Localization of Maxillary Impacted Canine Using Cone Beam Computed Tomography for Assessment of Angulation, Distance From Occlusal Plane, Alveolar Width and Proximity to Adjacent Teeth

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ABSTRACT

Backgrounds: Maxillary canine impaction is complicated and time consuming to treat, for being highly diverse in inclination and location; it may be a companied by root resorption of the neighboring teeth. CBCT has been used for its diagnostic reliability in localization of impacted canine and revealing its serious local complications.

Objectives: Localization of maxillary impacted canine using cone beam computed tomography for assessment of angulation, distance from occlusal plane, alveolar width and proximity to adjacent teeth.

Subjects and Methods: The study sample was 33 subjects 16 females and 17 males attended to Al-Wasitti general hospital in Baghdad city-Oral and maxillofacial radiology department for CBCT scan investigation from November/2015 to April/2016. By using theCS 9000 device, 3D images and coronal, axial and sagittal views obtained to perform the selected measurements.

Results: Contact of impacted canine to the nearby teeth had a strong effect on their root resorption. Vertical or horizontal angulation measurement in axial view, was not possible for a number of cases. Comparison of the angulation measurement validity between axial and coronal views, had showed an obvious statistical difference in coronal view for vertical angulation, and in the axial view for horizontal angulation calculation. Correlation of the canine localizations found in the study with the measurements, showed a significant statistical difference with age and vertical angulation (coronal view). Age or gender correlation with the measurements was non significant statistically, except for age with vertical angulation (coronal view).

Conclusion: utilization of CBCT provides a worthy data about the impacted maxillary canine localization, for more explanation and treatment of these cases surgically and by orthodontics.

Keywords: localization, canine, maxillary, CBCT, impaction. (J BaghColl Dentistry 2017; 29(1):70-75).

INTRODUCTION

The secondary cuspids represent the establishment of dynamic occlusion in addition to equiponderant smile. The canine is the pillar or corner stone of the maxillary arch. Canine impaction elevates the hazard of cyst formation, infection as well as settlement of long-term prognosis of nearby lateral incisor due to their root resorption. Moreover a morbid complexities manifested as referred pain, lack of dental arch length and others.

Although the optimal treatment choices for the emendation of canine impaction is those options with long-term prognosis which are to get these teeth in collocation. For that reason careful localization and assortment of impacted cuspids is mandatory to manage them in best way. The initial stage of handling is accurate revealing of presence of an impacted maxillary cusp. Precise examination of the neighboring anatomical structures is entailed for localizing an impacted tooth.

Regarding the diagnosis and treatment planning, the most usual imaging means, was classic bi-dimensional radiographs by which the semblance of the long axis and the relevance with the adjacent dental and bony structures were not delicate due to superposition of these complex structures in the maxillofacial area. Image disfigurement projection mistakes, blurred radiographs; also complex maxillofacial projection onto a bi-D level could decrease the precision and effectiveness, and elevate the hazard of misconstruction of the radiograph.

Therefore CT was employed for similar conditions, to localize the impactions and assessment of resorption of incisors, because of superior tissue contrast and accurate granted tri-D radiographs.

CBCT concerning canine impaction has diagnostic potency and may impact on organizing the treatment, in addition it is possible to do a suggestive remediation for the resorption of the roots of incisors. In addition CBCT does not distort radiographs of impacted teeth. In contrast to conventional CT it offers a volumetric radiographs at raised spatial resolution with a decreased dose of radiation for the dental arch, the 3D radiography offers the information in depth width and length.

In the current study, the use of CBCT images is for evaluation of maxillary impacted canine.
SUBJECTS AND METHODS
(33) Iraqi subjects (17 males and 16 females) with an age range (13-27 years), were referred to the Oral and maxillofacial radiology department / Al-Wasitti general hospital in Baghdad city, from (November/2015 till April/2016) to have CBCT imaging for localization of maxillary impacted canines. 50 cases of maxillary impacted canines were found (22 in females and 28 in males), involved both bilateral and unilateral impactions. All patients participated in the study were informed about it and they were asked to sign an informed consent form before undergoing the examination. The clinical examination included the intraoral examination of each patient in order to meet the selective criteria of the sample. The patients should be without history of orthodontic treatment or orthognathic surgery, no history of dentofacial deformities, pathological lesions at the examined area of the jaw or facial trauma, no gross distortion of dental arches due to cleft lip/palate and with good medical history and no hormonal disturbances. The CBCT machine CS 9000 3D Extraoral Imaging System-CareStream dental, was used to obtain the measurements of selected Variables which were:

1. Impacted maxillary canine localization: in 3D images to show the presence or absence of maxillary canine (fig. 1). The relative position of the impacted maxillary canine was classified to 5 basic localization described by Fragiskos(16).

