Cone Beam Computed Tomography as a Tool to Detect the Causes of Permanent Maxillary Central Incisors Impaction

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Abstract: Background: When the maxillary central incisors fail to erupt into the oral cavity at the normal time, a clinician should determine the reasons and perform an accurate treatment plan. Although the impaction of maxillary central incisors is not a frequently case in dental practice, but its treatment is challenging because of its importance to facial esthetics in addition to functional demands thus the early radiographic diagnosis is very important. The purpose of this study is to evaluate the ability of Cone-beam computed tomography (CBCT) as a tool to diagnose the causes of impacted permanent maxillary central incisors. Material and method: CBCT scans of 50 subjects with age range (9-12) years with impacted maxillary central incisors, the following parameters were evaluated: main causes of impaction such as (malposition, presence of supernumerary teeth or odontomas and other pathological lesions), gender, unilateral/bilateral occurrence, and the side of impaction. Results: Most of the impacted maxillary central incisors were observed in males (56%), bilaterally (27 cases). In most of the impacted cases supernumery was responsible for the highest percentage (54%), followed by (28%) caused by malposition, (12%) caused by odontoma, (6%) caused by Pathologic cyst. Conclusion: CBCT images can provide a reliable assessment of the impacted maxillary central incisors and differentiate between the causative factors that leading to this impaction.

Keywords: CBCT, impacted maxillary central incisors, causes

1. Introduction

The impaction of maxillary permanent central incisors usually occurs less frequently than that of third molars and permanent canine, but the patients often visit a dental clinic for management due to the high esthetic and functional demand, maxillary incisors are considered the most prominent teeth in the smile of an individual and these teeth also have a great role on speech.[1]

The specific age for normal eruption of impacted maxillary incisors occurs at 7 years, so the impaction is suspected when the tooth eruption is delayed or does not erupt within a specific time and the contralateral tooth has been erupted about six months.[2] Many studies show different causes for the impaction of maxillary incisors such as supernumerary teeth, odontomas, cysts that develop in the eruptive way of the incisor.[3] Eruption failure may occur due to trauma to a deciduous tooth which causes malformation or dilacerations of developing permanent toothbud.[3,4] Ankylosis, non-vitality of primary teeth, endocrinal abnormalities, and bone disease are also recorded as possible causes of eruption loss of maxillary incisors. [5] When the incisors do not erupt at the expected period of time, it is necessary to determine the cause and prepare a suitable treatment plan. An accurate diagnosis may be obtained after proper clinical and radiographic examination. [3]

The radiographic evaluation can be obtained through several imaging modality such as: Panoramic radiograph, Lateral cephalometric, computerized tomography(CT) which show an accurate position of an unerupted tooth and identifying any root resorption of adjacent teeth not detectable by other methods [6], and Recently cone-beam CT (CBCT) has been used as a new imaging technique in dental and maxillofacial field. It has less radiation dose of computed tomography, less cost and less time consuming, with 3D images option that produce good bone differentiation and an unlimited number of views, but this technique suffering from some spatial resolution (the ability to distinguish fine details of two different objects that are close to each other) and less representation of soft tissues when compared to computerized tomography (CT) view.[7] The aim of this study is to evaluate the ability of Cone-beam computed tomography (CBCT) as a tool to diagnose the causes of impacted permanent maxillary central incisors.

2. Material and Methods

A prospective radiographic study of (50) patients aged (9-12) years with unerupted maxillary central incisors who underwent for CBCT examination performed for the evaluation and management of impacted maxillary incisors after a good clinical examinations. CBCT images were done using Kodak cone beam computed tomography unit with scanning parameters: (90 kVp), (10) s, (10) mA, (300) mm voxel size, and field of view (15) mm.

All patients and parents were fully informed about the objectives and the procedures with detailed consent form before the beginning of the CBCT examination.

This study considered a tooth to be impacted when it was fully or partially embedded in the bone and more than 2/3 of its root is developed.

Each CBCT image was evaluated in axial, sagittal, and coronal plane and in 3D reconstruction view and interpreted for unilateral/bilateral occurrence, side, malposition, presence of supernumerary teeth or odontomas and any
pathological lesions. The age was divided into 2 age groups: (9-10.5 and +11) and the gender of each patient was recorded, then the collected data were analyzed statistically using Fisher's exact probability test (F.E.P.T), exact sig.(2-sided), and Chi-square test.

