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Review Article

Dentistry Section

Unusual Presentations of Dental Impactions: CBCT-based Pictorial Review

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ABSTRACT

The advent of Cone Beam Computed Tomography (CBCT) has significantly transformed the field of Oral maxillofacial radiology. This has brought a true paradigm shift from two-dimensional to three-dimensional imaging. Impacted teeth are frequently encountered in clinical practice and may predispose to dental caries, infections, resorption of adjacent teeth, neural compression, periapical pathology, and the development of cysts or tumours. CBCT plays a pivotal role in the evaluation of impacted teeth by defining the exact position of the tooth and its relation to the vital structures. Moreover, it also reveals the hidden aspects of an impacted tooth, like its morphological alterations, that are not shown on two-dimensional radiography. Authors, hereby present a plethora of such deceptive impactions caught on a CBCT.

Keywords: Dens in dente, Germination, Impactions, Radiology, Supernumerary teeth

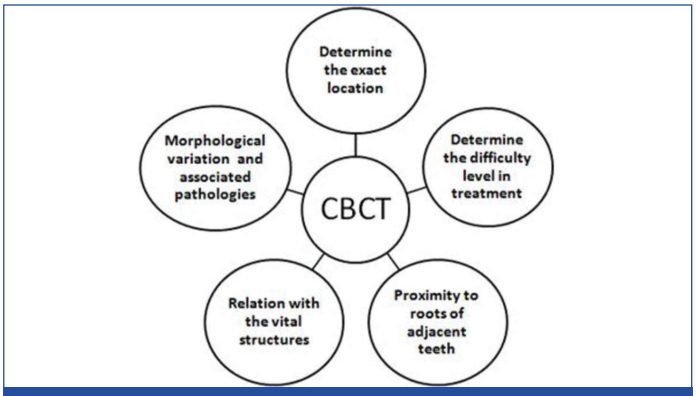
INTRODUCTION

Dental impaction is one of the most common conditions affecting the general population. It is often asymptomatic; therefore, only a small number of the population seek treatment. Therefore, practitioners need to understand the importance of early detection and intervention of an impacted tooth to prevent any possible harmful consequences [1].

Tooth impaction is a frequent phenomenon, but the prevalence and distribution of these impacted teeth may vary considerably based on their location in the jaws. The order of frequency appreciated with respect to the impacted teeth are : mandibular third molar (82.5%), maxillary third molar (15.6%), maxillary canine (0.8%), mandibular premolar (0.4%), maxillary premolar (0.2%), mandibular canine (0.1%), maxillary central and lateral incisor (0.1%), mandibular central and lateral incisor (0.07%) [2]. According to the literature, the prevalence of impacted tooth has been estimated to be between 8% and 38% in different countries [3] with a female predilection [4,5].

Impacted teeth can give rise to various symptoms and pathologies such as pericoronitis, pain, swelling, cheek ulceration, caries, periodontitis and root resorption of the adjacent teeth. It can also give rise to odontogenic cysts, benign or malignant tumours, cellulitis, osteomyelitis, trismus, temporomandibular joint disorder and systemic infections [6].

Oral and maxillofacial radiography remains the first step in the diagnostic approach to jaw lesions. Although new diagnostic imaging techniques have been introduced in recent years, conventional two-dimensional (2D) radiographs, including periapical radiographs, occlusal and panoramic, remain the most commonly used modality for the primary diagnosis and localisation of unerupted teeth and treatment planning [7]. However, 2D radiographs have several limitations, such as a lack of sharpness due to overlapping structures, distorted and magnified images, technique sensitivity, and an inability to locate objects buccally or lingually [8]. Due to the limitations mentioned above, they are not accurate in demonstrating the exact location of an impacted tooth and the anatomy of its roots. Also, it isn't easy to assess its impact on the neighbouring teeth and other adjacent structures, which is highly relevant in treatment planning. So, here comes the role of CBCT as it provides three-dimensional images of high diagnostic quality in the three orthogonal planes (sagittal, axial and coronal) as compared to that of two-dimensional imaging and at a lesser radiation dose (0.068 mSv) compared to that of CT (0.6 mSv) [9]. Therefore, CBCT is indispensable in arriving at an accurate diagnosis and treatment plan. The role of CBCT in determination of impacted teeth has been illustrated in [Table/Fig-1] showing role of CBCT imaging in evaluation of impacted teeth.



