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Orthodontic Management of Impacted Teeth

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Surgery

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Certification of the Supervisor

I certify that this project entitled "*Orthodontic management of impacted teeth*" was prepared by the fifth-year student *Abdalla Ali Dwesh* under my supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry.

Signature

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Dedication

To the soul of the greatest man ever, my beloved father, To the prayer of my sunshine, My superwoman, My model, My beloved Mother, To all my family member whom lived this long journey with me, To all teachers, doctors and every person leaved impact in me, and especially, For all my friends, Whom where always their for me, I dedicate my graduation project .

**Your sincere son, Student and friend
Abdalla ali Dwesh**

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Introduction

An impacted tooth is one that fails to fully erupt into the dental arch within the usual range of expected time. The tooth becomes impacted because abnormal tooth orientation, adjacent teeth, dense overlying bone, excessive soft tissue, or a genetic abnormality prevents eruption. Because impacted teeth do not erupt, they are retained for the patient's lifetime unless surgically removed or exposed because of resorption of overlying tissues. The term unerupted teeth includes impacted teeth and teeth that are in the process of developing and erupting (**James *et al*, 2019**).

Third molars are by far the most common teeth to be impacted, usually attributable to their location in relation to the length of the dental arch. Because of this tooth size–arch length discrepancy, conservative alignment of these teeth is not frequently advised, since no arch length into which they may be uprighted exists.

the other hand, when second premolars are absent, consideration of treatment aimed at mesially drawing first and second molars to provide space for the resolution of an otherwise impacted third molar often may be justified (**Graber, 2012**).

The mandibular premolars erupt after the mandibular first molar and mandibular canine; thus if the room for eruption of premolars is inadequate, one of the premolars usually the second premolar remains unerupted and chances of getting impacted are more (**Peterson, 2003**).

The maxillary canine is a far more important tooth to treat than its 1% to 2% impaction prevalence in most populations would suggest (**Dachi and Howell, 1961; Becker, 2012**). This is attributable to its position at the front of the mouth, its relative importance vis-à-vis the occlusion, and the patient's appearance (**Graber, 2012**).

As a general rule, all impacted teeth should be removed unless removal is contraindicated. Removal of impacted teeth becomes more difficult with advancing

Introduction

age of the patient. The dentist should typically not recommend that impacted teeth be left in place until they cause difficulty. If the impacted teeth are left in place until problems arise, the patient may experience an increased incidence of local tissue morbidity, loss of, or damage to, adjacent teeth and bone, and potential injury to adjacent vital structures. In addition, if the removal of impacted teeth is deferred until problems arise later in life, surgery is more likely to be complicated and hazardous because the patient may have compromising systemic diseases, the surrounding bone becomes denser, and more fully formed roots may grow near structures such as the inferior alveolar nerve or the maxillary sinus (**James *et al.*, 2019**).

Aim of the review

The aim of this review is :-

- To know about the possible causes of impaction
- Discuss all the available methods to relief this impaction and prevent its negative outcomes whether with orthodontic treatment or other lines of intervention
- To know the benefits of treatment of impacted teeth

CHAPTER ONE : Review of literature

1.1 Development of dentition

Malocclusion is a reflection of disturbances that might have occurred during the normal process of occlusal development. Functional disturbances of the masticatory system may have their beginning during the development of occlusion, a period when position of the tongue, swallowing habits, chewing patterns, etc. are established. Thus, it is imperative to understand the development of dental occlusion in order to recognize and intervene in case of any abnormal development and also to treat an already existing malocclusion (**Phulari, 2017**).

It is also important to note that certain occlusal irregularities, observed during the developing stages of occlusion are transient and thus do not require treatment. For instance, midline diastema and flaring of upper anteriors observed during ugly duckling stage at mixed dentition period get self-corrected once the permanent canines erupt fully. Humans have two sets of dentition namely, deciduous and permanent, which contain 20 and 32 teeth respectively. The formation and eruption of these teeth follow a definite pattern and fairly consistent timetable, The chronology of human dentition is given in Tables 1 and 2 (**Phulari, 2017**).

