International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

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

**Zainab H. Al-Ghurabi[1], Zainab M. Al-Bahrani[2]**

[1, 2]University of Baghdad, College of Dentistry, Department of Oral Diagnosis, Baghdad-Iraq

**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 anaccurate treatment plan. Although the impaction ofmaxillarycentral incisors is not a frequently case in dental practice, but its treatment is challenging because of its importance to facial esthetics in addition to functionaldemands thus the earlyradiographic diagnosis is very important. The purpose of this study is toevaluate 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 odontomasand other pathological lesions) , gender, unilateral/bilateral occurrence, and the side of impaction, the collecteddata was obtained from Specialist Health Center in AL-Sadder city in Baghdad 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. Results: Most of the impacted maxillary central incisors were observed in males (56%), bilaterally (27cases). In most of the impacted cases supernumerary 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 individuals and these teethalso 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 eruptwithin 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 totrauma to a deciduoustooth which causesmalformation 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 accurateposition 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 lessradiation dose of computed tomography, less costand less time consuming,with 3D images option that produce good bone differentiation and an unlimited number of views, but this techniquesuffering 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) patientsaged (9-12) years with unerupted maxillary central incisors who underwent for CBCT examinationperformed for the evaluation and management of impacted maxillary incisors after a good clinical examinations.CBCT images were done using Kodak cone beam computed tomography unitwith 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 beimpacted 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 odontomasand any

pathological lesions. The age was divided into 2 age groups: (9-10.5 and +11) and the gender of each patientwas record, then the collected data analyzed statistically usingFisher's exact probability test (F.E.P.T), exact sig.(2-sided), and Chi-square test.

**Figure 1:** Axial slice of CBCT image show a malposed impacted maxillary c entral incisor

.**Figure 2:** Sagittal slice of CBCT image show anodontoma

**Figure 3:**Sagittal slice of CBCT image showpresence of supernumerary tooth.

## 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) 46%were with unilateral and (27) 54%were with bilateral occurrence. The highest percentage of patients withimpacted 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 toshow the relation between age, gender, side and occurrence of impacted teeth which was non- significant.Chi-square testwas used to show therelationship 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.TheCBCT 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 relaation 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 topathologic cyst and presence of supernumerary tooth, table(4).

**Table 1:** Distribution of variables by subjects

| Variables | Categories | NO. | % |
|---|---|---|---|
| Age (Year) | 9-10.5 | 20 | 40 |
| | 11+ | 30 | 60 |
| | Total | 50 | 100 |
| Gender | Males | 28 | 56 |
| | Females | 22 | 44 |
| | Total | 50 | 100 |
| Cause | malposed | 14 | 28 |
| | odontoma | 6 | 12 |
| | Pathologic cyst | 3 | 6 |
| | supernumerary | 27 | 54 |
| | Total | 50 | 100 |
| Occurrence | unilateral | 23 | 54 |
| | Bilateral | 27 | 46 |
| | Total | 50 | 100 |

**Table 2:** Relationship between variables and impacted maxillary central incisors

| Test | Variable | Category | N (77) | % | Sig. (2-tailed) |
|---|---|---|---|---|---|
| Binomial test | Age (Year) | 9-10.5 | 32 | .42 | .171 (NS) |
| | | 11+ | 45 | .58 | |
| | Gender | Male | 44 | .57 | .254( NS) |
| | | Female | 33 | .43 | |
| | Side | Left | 39 | .51 | 1.000 ( NS) |
| | | Right | 38 | .49 | |
| | Occurrence | Unilateral | 23 | 0.46 | 0.672(NS) |
| | | Bilateral | 27 | 0.54 | |
| Chi-square | Cause | malposed | 17 | 22.08 | $0.000^{**}$ (H.S) |
| | | Supernumerary | 48 | 62.34 | |
| | | Odontoma | 8 | 10.39 | |
| | | Pathologic cyst | 4 | 5.19 | |