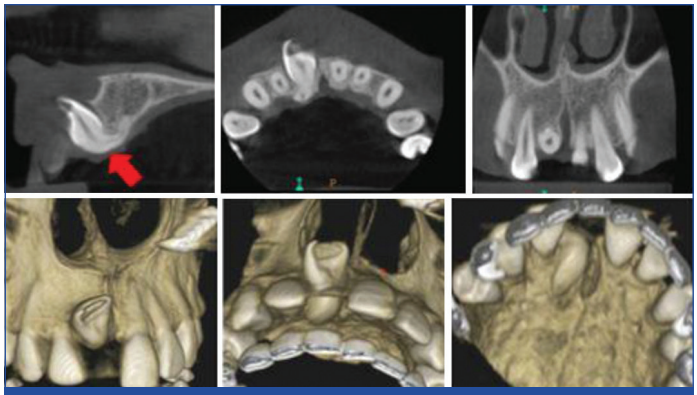
[Table/Fig-1]: Role of CBCT in the determination of impacted teeth.

Therefore, the present article aims at presenting a series of interesting single impactions, multiple impactions and impactions with abnormalities/associated pathologies with unique characteristics and rare presentations.

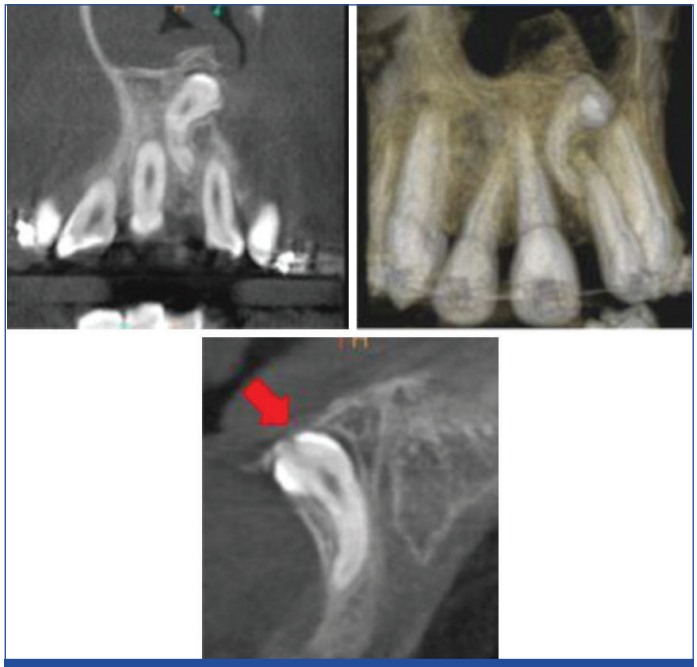
IMAGING FINDINGS

The first five cases from category 1 were of single impaction with various morphological alterations. First case was a labiopalatally impacted #11 with a 'U' shaped root morphology [Table/Fig-2]. In the second case, we found an inverted and vertically impacted, Comma/crescent-shaped #21 [Table/Fig-3]. The third case was inverted, vertically impacted mesiodens [Table/Fig-4]. The fourth case was an impacted supernumerary tooth simulating a shell tooth-like appearance [Table/Fig-5]. The fifth case was an impacted tooth with resorption at the cusp tip [Table/Fig-6].

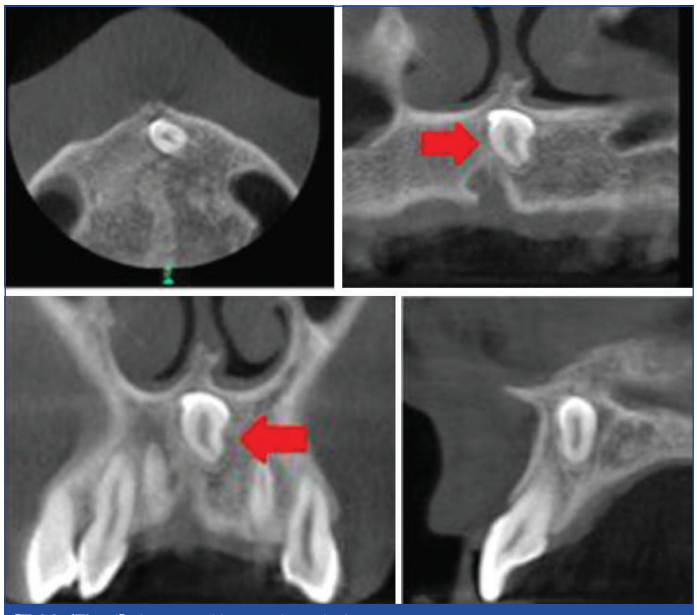
The three cases of category 2 were of multiple impactions, which are rarely found. The first case of this category showed an obliquely impacted #13 and horizontally impacted #23 and #25 [Table/Fig-7a,b]. The second case was of a rotated and labiopalatally impacted #11, #21 [Table/Fig-8]. The third case was obliquely impacted #33, #43 with the presence of the Gubernacular Canal (GC) bilaterally [Table/Fig-9].