Table (1) : Deciduous teeth development (Phulari, 2017)

Tooth	First evidence of calcification	Amount of enamel formed at birth	Crown completed	Eruption	Root completed
Primary Dentition					
Maxillary					
Central incisor	4 months <i>in utero</i>	Five-sixths	1½ months	7½ months	1½ years
Lateral incisor	4½ months <i>in utero</i>	Two-thirds	2½ months	9 months	2 years
Cuspid	5 months <i>in utero</i>	One-third	9 months	18 months	3¼ years
First molar	5 months <i>in utero</i>	Cusps united	6 months	14 months	2½ years
Second molar	6 months <i>in utero</i>	Cusp tips still isolated	11 months	24 months	3 years
Mandibular					
Central incisor	4½ months <i>in utero</i>	Three-fifths	2½ months	6 months	1½ years
Lateral incisor	4½ months <i>in utero</i>	Three-fifths	3 months	7 months	1½ years
Cuspid	5 months <i>in utero</i>	One-third	9 months	16 months	3¼ years
First molar	5 months <i>in utero</i>	Cusps united	5½ months	12 months	2¼ years
Second molar	6 months <i>in utero</i>	Cusp tips still isolated	10 months	20 months	3 years

Table (2) : Permanent teeth development (Phulari, 2017)

Tooth	First evidence of calcification	Amount of enamel formed at birth	Crown completed	Eruption	Root completed
Permanent Dentition					
Maxillary					
Central incisor	3–4 months	—	4–5 years	7–8 years	10 years
Lateral incisor	10–12 months	—	4–5 years	8–9 years	11 years
Cuspid	4–5 months	—	6–7 years	11–12 years	13–15 years
First bicuspid	1½–1¾ years	—	5–6 years	10–11 years	12–13 years
Second bicuspid	2–2¼ years	—	6–7 years	10–12 years	12–14 years
First molar	At birth	Sometimes a trace	2½–3 years	6–7 years	9–10 years
Second molar	2½–3 years	—	7–8 years	12–13 years	14–16 years
Third molar	7–9 years	—	12–16 years	17–21 years	18–25 years
Mandibular					
Central incisor	3–4 months	—	4–5 years	6–7 years	9 years
Lateral incisor	3–4 months	—	4–5 years	7–8 years	10 years
Cuspid	4–5 months	—	6–7 years	9–10 years	12–14 years
First bicuspid	1¾–2 years	—	5–6 years	10–12 years	12–13 years
Second bicuspid	2¼–2½ years	—	6–7 years	11–12 years	13–14 years
First molar	At birth	Sometimes a trace	2½–3 years	6–7 years	9–10 years
Second molar	2½–3 years	—	7–8 years	11–13 years	14–15 years
Third molar	8–10 years	—	12–16 years	17–21 years	18–25 years

1.2 Causes of impaction

1.2.1 Primary displacement of the tooth bud: displacement occasionally occurs with canines, but other teeth are not immune. The tooth develops in an ectopic location (Fig.1); although it may have normal eruptive potential, its eruptive movements may not bring it in an appropriate direction, and thus the tooth may not emerge into the oral cavity. Aside from impaction, primary displacement is sometimes associated with tooth transposition. Treatment: The tooth is surgically exposed, followed by biomechanical redirection or extraction (**Graber, 2017**).

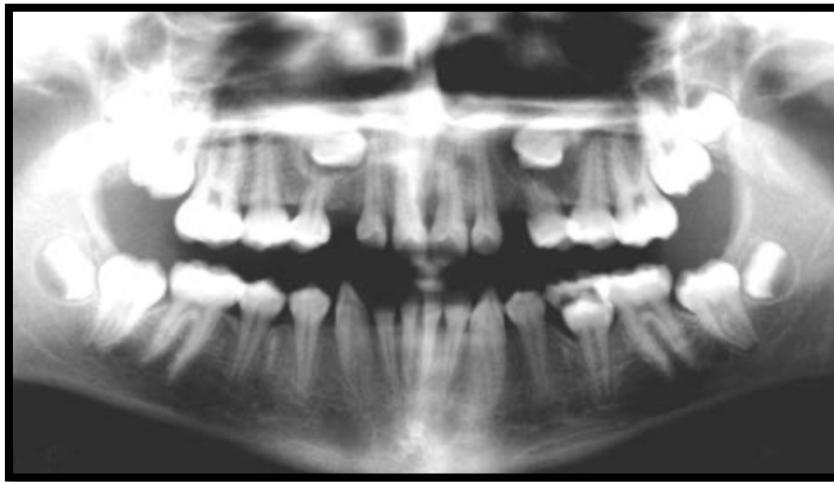


FIGURE (1) : Maxillary bilateral impacted canines are trans- posed with the first premolars (**Graber, 2017**)

1.2.2 Space inadequacy: Inadequate space includes crowding and space loss in the dental arch, such as the drifting that occurs after the early extraction of deciduous teeth. Teeth possess the intrinsic potential for eruption but, under these conditions, are prevented from erupting. Treatment: Space is re-created by moving neighboring teeth or by remedial extraction of other teeth (**Graber, 2017**).

