

## A review of the diagnosis and management of impacted maxillary canines

A. Watted, O. Awadi, M. Garah, M. Watad

**A. Watted:** Heine Str. 2, 97070 Wuerzburg, Germany (ali.watted@gmx.de)

**O. Wadi:** Center for Dentistry, Research and Aesthetic, Jatt, Israel (awad.obaida@gmail.com)

**M. Garah:** Center for Dentistry, Research and Aesthetic, Jatt, Israel (one\_806@hotmail.com)

**M. Watad:** Center for Dentistry, Research and Aesthetic, Jatt, Israel (dr.watad@yahoo.com)

**Abstract:** Impacted teeth are those which are not predictable and do not erupt absolutely based on clinical and radiographic assessment. Certain impactions can be complicated and the outcome unpredictable if the tooth is positioned unfavorably either horizontally or vertically in the alveolar bone. Presence of canines buccally, palatally or lingually can be known by various diagnostic methods. Factors that interfere with its development and eruption had serious consequences on esthetics, function and stability of stomatognathic system. The authors conducted a literature review regarding the clinical and radiographic diagnoses of impacted maxillary canines, as well as the interceptive treatment (including surgical and orthodontic management) used to prevent or properly treat impacted canines.

**Key words:** Impacted teeth, maxillary canines, surgical techniques; orthodontic techniques.

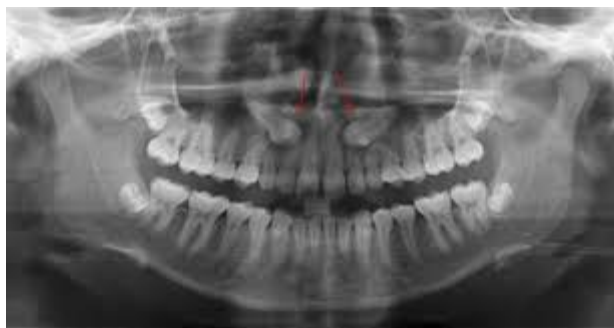
Date of Submission: -12-2017

Date of acceptance:12-01-2018

### I. Introduction

Orthodontics is an art and science. In addition to straightening teeth, Orthodontists are also artists in creating a smile. Although it is more of a science, Orthodontics is still very subjective. In orthodontics, certain time tested requirements for long term stability should be addressed during treatment planning.(1,2) The goal is to place the teeth in a particular position that will give the most functional esthetic and stable results possible.(1,2)

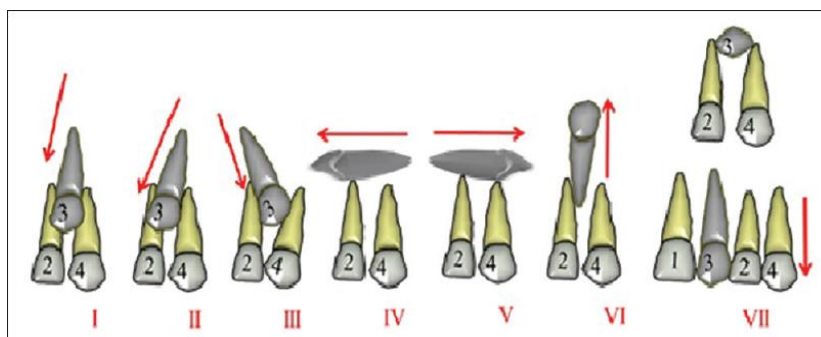
Impacted teeth are those with delayed eruption time or that are not predicted to erupt absolutely based on clinical or radiographic assessment. (3)Permanent maxillary canine are the second most frequently impacted teeth (mandibular third molars being first). The incidence of their impaction is 1-2% in general population. (1,2,4)This is the most probably due to a prolonged development period (i.e 5 months -12 years) and the long, convoluted path of eruption before the canine appears into full occlusion . (5)About one third of impacted maxillary canines are positioned labially within the alveolus and two third located palatally . Family history visual and tactile clinical examination by the age of 9-10 years and thorough radiographic assessment are the methods o diagnosis that may allow for early detection and prevention of impacted canines. The outcome of certain canine impactions can be unpredictable and challenging if not diagnosed properly. Eruption process can be simplified with proper diagnosis.(1,2)