[Table/Fig-2]: Labopalatally impacted #11 with U-shaped root morphology.

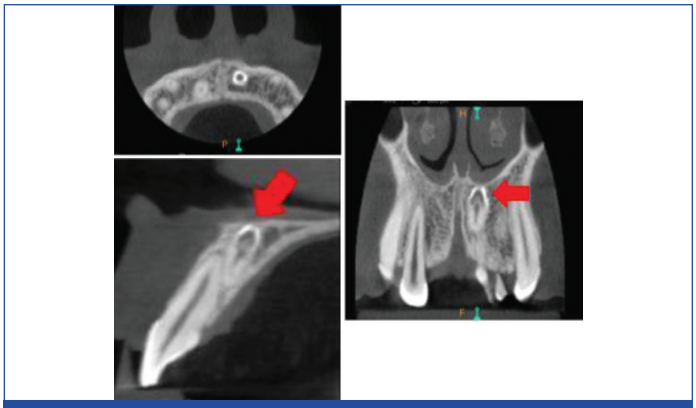


[Table/Fig-3]: Inverted and vertically impacted, comma/crescent shaped #21.

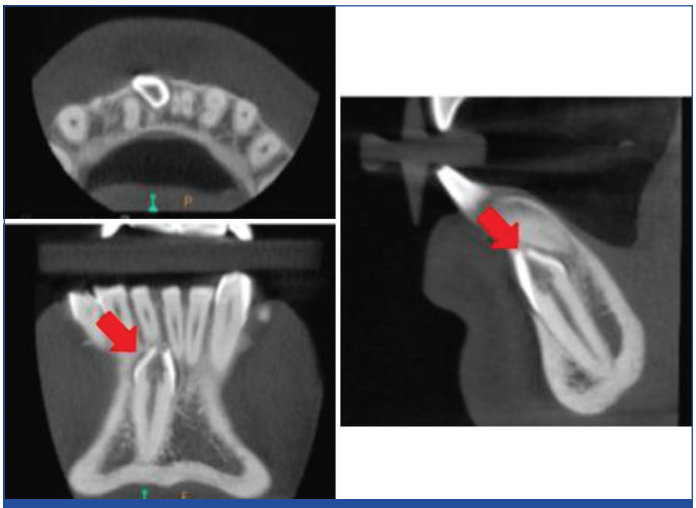


[Table/Fig-4]: Impacted inverted mesiodens.

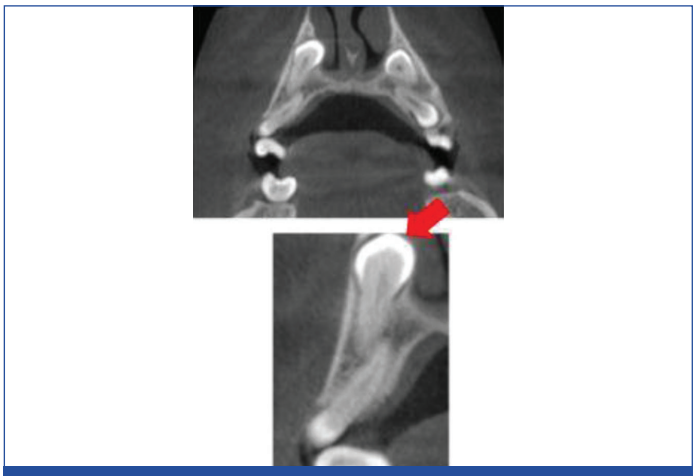
The last three cases from category 3 were of impactions with various pathologies. The first case was a combination of a compound odontome, vertically impacted #21 with an open apex and vertically impacted #22 with a flexed root [Table/Fig-10a-c]. The second case was of two supernumerary teeth with dens in dente in one and a dilacerated root in the other [Table/Fig-11a,b]. Third case was of germination of impacted mandibular third molar with hyperplastic follicular space [Table/Fig-12]. [Table/Fig-13] show the summary of these cases.