**Table 2:**Association between causes and age, and gender by total number of subjects.

| Variables | Categories | | Cause | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | malposed | odontoma | pathologic cyst | supernumerary | Total | F.E.P.T | df | Sig. |
| Age(Year) | 9-10.5 | NO. | 5 | 4 | 0 | 11 | 20 | 3.436 | 3 | 0.348(NS) |
| | | % within Age | 25.00 | 20.00 | .00 | 55.00 | 100.00 | | | |
| | | % of Total | 10.00 | 8.00 | .00 | 22.00 | 40.00 | | | |
| | 11+ | NO. | 9 | 2 | 3 | 16 | 30 | | | |
| | | % within Age | 30.00 | 6.67 | 10.00 | 53.33 | 100.00 | | | |
| | | % of Total | 18.00 | 4.00 | 6.00 | 32.00 | 60.00 | | | |
| Total | | NO. | 14 | 6 | 3 | 27 | 50 | | | |
| | | % within Age | 28.00 | 12.00 | 6.00 | 54.00 | 100.00 | | | |
| | | % of Total | 28.00 | 12.00 | 6.00 | 54.00 | 100.00 | | | |
| Gender | Male | NO. | 9 | 2 | 2 | 15 | 28 | 1.850 | 3 | 0.647(NS) |
| | | % within Gender | 32.14 | 7.14 | 7.14 | 53.57 | 100 | | | |
| | | % of Total | 18.00 | 4.00 | 4.00 | 30.00 | 56.00 | | | |
| | Female | NO. | 5 | 4 | 1 | 12 | 22 | | | |
| | | % within Gender | 22.73 | 18.18 | 4.55 | 54.55 | 100 | | | |
| | | % of Total | 10.00 | 8.00 | 2.00 | 24.00 | 44.00 | | | |
| Total | | NO. | 14 | 6 | 3 | 27 | 50 | | | |
| | | % within Gender | 28.00 | 12.00 | 6.00 | 54.00 | 100 | | | |
| | | % of Total | 28.00 | 12.00 | 6.00 | 54.00 | 100 | | | |

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

**Table 4:** Association between causesand age, gender, and sideby total number of teeth

| Variables | Categories | | Cause | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | malposed | odontoma | pathologic cyst | supernumerary | Total | F.E.P.T | df | Sig. |
| Age(Year) | 9-10.5 | NO. | 5 | 21 | 6 | 0 | 32 | 7.074 | 3 | 0.059(NS) |
| | | % within Age | 15.63 | 65.63 | 18.75 | .00 | 100.00 | | | |
| | | % of Total | 6.49 | 27.27 | 7.79 | .00 | 41.56 | | | |
| | 11+ | NO. | 12 | 27 | 2 | 4 | 45 | | | |
| | | % within Age | 26.67 | 60.00 | 4.44 | 8.89 | 100.00 | | | |
| | | % of Total | 15.58 | 35.06 | 2.60 | 5.19 | 58.44 | | | |
| Gender | Male | NO. | 12 | 27 | 2 | 3 | 44 | 4.89 | 3 | 0.158(NS) |
| | | % within Gender | 27.27 | 61.36 | 4.55 | 6.82 | 100.00 | | | |
| | | % of Total | 15.58 | 35.06 | 2.60 | 3.90 | 57.14 | | | |
| | Female | NO. | 5 | 21 | 6 | 1 | 33 | | | |
| | | % within Gender | 15.15 | 63.64 | 18.18 | 3.03 | 100.00 | | | |
| | | % of Total | 6.49 | 27.27 | 7.79 | 1.30 | 42.86 | | | |
| Side | Right | NO. | 9 | 23 | 4 | 2 | 38 | 0.344 | 3 | 0.974(NS) |
| | | % within cause | 23.68 | 60.53 | 10.53 | 5.26 | 100.00 | | | |
| | | % of Total | 11.69 | 29.87 | 5.19 | 2.60 | 49.35 | | | |
| | Left | NO. | 8 | 25 | 4 | 2 | 39 | | | |
| | | % within cause | 20.51 | 64.10 | 10.26 | 5.13 | 100.00 | | | |
| | | % of Total | 10.39 | 32.47 | 5.19 | 2.60 | 50.65 | | | |

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

## 4. Discussion

Tooth eruption belongs to the change in position reaching to its finalarrival into the oral cavity.[8] The formandlocation of tooth may bealtered 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 commoncause of the impaction of maxillary central

incisors in the present study54%of the cases were due to the presence of supernumerary teeth that causinga direct obstructionfor the path of eruption of maxillary central incisors, shifting of the neighboringteeth to the position of the impacted tooth,moving of the tooth bud, and malformations in the root of theimpactedtooth [10-14], this result is in agreement with Smailiene et al[15]study that found the premaxillary supernumerary teeth caused impaction of permanent incisors in56-60% of cases.

Malposition usually affects the maxillary central incisors,thismay be due to the fact that this area is widely exposed to trauma in this age groups, so 28% ofcases in this studywere 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 lateeruption 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 Smailiene 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 toeliminate 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 impactionas conclusionCBCT is recommended to be a routine method in diagnosing possible causes of impacted maxillary central incisors due to highly informative 3D details.

