PPD), and soft tissue recession over the 12-month follow-up period when compared to the immediate post-treatment measurements, indicating a deterioration in periodontal parameters following surgical-orthodontic intervention.

Alveolar Bone Condition: Radiographic assessment corroborated the clinical findings, demonstrating a 5–10% reduction in alveolar bone support in surgically treated impacted central incisors compared to their normally erupted counterparts. A notable decrease in labial alveolar bone

thickness was evident immediately post-treatment. Notably, substantial labial alveolar bone loss was also observed in the contralateral central incisors. Labial bone loss may result from the initial inclination of impacted incisors, surgical exposure, and orthodontic tipping forces, contributing to post-treatment gingival irregularities. Early intervention, as noted by Sun et al., may limit bone loss and allow partial regeneration. Impacted teeth can often be successfully aligned within the arch.

Key factors influencing success include

- Tooth position and angulation,
- Root development stage,
- Presence of dilaceration, and
- Availability of space in the arch.

Timely surgical and orthodontic intervention is essential to prevent complications in aligning impacted teeth. Two common techniques for labial exposure are:

- The window technique, which involves full exposure of the anatomic crown with excision of all keratinized tissue, and
- Partial exposure, revealing only 4–5 mm of the cusp tip while preserving 2–3 mm of keratinized gingiva. [(11)(12)]

In the present case, adequate space permitted successful alignment of the impacted tooth into its correct anatomical position. Literature indicates that the "window" technique is associated with a significant risk of attachment loss, gingival recession, and inflammation, particularly in maxillary canines. To mitigate these outcomes, preservation of keratinized gingiva or the use of an apically positioned flap is advised, facilitating eruption through attached gingiva rather than alveolar mucosa. [(13)] In cases where the impacted tooth exhibits complete root formation or is positioned unfavorably, a combined surgical and orthodontic approach is imperative for optimal outcomes.

CONCLUSION

The orthodontic management of an impacted maxillary central incisor due to a complex odontome necessitates a multidisciplinary approach involving accurate radiographic diagnosis, surgical enucleation of the odontogenic mass, and biomechanically controlled orthodontic traction. Early intervention minimizes the risk of complications such as root dilaceration, adjacent tooth displacement, or alveolar bone loss. When executed with proper case selection and coordinated interdisciplinary planning, the combined surgical-orthodontic protocol facilitates successful eruption and alignment of the impacted incisor, while preserving periodontal integrity and achieving functional and esthetic rehabilitation.

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