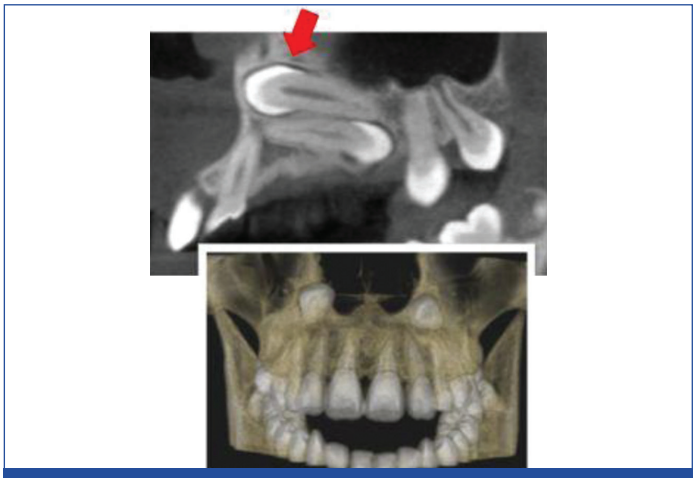
[Table/Fig-5]: Impacted inverted supernumerary simulating shell tooth-like appearance.



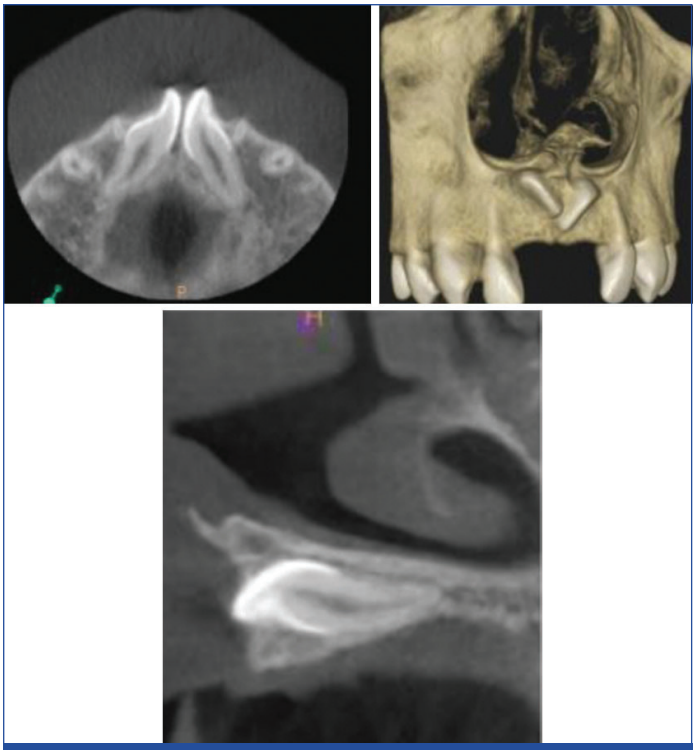
[Table/Fig-6]: Vertically impacted #43 with resorption at cusp tip.



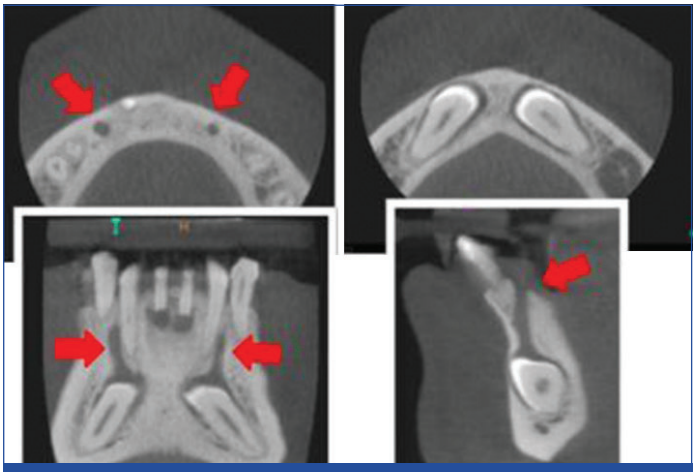
[Table/Fig-7a]: Inverted obliquely impacted #13.