**Fig.1;** Maxillary Canine Impaction

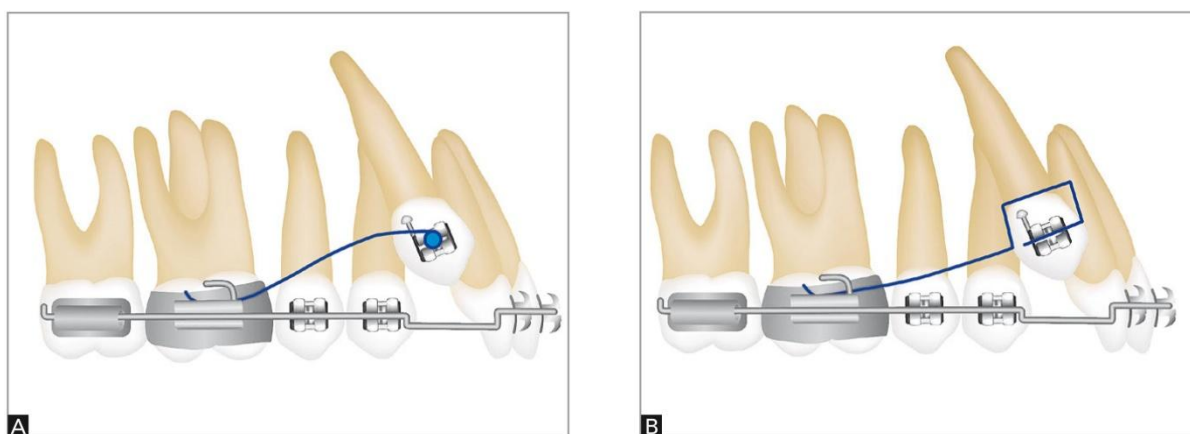
The etiology of canine impaction may be related to general factors, such as inheritance, endocrine deficiencies, febrile diseases, and irradiation. Regarding local factors, the causes include tooth size-arch length discrepancy, prolonged retention, premature loss of primary canines, abnormal position of the tooth germ, presence of

alveolar cleft, agenesis, ankylosis, supernumerary teeth, deleterious oral habits, trauma, disruption of the root structure, iatrogenic and idiopathic causes (5,6,7,8), and ectopic path of eruption (8). The incidence of canine impaction ranges from 0.92 to 2.2% (3), and may reach 2.56% of cases (9), occurring more frequently in the palatal than in the labial region (2:1). The condition affects females more than males (3:1), exhibiting left sided predominance of unilateral occurrence (10).



**Fig.2:** Schematic representation of the classification system of maxillary canine impaction used in this study: seven different types have been used based on anatomical relationship of impacted canines. Tooth 3 represents maxillary canine; teeth 2 and 4 represent maxillary lateral incisor and first premolar, respectively

The location of the impacted tooth determines the type of surgical approach. In general, there are three steps to clinical localization.<sup>6</sup> Visual inspection and digital palpation are the first two steps, while radiographic examination is the third and most critical step. Periapical, occlusal, cephalometric, posterior-anterior and panoramic radiographs, as well as polytomography have all been used to localize impacted. (7,8) Several factors should be taken into account when surgical-orthodontic traction of an unerupted tooth is chosen, including meticulous surgical technique with complete flap closure, minimal removal of bone and dental follicle, avoiding manipulation of the root until the application of orthodontic mechanics, and application of light forces, with a reliable anchorage unit that is resistant to the applied load. Adverse effects on periodontal tissues and unfavorable aesthetic and functional results have been associated with inadequate diagnosis and treatment planning(7).



**Figure 3** Cantilever (A) and rectangular loop (B) for canine extrusion.

Surgical exposure and orthodontic traction is the preferred approach for management of palatally impacted canines in compliant, motivated patients, with good dental health, where interceptive measures are inappropriate. (11) The position of the impacted canine gauged radiographically is instrumental to the orthodontist's decision to both expose and orthodontically align, or to remove the impacted maxillary canine. (12) A grading system to determine the severity of palatal impaction of canines based on radiographic location has been proposed, with high canines having severely transposed roots considered most unfavorable. Four main radiographic predictors believed to correlate with prognosis for exposure and alignment of ectopic canines have been described. These considerations include angulation of the canine long axis to the midline, vertical position of the canine crown from the occlusal plane, anteroposterior position of the canine root apex relative to the midline, and the degree of overlap of the adjacent incisor by the canine crown tip(13).