3. Results

The ages of the patients ranged from 9 to 12 years (mean age: 10.68 years). The impacted maxillary central incisors were mostly observed in males (28 cases) followed by (22 cases) in females. Out of 50 patients 77 maxillary central incisors were impacted (23 cases) were with unilateral and (27) 54% were with bilateral occurrence. The highest percentage of patients with impacted maxillary central incisors was in age group (11+) years (60%), followed by (40%) in age groups (9-10.5). The frequency distribution of the study sample among various causes for impaction of maxillary central incisors diagnosed by CBCT are presented in table 1, as a cause for impaction, the presence of supernumerary teeth has the highest percentage (54%), followed by (28%) malposition, (12%) caused by odontoma, and (6%) caused by pathologic cyst. The Binomial test was used to show the relation between age, gender, side and occurrence of impacted teeth which was non-significant. Chi-square test was used to show the relationship between variables and impacted maxillary central incisors, table 2. The total association between age and gender of the study sample (by 50 subjects) with different possible causes of impaction shown in table 3, malposition, Pathologic cyst and presence of supernumerary tooth are frequently cause the impaction with increase age, while the association between the gender and the causes show high value in male than female except the odontoma. The CBCT examination was able to establish the frequency of central incisor impaction causes in total (77) teeth of the (50) patients that show an ordered increase in the number of impacted teeth in relation with malposition, odontomas, and then with the presence of supernumerary tooth respectively with age increasing. In addition (Fisher's exact probability test) when applied and although there was increased severity for most variables with male more than female but it did not reach the statistical significance. According to the occurrence the impacted teeth were equally distributed between left and right side due to pathologic cyst and presence of supernumerary tooth, table 4.

![Figure 1: Axial slice of CBCT image show a malposed impacted maxillary central incisor](image)

![Figure 2: Sagittal slice of CBCT image show anodontoma](image)

![Figure 3: Sagittal slice of CBCT image show presence of supernumerary tooth](image)

### Table 1: Distribution of variables by subjects

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>NO.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (Year)</strong></td>
<td>9-10.5</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>11+</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td>Males</td>
<td>28</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>22</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td><strong>Cause</strong></td>
<td>malposed</td>
<td>14</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>odontoma</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Pathologic cyst</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>supernumerary</td>
<td>27</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td><strong>Occurrence</strong></td>
<td>unilateral</td>
<td>23</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>Bilateral</td>
<td>27</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>50</td>
<td>100</td>
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Table 2: Association between causes and age, and gender by total number of subjects.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
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<th>Gender</th>
<th>Cause</th>
<th>malposed</th>
<th>odontoma</th>
<th>pathologic cyst</th>
<th>supernumerary</th>
<th>Total</th>
<th>F.E.P.T</th>
<th>df</th>
<th>Sig.</th>
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<td>6</td>
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<td></td>
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<td></td>
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<td>NO.</td>
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<td>27</td>
<td>2</td>
<td>3</td>
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<td></td>
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<td>25</td>
<td>4</td>
<td>2</td>
<td>39</td>
<td>6.82</td>
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<tr>
<td></td>
<td></td>
<td>Right</td>
<td>Left</td>
<td>NO.</td>
<td>8</td>
<td>25</td>
<td>4</td>
<td>2</td>
<td>39</td>
<td>6.82</td>
<td>7.89</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Fisher's exact probability test (F.E.P.T)

4. Discussion

Tooth eruption belongs to the change in position reaching to its final arrival into the oral cavity.[8] The formation location of tooth may be altered even before it appear in the oral cavity and it may be remain impacted. Many factors are responsible for impaction of maxillary central incisors.[9] Supernumerary teeth are considered to be one of the most common cause of the impaction of maxillary central incisors.
incisors in the present study 54% of the cases were due to the presence of supernumerary teeth that causing a direct obstruction for the path of eruption of maxillary central incisors, shifting of the neighboring teeth to the position of the impacted tooth, moving of the tooth bud, and malformations in the root of the impacted tooth [10-14], this result is in agreement with Smialiene et al [15] study that found the premaxillary supernumerary teeth caused impaction of permanent incisors in 56-60% of cases.

Malposition usually affects the maxillary central incisors; this may be due to the fact that this area is widely exposed to trauma in this age groups, so 28% of cases in this study were due to malposition [16] Wasserstein et al. [17] also described an impacted maxillary central incisor and incomplete transposition between the canine and the lateral incisor and related these anomalies to an earlier traumatic event. Odontoma was responsible for 12% of impaction cases; Bayram et al. [18] study revealed that one of the most common causes of impaction is odontoma in addition to supernumerary teeth, and loss of space.

Tanki et al. [19] stated that many literatures shows pathological obstructions, such as cysts that may develop in the way of the incisor resultedin failure or late eruption of maxillary central incisors, in our study 6% of impacted cases were associated with pathological cysts. The patients’ distribution according to their gender was (56%) males and (44%) females this result was close to findings of Smialiene et al. (15) (57.6%) males and (42.4%) females.

Early diagnosis of impacted maxillary central incisors through radiographic evaluation is very important for planning a treatment guideline to eliminate the cause of the impaction to restore function and esthetic. [20] CBCT has proved to be the method of choice in visualizing precise position, form, and causative factors of impactions conclusion CBCT is recommended to be a routine method in diagnosing possible causes of impacted maxillary central incisors due to highly informative 3D details.

References


Author Profile


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