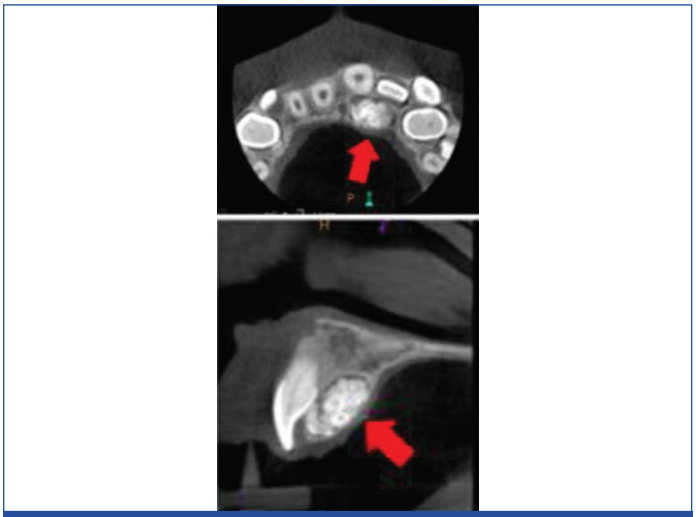
[Table/Fig-7b]: Horizontally impacted #22, #23.



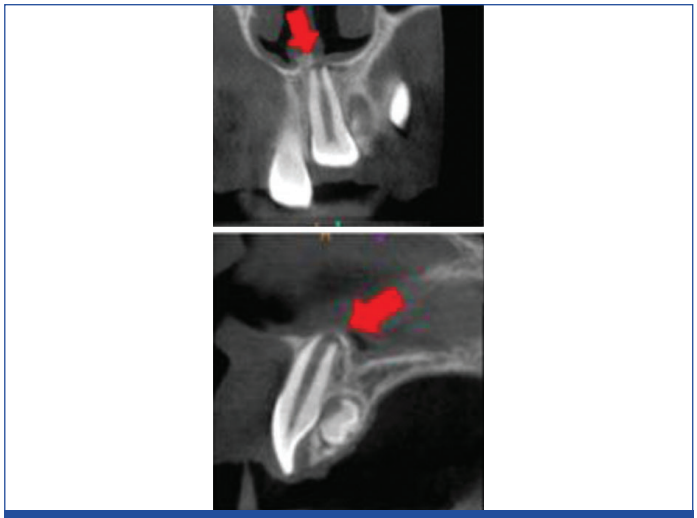
[Table/Fig-8]: Rotated and labiopalatally impacted #11, #21.



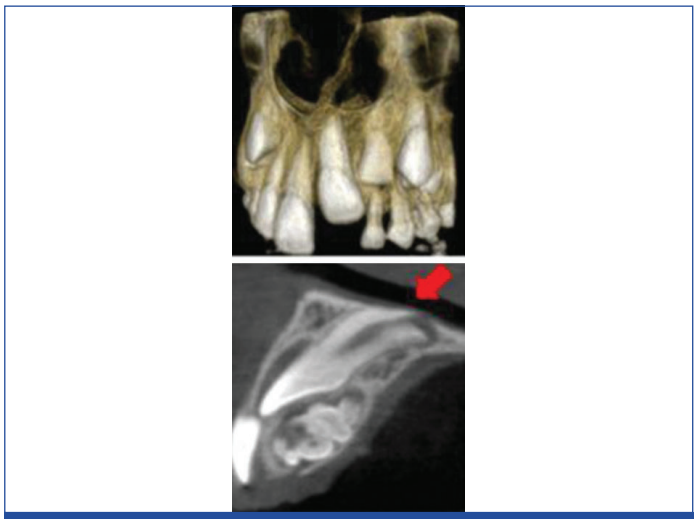
[Table/Fig-9]: Obliquely impacted #33, #43 with presence of gubernacular canal bilaterally.



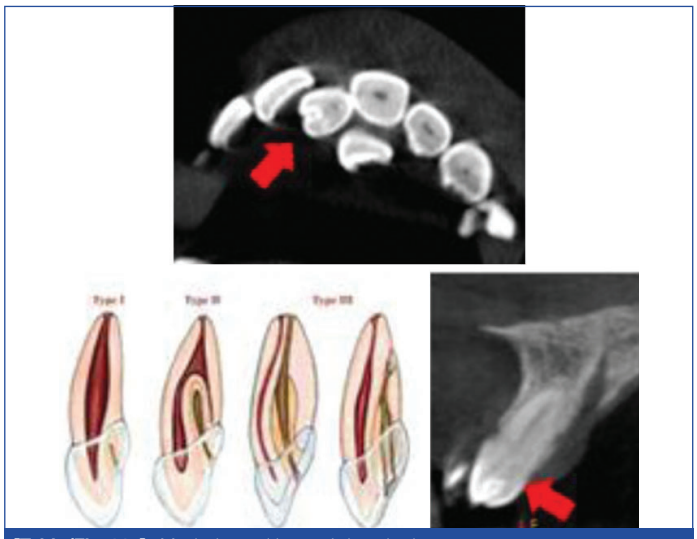
[Table/Fig-10a]: Compound odontome in left anterior.