**Fig.4:** Placement of three-dimensional canine loop on the palatal aspect

However, there is little evidence linking the duration of orthodontic mechanical eruption of the impacted palatal canine to these influential radiographic predictors. Stewart et al, (14) in a retrospective study, suggested alignment of canines positioned 14 mm or more above the occlusal plane to take longer than those in a more favorable vertical position. Furthermore, Zucatti et al reported a strong association between the number of visits and increasing age, vertical height, and mesial displacement of the cusp tip. However, that study involved a heterogeneous sample treated by multiple operators(15).

The authors conducted a literature review regarding the clinical and radiographic diagnoses of impacted maxillary canines, as well as the interceptive treatment (including surgical and orthodontic management) used to prevent or properly treat impacted canines.

## **II. Diagnosis**

When dealing with impacted maxillary canines, an accurate diagnosis is critical for the success of the proposed treatment. Unlike impacted mandibular third molars, unerupted permanent maxillary canines cause patients relatively few problems. (16) A retained primary canine may have a relatively poor appearance compared with a properly aligned permanent canine, but many patients are often unaware of the presence of and do not seek treatment for a retained primary canine (11,13,16). Consequently, the discovery of an impacted canine is frequently made at the time of a routine radiographic examination.(3,4,5)

Jacobs gave the four reasons why it is important to localize an impacted maxillary canine. Firstly, it is a sound principle not to extract a well-placed tooth in order to make space for a poorly positioned one. If a well-placed tooth is preserved, the treatment time may be shortened considerably, and the result is predictable.(17) The converse is also true. If a poorly placed canine is kept and a well-aligned tooth extracted, then the treatment time will be prolonged and the result is unpredictable. Secondly, an error in the localization process can result in a surgical flap being raised in the wrong area. Thirdly, the clinician must estimate the degree of difficulty involved in uncovering a displaced canine. Uncovering a malpositioned canine may be more hazardous to the adjacent teeth than extracting the canine (18). And, fourthly, if suitable clinical conditions exist, a palatally impacted maxillary canine may be induced to spontaneously erupt into the line of the arch, simply by extraction of the primary canine (19). As extraction of the primary canine is often successful in allowing the palatally impacted canine to erupt spontaneously, the necessity for surgery and orthodontics with all their associated discomforts, hazards, and costs are avoided. This procedure may also reduce the incidence of resorption of the roots of an adjacent incisor by an impacted canine.(20)

Diagnosis plays an important role for every clinician in helping decide whether the impaction is favorable or not. This is done based on proper clinical and radiographic assessment of the subject. (21) Clinical assessment is carried out by inspection and palpation of alveolar process, by the presence of labial tipping of lateral incisors and peg shaped lateral incisors. Radiographic methods include:

### **Occlusal radiographs:**

The most practical method of obtaining an occlusal radiograph is by positioning the x-ray tube directly over the bridge of the nose, at a 60-degree angle to the occlusal plane. This method has been used to determine the bucco-palatal position of impacted teeth.(21)

### **Periapical radiographs:**

Traditional method of locating impacted teeth, specifically maxillary canines, has been the use of a two-dimensional technique with periapical radiographs, known as the buccal object rule. (5,7) This technique consists of taking two periapical radiographs at different mesiodistal angulations and using the same-lingual-

opposite buccal (SLOB) rule to determine the tooth's buccolingual position. The radiographic interpretation of the SLOB rule is if, when obtaining the second radiograph, the clinician moves the x-ray tube in a distal direction, and on the radiograph the tooth in question also moves distally, then the tooth is located on the lingual or palatal side. Accordingly, if the impacted canine is located buccally, the crown of the tooth moves mesially.(3,4,5,6,7)

**Extra oral radiographs:**

- (a) Frontal and lateral cephalograms can sometimes aid in the determination of the position of the impacted canine, particularly its relationship to other facial structures (e.g., the maxillary sinus and the floor of the nose).
- (b) Panoramic films are also used to localize impacted teeth in all three planes of space, much the same as with two periapical films in the tube-shift method, with the understanding that the source of radiation comes from behind the patient; thus the movements are reversed for position. (3,4,5,6,7)