2. Angulation: the angle between long axis of tooth and the mid-sagittal plane, (Vertical angulation) & the angle between the long axis of tooth and occlusal plane (horizontal angulations), as described by Al-Ansari et al. (17) in axial and coronal view (fig.2, 3).

3. Cusp tip distance: The distance from the tip of cusp to occlusal plane line, in coronal view (fig.4)
4. Root resorption of adjacent teeth: in sagittal view, based on the grading systems suggested by Ericson et al. (18): no, mild, moderate and severe resorption.

5. Alveolar width (in millimeters): mean width around the tooth (fig. 5), in sagittal view. (19)

Figure 5: Alveolar width measurement.

6. Proximity to adjacent teeth: Sagittal view, the alveolar width determines the proximity, described by Ericson et al. (18): no contact or contact.

RESULTS

56% of the patients were males and 44% females. Age range (13-27 years) was divided to 3 groups were: (13-15, 16-20, 21 years - older). Impacted canine tooth localization was found in the study was: Labial localization, labial localization of crown and palatal localization of root, palatal localization and Palatal localization of crown and labial localization of root. Labial localization had the highest percentage (42%), while least (4%) for palatal localization crown and labial localization root, none was found as ectopic localization. The highest percentage of the study sample unite did not have root resorption forming (56%) of total cases. The remaining had mild and moderate resorption, none showed severe resorption. A significant statistical relation was found between the impacted canines in contact or touch with the neighboring teeth and those without contact (table 1). Both vertical or horizontal angulation measurement in axial view, was not possible for a number of the cases, exceeded half of the sample (table 2); a single case of measuring vertical angulation in coronal view and another case of measuring horizontal angulation in axial view did not have an angulation with the mid-sagittal and occlusal plane respectively. Comparison of the 2 views validity in measurement of vertical angulation showed a higher mean of angulation calculated in coronal than axial view and a significant statistical difference between the 2. A higher mean of horizontal angulation measurement was found in axial than coronal view with a significant difference between the 2 views. Correlation of the four impacted canine localizations found with the measurements showed a significant statistical difference only with age and vertical angle (coronal view) (table 3). No mentionable statistical difference for gender or age with the measurements, except between age and vertical angulation (coronal view) (table 4).

Table 1: Association between the anatomical proximity of the impacted canine to the nearby teeth and their root resorption

<table>
<thead>
<tr>
<th>Resorption</th>
<th>Negative</th>
<th>%</th>
<th>Positive</th>
<th>%</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No resorption</td>
<td>2</td>
<td>86.20</td>
<td>3</td>
<td>14.28</td>
<td>5</td>
<td>56.0</td>
</tr>
<tr>
<td>Mild</td>
<td>3</td>
<td>10.34</td>
<td>1</td>
<td>61.90</td>
<td>4</td>
<td>32.0</td>
</tr>
<tr>
<td>Moderate</td>
<td>1</td>
<td>3.44</td>
<td>5</td>
<td>23.80</td>
<td>6</td>
<td>12.0</td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td>100.0</td>
<td>2</td>
<td>100.0</td>
<td>5</td>
<td>100.0</td>
</tr>
</tbody>
</table>

None had severe resorption; P (Mann-Whitney) = 0.012[S]

Table 2: The relative frequency of cases whom the measurements of the vertical angulation and horizontal angulation in axial section was technically not feasible

<table>
<thead>
<tr>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical angulation in axial section-validation</td>
<td>29</td>
</tr>
<tr>
<td>Measurable</td>
<td>21</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
</tr>
<tr>
<td>Horizontal angulation in axial section-validation</td>
<td>30</td>
</tr>
<tr>
<td>Measurable</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
</tr>
</tbody>
</table>
### Table 3: Association between impacted canine tooth localization and measurements