[Table/Fig-10b]: Vertically impacted #21 with an open apex.



[Table/Fig-10c]: Vertically impacted #22 with an flexed root.

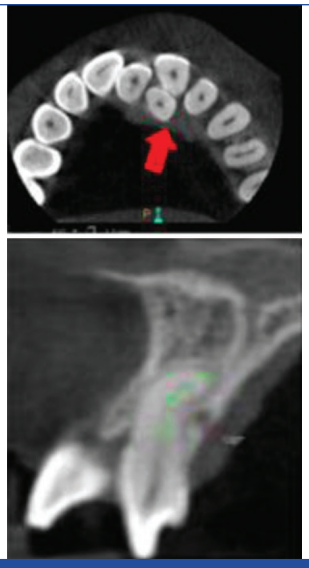


[Table/Fig-11a]: Mesiodens with type I dens-in dente.

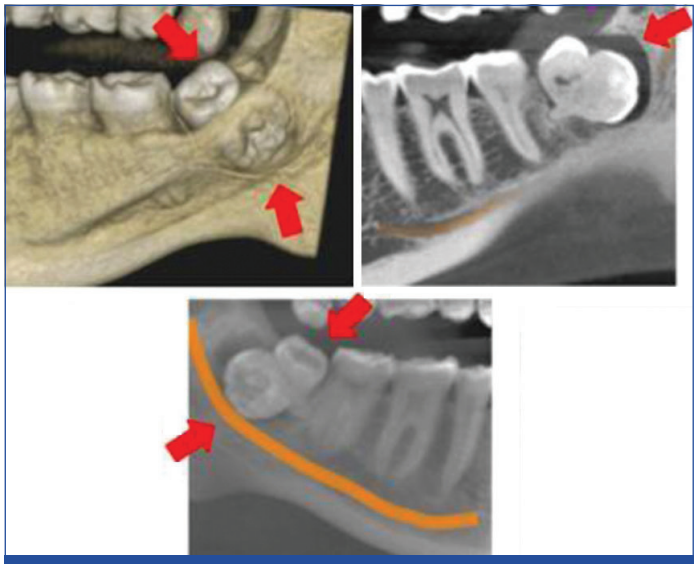
DISCUSSION

An impacted tooth is a tooth that is prevented from erupting into the dental arch by overlying gum, bone or another tooth [10]. The prevalence of tooth impaction in the North Indian population has been reported to range from 5.6% to 18.8% [11]. Impaction can be associated with both primary and permanent dentition or even with a supernumerary tooth. Supernumerary teeth are the presence of an additional or excessive number of teeth to the regular series in either of the dentitions. Since the incidence of supernumerary has been reported as less than 1% [12], its presence is sometimes overlooked by the patients. Prevalence of supernumerary teeth is reported to lie between 1% and 3% in permanent dentition [11].

As mentioned above, the first category consisted of cases with single impactions, exhibiting various morphological alterations. The first case documented was that of an impacted maxillary central incisor with a “U shaped” root morphology. Impaction of maxillary



[Table/Fig-11b]: Supernumerary tooth palatal to #21 with dilacerated root.



[Table/Fig-12]: Gemination of impacted mandibular third molar with hyperplastic follicular space.

central incisors occurs with a prevalence of 0.06-0.2% [13]. In a review of 1166 patients, Neville BW et al., found 176 dilacerated teeth. Of these teeth, maxillary and mandibular incisors were least frequently involved, thus, affecting nearly 1% of the series [14]. This unusual presentation has been reported previously only by Punde PA et al., who stated that this morphology is a very rare appearance [15]. Trauma and developmental disturbances are considered to be the probable causes of dilacerations. The curve or bend could occur anywhere along the length of the root, depending on the amount of root formed when the injury occurred [16]. The root curvature predisposes the root to fracture during surgical removal. Therefore, proper surgical protocol is to be followed in order to prevent complications such as displacement of fractured root in any of the vital structures.

The second case was that of a vertically inverted supernumerary tooth, which was comma or crescent-shaped. Only one case has been reported to date of a crescent-shaped supernumerary tooth by Kalluri S et al., [17].