**Fig.5;** Maxillary canine impaction increases root resorption risk of adjacent teeth: A problem of physical proximity

**Cone-beam computed tomography (CBCT):**

Cone-beam computed tomography (CBCT) can identify and locate the position of impacted canines accurately. By using this imaging technique, dentists also can assess any damage to the roots of adjacent teeth and the amount of bone surrounding each tooth. (22,23)

In a study, **Liu and colleagues** used CBCT to evaluate variations in location of impacted maxillary canines. They found that the position of impacted maxillary canines varies greatly. Reports of maxillary canine impactions vary considerably in orientation, and CBCT provides information to dentists so that they can properly manage impacted canines surgically and orthodontically.(24)

However, increased cost, time, radiation exposure and medicolegal issues associated with using CBCT, limit its routine use .(7,8,9,22)

**Management:**

There are five (5) treatment options for the management of impacted teeth:

- a) **Observation**
- b) **Interceptive**
- c) **Intervention**
- d) **Relocation**
- e) **Extraction**

a) **Observation:** It implies no treatment for a specific period. It generally initiates with the completion of deciduous dentition eruption and ends with the eruption or removal of an impacted tooth. For this to be a viable

treatment option, a clinician should use clinical and radiographic evaluation which in most cases predicts tooth impactions. (3,4,7,8)

b) **Interceptive:** it is a procedure which is carried out in order to prevent impaction of teeth. This is done by the early removal of primary canines. (4,5,8,9) This procedure is carried out when:

- ❖ Clinical bulge is not palpable at 9 years
- ❖ When there is a medial tilt of ling axis of canine radiographically
- ❖ Lingual position of canine in relation to incisors
- ❖ When there is horizontal overlap of canine radiographically

c) **Intervention:** It is a procedure which is carried out when there is obstruction to the eruption of canine. It can be due to presence of supernumerary teeth, tissue obstruction and ankylosis or over retained deciduous teeth. More than 90% of the supernumerary teeth can lead to the normal eruption of the permanent canines. (6,7,8)

Tissue obstruction: it causes delay in permanent tooth eruption and unexceptional findings of clinical and radiographic assessment, subsequently clinicians should consider a soft tissue or an osseous interference. (8,9)

Over retained deciduous teeth: Maxillary deciduous teeth are more commonly ankylosed than mandibular deciduous teeth. This leads to delayed or non Resorption of deciduous roots which result in impaction. (3,6,9)

d) **Relocation:** it refers to the repositioning of an impacted tooth first surgically and then orthodontically<sup>8</sup>. Surgical exposure and orthodontic eruption of an impacted tooth is ideal when its apex is completely formed. During surgical exposure the crown should be uncovered up to the cement-enamel junction (CEJ). Space must be orthodontically created before the exposure and orthodontic eruption of impacted teeth. If tooth movement is not detected with reasonable digital force and orthodontic forces are unsuccessful, then the tooth is ankylosed. (6,7,8,9) When tooth movement is apparent with reasonable digital force, but there is no response to orthodontic forces, then primary failure of eruption must be ruled out. The orthodontic appliances [Including cements, bands, brackets and other auxiliary attachments] and poor access to the crown of the impacted tooth compromise local hygiene practice. (11,16) Due to the possibility of contamination of oral fluids, bonding an attachment to the impacted tooth is complicated. Newer bonding materials with an affinity for moisture can enhance the placement of attachments on impacted teeth. These materials have simplified procedures for bonding and bone removal. (3,5,7,8,9)

e) **Extraction:** impacted teeth which cannot be repositioned go in for extraction. Unfavorably positioned impacted canines cannot be repositioned and hence go in for extraction. (3) Therapeutic extraction has been one of the major controversies in orthodontics. The teeth most commonly extracted for orthodontic treatment (therapeutic extraction) are either first premolar or second premolar (4). In case of borderline space discrepancy, extraction of premolar might create more than required amount of space. In such cases of borderline space discrepancy in mandibular arch, a better alternative is to follow an atypical therapeutic extraction viz extracting one or two mandibular incisors. (16,25) The concept of removing the lower incisor for the purpose of relieving the crowding was introduced by Hahn. (23,24) The critical decision of which incisor to extract depends on several considerations, mainly periodontal conditions, mesio-distal width of each tooth etc. It is especially suitable for patients with mild skeletal Class III malocclusion. (25,26)