<table>
<thead>
<tr>
<th>Impacted canine tooth localization</th>
<th>palatal localization</th>
<th>palatal localization of crown, labial localization root</th>
<th>labial localization crown, palatal localization root</th>
<th>labial localization root</th>
<th>P (ANOVA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>(13 to 27)</td>
<td>(14 to 25)</td>
<td>(13 to 27)</td>
<td>(13 to 21)</td>
<td>0.005 [S]</td>
</tr>
<tr>
<td>Range</td>
<td>18.4</td>
<td>19.5</td>
<td>18</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>4.19</td>
<td>7.78</td>
<td>5.11</td>
<td>2.22</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>1.16</td>
<td>5.5</td>
<td>1.37</td>
<td>0.49</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>13</td>
<td>2</td>
<td>14</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Vertical angulation in coronal section</td>
<td>(24 to 64)</td>
<td>(25 to 31)</td>
<td>(26 to 88)</td>
<td>(18 to 60)</td>
<td>0.008[S]</td>
</tr>
<tr>
<td>Range</td>
<td>41.9</td>
<td>28</td>
<td>45.8</td>
<td>31.2</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>11.59</td>
<td>4.24</td>
<td>17.68</td>
<td>10.04</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>3.21</td>
<td>3</td>
<td>4.9</td>
<td>2.19</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>13</td>
<td>2</td>
<td>13</td>
<td>21</td>
<td></td>
</tr>
</tbody>
</table>

**DISCUSSION**

Maxillary cuspids are the perfect alternative preservation of the occlusal outline, they are the principle agent in the permanence and esthetics of the dental arch. [20] Accurate diagnosis and localization are needed for the several handling means of the impacted canines which involve surgical disclosure then orthodontic induced eruption later.[13] In dentistry obtaining volumetric images of the dental arch and the surrounding tissues at a decreased dose of radiation and raised spatial resolution is permitted by CBCT utilization. [21]

This study agreed with findings of a study by Al-Ansari et al. [17], that there's a remarkable link of contacting the impacted canine to the nearby teeth and their root resorption. As this study, they also revealed that all the resorption conditions occurred in group of positive touching. Uday et al. [19] had demonstrated the same, except that larger number of mild resorption cases happened in negative contact group, may be due to different sample size. Algerban et al. [9], reported a familiar findings specified that following the diagnosis of root resorption of adjacent teeth was determined, the splitting of impacted maxillary canine and the nearby incisors should be instant and, to pause the resorption procedure.

In this study 21 cases of vertical angulation measurement as well as 20 cases of horizontal angulation measurement could not be obtained in the axial section respectively. These results were also recognized by Uday et al. [19], who reported that in order to gain the longitudinal axis of the tooth and for multiple sorts of impaction if various sections were utilized then it is substantial to direct the angulation to the mid-sagittal plane. Due to parallelism with the mid-sagittal plane and occlusal plane respectively, 2 cases of angulation measurement:vertical angle in coronal view (vertical impaction) and horizontal angulation in axial view (horizontal impaction) could not be obtained, this in accordance to Al-Ansari et al. [17] and Archer [23].

In this study there was a statistically significant difference in vertical angulation value for coronal than axial section, (P=0.002). A study done by Uday et al. [19] did not agree with these, they found that the difference between the 2 sections in mean measurement of vertical angulation was not significant statistically. On the
other hand they agreed that there's a higher mean angulation recorded in coronal compared to axial section. In the current study there was a statistical important difference for the axial than coronal view (P>0.001), for the horizontal angulation measurement.

The highest mean of alveolar bone width surrounding the impacted canine was found in this study in cases of palatal crown labial root localization, which come in accordance to with that obtained by Uday et al. (19), the lowest mean found for labial crown palatal root localization; such findings can lead to improvement of surgical approach to make the most suitable window or disclosure of the impacted cuspid by the operator, in order to do appropriate positioning of an orthodontic attachment. There's no statistical significant difference of both genders with all the selected measurements in this study, such result came in agreement with Ericson and Kurol, (24), Elefteriadis(25), Preda et al.(27). Basically there's a different craniofacial evolution and expansion between both sexes.

REFERENCES

الخلاصة:

الخلفية: إنطمار الناب العلوي يعتبر حالة معقدة ومتقلبة عند العلاج، وذلك لكونه يشمل المناطق المتعددة، كما قد يصاحب إصابة الجروح والأسنان المجاورة. لذا فإن استخدام الأجهزة الحديثة للتصوير بالأشعة القادرة على تحديد مواقع الناب العلوي المطمور يعد ضرورياً.

الطريقة: الذي استخدم الهيكل العظمي لمفهوم تغطية الأسطح المحيطة بالأسنان المجاورة. وقد استخدم عوامل العظام والأحشاء في تقييم موقع الناب المطمور.

النتائج: الناب المطمور تحليلياً يمكن تحديدها عن طريق التصوير بالأشعة، إذا كانت الناب تصل إلى الأسنان المجاورة، هذا يؤدي إلى نخر الجذور. عدم القدرة على قياس الزوايا في بعض الحالات، ولا يمكن قياس الزوايا في بعض الحالات.

الاستنتاج: المعايير المطبوعة في هذه الدراسة توضح وعلاج هذه الحالات جراحياً وتشخيصياً.