The third case reported was of an inverted mesiodens close to the nasal floor and nasopalatine canal. Anusha RL et al., have documented the frequency of inverted mesiodens as 9-67% of all the reported cases [18]. Mossaz J et al., found that 20.5 % of mesiodens were in contact with the nasal floor and 49% in relation to the nasopalatine canal [19]. Saleh EB and Philip MR reported a case of an inverted impacted mesiodens perforating the nasal floor [20]. The relation between impacted mesiodens and nasopalatine canal

S. No.	Tooth involved	Morphology/ rarity/pathology	Type of impaction	Clinical implication
Category 1- Single tooth impactions with morphological alterations				
1	#11	U-shaped root	Labio-palatally impacted	Diagnostic challenge Surgical complications Pathological associations
2	#21	Comma or crescent shaped tooth	Inverted and vertically impacted	
3	Mesiodens	Smaller than normal tooth	Inverted and vertically impacted	
4	Supernumerary tooth	Shell tooth appearance	Inverted and vertically impacted	
5	#43	Resorption of cusp tip	Vertically impacted	
Category 2- Multiple teeth impactions				
1	#13,#23,#25	Normal	Obliquely impacted #13 Horizontally impacted #23, #25	Diagnostic challenge Surgical complications Pathological associations Endodontic/ orthodontic considerations
2	#11, #21	Normal	Rotated and labio-palatally impacted	
3	#33, #43	Normal with gubernacular canal bilaterally	Obliquely impacted	
Category 3- Impactions with pathologies				
1	#21, #22	Compound odontome	Vertically impacted #21, vertically impacted #22	Diagnostic challenge Surgical complications Pathological associations
2	Supernumerary teeth	Dens in dente; dilaceration of root	Vertically impacted	
3	Third molar	Gemination	Mesioangular	

[Table/Fig-13]: Summary of cases.

may affect the surgical procedure [21]. Damage to this structure can increase the risk of injury to the nasopalatine nerve, resulting in sensory loss to the anterior palate. Another structure that was found in proximity to mesiodens was Canalis Sinuosus (CS). CS is a bony canal that runs forward and downward to the inferior wall of the orbit, passing below the infraorbital foramen. Reaching at the anterior margin of the nasal aperture in front of the anterior end of the inferior concha, it follows the lower margin of the aperture. It opens next to the nasal septum in front of the incisive canal [22]. The CS transmits the anterior superior alveolar nerve, along with the corresponding veins and arteries, and is responsible for supplying incisors, canines and the adjacent soft-tissue [23-25].

The fourth case is that of an impacted supernumerary tooth simulating a shell tooth-like appearance, and the fifth case is that of an impacted mandibular canine with resorption at the cusp tip. After a thorough literature search, it was concluded that the incidence of such cases has not been reported in the literature to date. The plausible causes suggested for resorption found in the fifth case could be due to the pressure exerted by the erupted permanent tooth, or due to caries or a result of developmental defect. It could be a case of Pre-eruptive Intracoronal Resorption (PEIR), also known as preeruptive intracoronal dentin defect. These results are due to the acquired pathological conditions from apical inflammation of predecessor primary teeth or dental caries of the unerupted teeth [26].

The current review's second category highlights rare cases with multiple impactions. In first case, horizontally impacted canine and premolar are placed in juxtaposition within the left maxilla. Only one case has been reported till date of horizontally impacted canine and premolar present concomitantly by Peng CL et al., in 2006 [27]. A prevalence of 8% has been reported for inverted maxillary canine in a study conducted by Alassiry A [28]. Such cases are of prime importance as they encroach the vital structures, thereby, affecting the treatment plan. Such cases need to be reviewed for both orthodontic and surgical intervention.

Second case in this category was that of horizontally bilateral impacted maxillary central incisors which were positioned labio-palatally. Prevalence of such bilateral horizontal impaction has not been reported in literature. However, a few cases of single maxillary central incisor impactions have been reported by Chawla HS and Kapur A, Rizzatto SM et al., and Cesur MG et al., [29-31].

The third case was that of bilateral impacted mandibular canine with GC. On axial section, GC appeared as a mental foramen giving a wrong impression. Therefore, it's important to know of its presence to prevent a misdiagnosis. Detection rate of GC has been reported ranging from 43.7-100% [32]. In a study conducted by Araujo HG et al., in 2019, highest detection rate of GC was found in normally erupting teeth (94.1%), followed by impacted teeth (87.1 %) and teeth with delayed eruption (62.9%) [33].