All the advantages and disadvantages of surgical and orthodontic repositioning as well as the risks (including that of being unable to achieve the desired goals) and the need for good cooperation were discussed, and these were understood and accepted by the patient. (27,28)

Impacted teeth are those with a delayed eruption time or those which are not expected to erupt completely based on clinical and radiographic assessment. (29) Impaction of the maxillary canine has been reported in 1-3%. (1,2) Palatal impactions are reported to occur 2-3 times more frequently than buccal ones. (11) Treatment plan for maxillary canine impaction should be decided among extraction, orthodontic traction, and autotransplantation according to several factors such as direction and position of the unerupted tooth, degree of developing root apex, eruption space, existence of supernumerary tooth, odontoma, or cyst. Surgical exposure of impacted canines, often together with orthodontic traction, has long been advocated. (11,16,29,30,31,32)

An autotransplantation provides not only a biological replacement of tooth which has potential to induce alveolar bone growth but also supports proprioceptive function by maintaining a normal PDL. (31,32) An autotransplanted tooth has potential to erupt with neighboring teeth during continued facial growth. Autotransplanted tooth maintains a normal interdental papilla and shows desired movement with orthodontic treatment. (29,30,31,32)

### III. Conclusion

The management of impacted canine is a complex procedure, require a multidisciplinary treatment approach. The clinician should communicate with each other to provide the patient with proper diagnosis, idea of prognosis, and optimal treatment plan based on scientific rationale.

### References

- [1]. Watted N, Abu-Hussein M: Prevalence of impacted canines in Arab Population in Israel. *International Journal of Public Health Research* 2014; 6: 71-77.
- [2]. Watted N, Abu-Hussein M, Awadi O, Watted M, Watted A: Clinical study of impacted maxillary canine in the Arab population in Israel. *International Journal of Public Health Research* 2014; 2: 64-70.
- [3]. Abu-Hussein\*,Nezar Watted ,Dana Feřtila ,Péter Borbély; Surgical-Orthodontic Treatment of Impacted Canines *Journal of Dental and Medical Sciences*2015, 14, 10 , 97-104. DOI: 10.9790/0853-1410597104
- [4]. M. Abu-Hussein\*, N. Watted , E. Hussien , P. Proff , A. Watted ; Maxillary Impacted Canines; *Clinical Review Journal Dental and Medical Sciences Research*2017, 1, 6,10-26
- [5]. Abu-Hussein M, Watted N, Proff P, Watted A. Clinical Management of Bilateral Impacted Maxillary Canines. *SRL Dentistry*. 2017;1(1): 001-007
- [6]. Nezar Watted, Emad Hussein, Peter Proff, Aksoy Dodan, Abu-Hussein Muhamad. Surgery of Labially Impacted Canine & Orthodontic Management – A Case Report. *Open Journal of Dentistry and Oral Medicine* 2017; 5: 1-6.
- [7]. Borbély P. Watted N. Dubovská I, Hegedűs V, Abu-Hussein M, Interdisciplinary Approach in the Treatment of Impacted Canines – Review. *International Journal of Maxillofacial Research* 2015; 1: 116-137
- [8]. Nezar Watted, Emad Hussein, Peter Proff, Aksoy Dodan, Abu-Hussein Muhamad. Surgery of Labially Impacted Canine & Orthodontic Management – A Case Report. *Open Journal of Dentistry and Oral Medicine* 2017; 5: 1-6.
- [9]. Watted N, Abu-Hussein M, Awadi O, Borbély P: Titanium Button With Chain by Watted For Orthodontic Traction of Impacted Maxillary Canines *Journal of Dental and Medical Sciences* 2015; 2: 116-127.
- [10]. Shafer WG, Hine MK, Levy BM. A textbook of oral pathology. 4th ed. Philadelphia: W.B. Saunders; 1984.
- [11]. Becker, A. The orthodontic treatment of impacted teeth. 2nd ed. London, UK: Martin Dunitz Publishers; 2007:19–140.
- [12]. Watted N, Abu-Hussein M.; Incidence Of Canine Impaction In Palestinian Population, *Journal of Advanced Oral Research*,2014;5,3,5-11
- [13]. Bishara SE. Impacted maxillary canines: A review. *Am J Orthod Dentofac Orthop*.1992; 101(2): 159-171
- [14]. Stewart, J. A. , G. Heo , K. E. Glover , P. C. Williamson , E. W. Lam , and P. W. Major . Factors that relate to treatment duration for patients with palatally impacted maxillary canines. *Am J Orthod Dentofacial Orthop* 2001. 119:216–225.
- [15]. Zuccati, G. , J. Ghobadlu , M. Nieri , and C. Clauser . Factors associated with the duration of forced eruption of impacted maxillary canines: a retrospective study. *Am J Orthod Dentofacial Orthop* 2006. 130:349–356
- [16]. Proffit WR, Fields Jr HW, Sarver DM. Contemporary orthodontics: Elsevier Health Sciences; 2014
- [17]. Jacobs SG. Radiographic localization of unerupted maxillary anterior teeth using the vertical tube shift technique: the history and application of the method with some case reports. *Am J Orthod Dentofacial Orthop*. 1999; 116: 415-423.
- [18]. Jacobs SG. Localization of the unerupted maxillary canine. *Aust Orthod J*. 1986; 9: 311-316.
- [19]. Ericson S, Kurol J. Early treatment of palatally erupting maxillary canines by extraction of the primary canines. *Eur J Orthod*. 1988; 10: 283-295.
- [20]. Watted N, Abu-Hussein M, Awadi O, Borbély P: Titanium Button With Chain by Watted For Orthodontic Traction of Impacted Maxillary Canines *Journal of Dental and Medical Sciences* 2015; 2: 116-127.
- [21]. Nezar Watted , Emad Hussein , Peter Proff , Aksoy Dodan , Abu-Hussein Muhamad; Surgery of Labially Impacted Canine & Orthodontic Management – A Case Report *Open Journal of Dentistry and Oral Medicine*2017, 5(1): 1-6
- [22]. Watted N, Proff P, Reiser V, Shlomi B, Abu-Hussein M, Shamir D: CBCT; In Clinical Orthodontic Practice: *Journal of Dental and Medical Sciences* 2015; 2: 102-115.
- [23]. Bedoya MM and Park JH. A review of the diagnosis and management of impacted maxillary canines. *J Am Dent Assoc* 2009;140;1485-1493