## References

[1] Deshpande A, Prasad S, Deshpande N. Management of impacted dilacerated maxillary central incisor: A clinical case report. ContempClin Dent. 2012 Apr;3(Suppl 1).
[2] SubbiahKannan PK, Palanisamy SK, Kumar TS. A case of impacted maxillary central incisor and its management. J Pharm BioallSci 2012;4, Suppl S2:174-6
[3] Huber KL, Suri L, Taneja P. Eruption disturbances of the maxillary incisors: a literature review 1: J ClinPediatr Dent 2008; 32(3): 221-230.
[4] Brin I, Zilberman Y, Azaz B. The unerupted maxillary central incisor: review of its etiology and treatment. ASDC J Dent Child 1982 Sep-Oct; 49(5): 352-356.
[5] Betts A, Camilleri GE. A review of 47 cases of unerupted maxillary incisors. Int. J Pediatr Dent 1999; 9: 285-292.
[6] Chiara Pavoni, Manuela Mucedero, GiuseppinaLaganà, Valeria Paoloni, and Paola Cozza. Impacted maxillary incisors: diagnosis and predictive measurements.Ann Stomatol (Roma). 2012 Jul-Dec; 3(3-4): 100–105.
[7] Chaushu S, Chaushu G, Becker A. The role of digital volume tomography in the imaging of impacted teeth.World J Orthod 2004; 5(2): 120-132.
[8] SahaiS, KaveriappaS, AroraH, AggarwalB.3D imaging in posttraumatic malformation and eruptive disturbance in per manent incisors: a case report. Dent Traumatol. 2011 Dec; 27(6):473-7.
[9] Bhadoria N, Maran S, Kukreja R, Nehete A, Aphale H. Management of Unerupted Dilacerated Central Incisor – A Case Report. Int J Oral Health Med Res 2016;2(5):106-108.
[10] Rajab LD, Hamdan M. Supernumerary teeth: review of the literature and a survey of 152 cases. Int J Paediatr Dent 2002: 12(4) 244 -54.
[11] Oliver RG, Moxham BJ. Malformations of teeth. Curr Pediatr1999;9:257-61.
[12] Acikgz G, Acikgz A, Keskiner I, Türk T, Otan F. Aggressiveperiodontitis with supernumerary teeth: a retrospective study. J Periodontol 2004; 75: 1458- 60.
[13] Roberts-Hary D, Sandy J. Orthodontics. Part 10: Impacted teeth. Br Dent J 2004; 196 (6): 319-27.
[14] Oliver R, Hodges ChGL. Delayed eruption of a maxillarycentral incisor associated with an odontome: report of case.J Dent Child 1988; 55(5): 368-71.
[15] Dalia Smailiene, AntanasSidlauskas, JevgenijaBucinskiene. Impaction of the central maxillary incisor associated with supernumerary teeth: Initial position and spontaneous eruption timing Stomatologija, Baltic Dental and Maxillofacial Journal, 8: 103-107, 2006.
[16] FarronatoG, MasperoC, FarronatoD.Orthodontic movement ofa dilacerated maxillary incisor in mixed dentition treatment.DentTraumatol. 2009 Aug; 25(4):451-6.
[17] Wasserstein A, Tzur B, Brezniak N. Incomplete canine transposition and maxillary central incisor impaction—a case report. Am J OrthodDentofacialOrthop 1997;111:635-9.
[18] Bayram M, Özer M, S¸ener I. Bilaterally Impacted Maxillary Central Incisors: Surgical Exposure and Orthodontic Treatment: A Case Report. J Contemp Dent Pract 2006 September;(7)4:098-105.
[19] Tanki J Z, Naqash T A, Gupta A , Singh R , Jamwal A.Impacted maxillary incisors: Causes, Diagnosis and Management IOSR-JDMS.Volume 5, Issue 2 (Mar.-Apr. 2013), PP 41-45.
[20] Cozza P, Marino A, Laganà G. Interceptive managment of eruption disturbances: case report. J ClinPediatr Dent 2004;29(1): 1-4.

## Author Profile

**Zainab H. Al-Ghurabi** did B.D.S., M.Sc Oral and Maxillofacial Radiology. Lecturer at department of oral diagnosis/ College of Dentistry, University of Baghdad.

***Zainab M. Al-Bahrani*** did B.D.S.,M.Sc.Oral and Maxillofacial Radiology, H.D.D. Oral & Maxillofacial Surgery. Lecturerat department of oral diagnosis/ College of Dentistry, University of Baghdad.