The last category was that of impactions with abnormalities/pathologies. First case was a triad of vertically impacted central incisor with an open apex, an impacted maxillary lateral incisor with a flexed root and compound odontome. The incidence of compound odontome ranges between 9 and 37% [34]. A case of compound odontome associated with an unerupted and dilacerated maxillary central incisor has been reported by Kulkarni VK et al., [35]. However, till date, such a triad has never been reported in literature which makes it an interesting and unique case.

The second case in this category was that of two supernumerary teeth, type I dens invaginatus in one of them which was a mesiodens and dilacerated root at 137 degree in relation to the other supernumerary tooth. Demiriz L et al., conducted a survey whereby he found 24.4% cases with two supernumerary teeth, which he stated was in accordance with the literature [36].

However, its association with mesiodens is a very rare phenomenon. To the best of authors' knowledge and review of English language literature through PubMed search showed only two cases reports of dens invaginatus in impacted mesiodens in last decade [37,38]. Treatment of dens invaginatus varies from conservative approach to extraction. However, in cases of mesiodens, extraction is usually the treatment of choice.

The third case was that of gemination in relation to an impacted mandibular third molar with a hyperplastic follicular space. The size of the normal follicular space is 2-3 mm. If the follicular space exceeds 5 mm, a dentigerous cyst is more likely. If uncertainty remains, the region should be re-examined in 4-6 months to evaluate any increase in size or any influence on surrounding structures characteristic of cysts [39]. Shilpa G et al., reported a prevalence of 0.95% in a study conducted in 2017 [40]. Talla HV et al., and Bhatt P et al., reported a similar case of germination [41,42]. Since extraction is considered as the treatment of choice in such cases, CBCT is necessary for the investigation purpose as it clearly shows the crown-root anatomy and its relation with inferior alveolar nerve canal and other vital structures without which an effective treatment plan would be difficult to establish.

Impacted teeth with morphological alterations pose significant diagnostic and therapeutic challenges. Abnormalities such as dilaceration, fusion, or dens invaginatus can complicate localisation, increase the risk of surgical complications, and limit orthodontic or endodontic treatment options. CBCT plays a vital role in their evaluation by providing accurate three-dimensional visualisation of tooth morphology, orientation, and proximity to vital structures [Table/Fig-14].

Aspect	Clinical implications	Role of CBCT
Diagnosis	Altered morphology (dilaceration, fusion, dens invaginatus) makes 2D interpretation difficult	Provides 3D visualisation of tooth morphology, position, and relation to adjacent structures
Surgical planning	Risk of root fracture, nerve injury, or sinus perforation during extraction	Accurately assesses root form, angulation, cortical perforation, and proximity to vital structures for safe access
Orthodontic management	Difficulty in orthodontic traction due to root curvature, ankylosis, or abnormal orientation	Determines tooth position, eruption path, and root morphology to plan traction vector and force direction
Endodontic considerations	Complex canal anatomy and periapical pathology may affect prognosis after eruption	Identifies root canal configuration, detects periapical lesions, and evaluates pulp status pre-surgically
Associated pathologies	Impacted teeth may be linked to cysts, tumours, or resorption of adjacent roots	Defines lesion extent, internal structure, and relation to teeth and bone for precise surgical planning
Multiple impactions	Spatial crowding complicates localisation and treatment sequencing	Enables 3D mapping of all impacted teeth and aids in coordinated multidisciplinary treatment
Aesthetic and functional concerns	Anterior impactions affect eruption, alignment, and facial aesthetics	Predicts eruptive potential and helps plan minimally invasive exposure to preserve bone and gingiva
Radiological and prognostic value	Misinterpretation may lead to complications and poor outcomes	Enhances diagnostic confidence, reduces iatrogenic risk, and provides medico-legal documentation

[Table/Fig-14]: Clinical implications of impacted teeth with morphological alterations and the role of CBCT.

CONCLUSION(S)

The growing awareness of aberrant dental impactions, such as impacted teeth with altered forms and altered positions, impacted supernumerary- supplemental and rudimentary teeth with different topologies highlights the variety of clinical presentations seen in practice. CBCT allows for precise localisation, morphologic assessment, and the detection of complications, helping maxillo-facial surgeons in their approach to difficult impactions while reducing danger to neighbouring anatomical structures. For uncommon impactions and supernumerary teeth-including those altered in shape or inversion the precision and clinical usefulness of CBCT imaging is important, helping assure successful diagnosis, treatment planning, and outcomes.

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