- [24]. Liu DG, Zhang WL, Zhang ZY, Wu YT, Ma XC. Localization of impacted maxillary canines and observation of adjacent incisor resorption with cone-beam computed tomography. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2008;105(1):91-98
- [25]. Raju DS, Veereshi AS, Naidu DL, Raju BHVR, Goel M, Maheshwari A. Therapeutic Extraction of Lower Incisor for Orthodontic Treatment. *J Contemp Dent Pract* 2012;13(4):574-577.
- [26]. Canut JA. Mandibular incisor extraction: Indications and long term evaluation. *Eur J Orthod* 1996;18:485-9.
- [27]. .Nezar Watted , Emad Hussein , Peter Proff , Aksoy Dodan , Abu-Hussein Muhamad; Surgery of Labially Impacted Canine & Orthodontic Management – A Case Report *Open Journal of Dentistry and Oral Medicine* 2017, 5(1): 1-6
- [28]. Abu-Hussein Muhamad and Watted Nezar Mini screws: Clinical Application of Orthodontic. *RRJDS*. 2014; 2: 32-43.
- [29]. Abu-HusseinM. , WattedN. ,Abdulgani A.; AUTOGENOUS TOOTH TRANSPLANTATION - REALITY OR NOT , *Int J Dent Health Sci* 2015; 2(4):722-730
- [30]. Abu-Hussein M. , Azzaldeen A. Autotransplantation of tooth in mixed dentition- A review. *Int. J. Dent.Clinics*. 2013;5(1):20-23.
- [31]. .Abu-Hussein Muhamad , Watted Nezar ,Abdulgani Mai, Abdulgani Azzaldeen; Tooth Autotransplantation; *Clinical Concepts Journal of Dental and Medical Sciences*. 2016, 15, 7, 105-113, DOI: 10.9790/0853-15078105113
- [32]. Muhamad AH, Watted N, Abdulgani A (2015) The Curve of Dental Arch in Normal Occlusion. *Open Science Journal of Clinical Medicine* 3: 47-54.