1.2.3 Local obstruction anomaly: Examples of obstruction-related anomalies are supernumerary teeth(**Brosjo *Et al*, 1960**). odontomes (Fig. 2 A,B), dentigerous cysts, and gingival fibrosis. Teeth possess the intrinsic potential for eruption but, under these conditions, are obstructed. Treatment: The causative entity is eliminated, with or without the provision of extrusive orthodontic mechanics(**Proffit and Vig , 1981**).

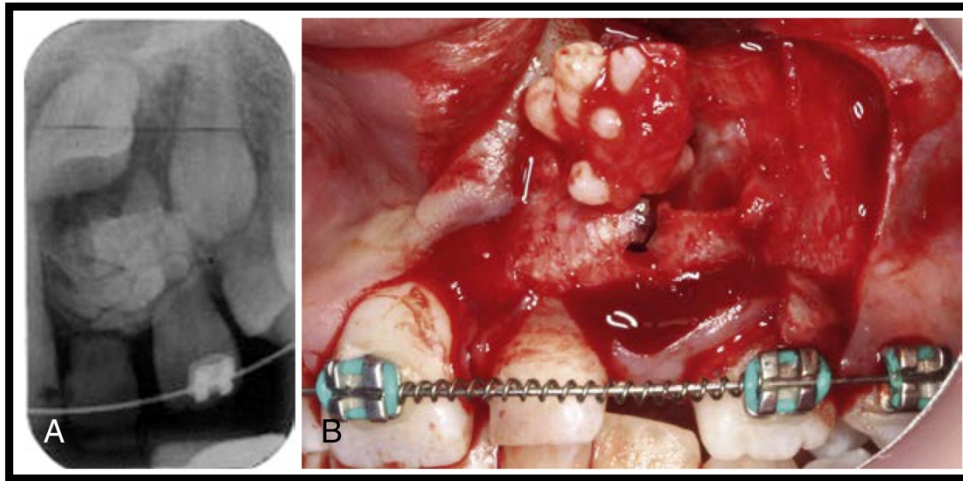


FIGURE (2) : A composite odontoma is revealed in a periapical radiograph and at the time of surgical exposure before extraction of the odontoma (Graber 2017)

1.2.4 Trauma: Early trauma to the deciduous anterior dentition may sometimes be transmitted to the developing permanent teeth, particularly the central incisors. Trauma may result in damage to the unerupted tooth, usually by causing attenuation or arrest of the development of the root. The result can be a short or dilacerate root and failure of the tooth to erupt (Fig. 3, A, B). Treatment: If long-term prognosis is poor, the tooth is surgically exposed, followed by orthodontic redirection with the intention of bringing the tooth into the arch, with its accompanying alveolar bone to provide a healthy base for a subsequent implant. In an extraction case, consideration should be given to extracting this tooth rather than extracting a normal healthy premolar (Graber 2017).

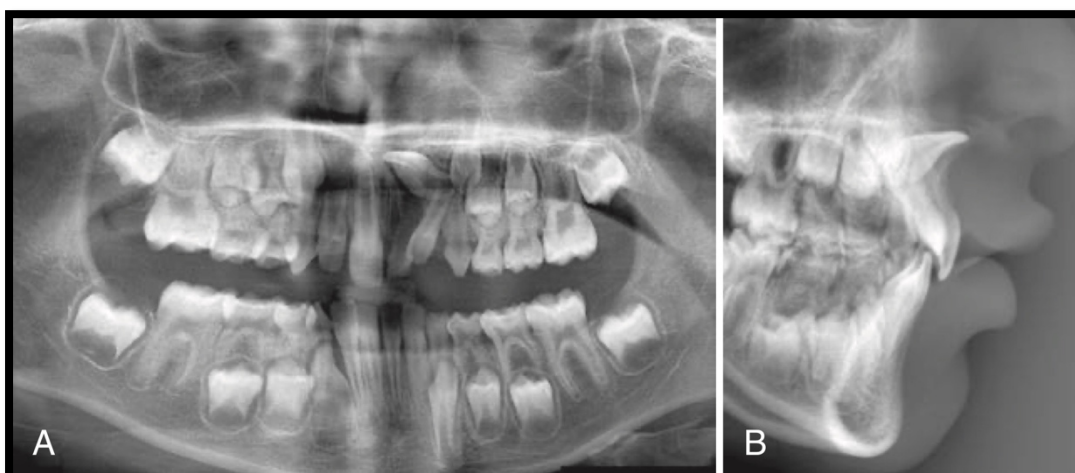


FIGURE (3) : A severely dilacerated maxillary central incisor is revealed in the panoramic and lateral cephalometric views. The incisal edge is located within the anterior nasal spine(Graber, 2017).

1.2.5 General conditions :with primary failure of eruption(PFE), (**Proffit and Vig , 1981; Frazier *et al*, 2010**). cleidocranial dysplasia (CCD)(**Becker *Et al*, 1997**). and hypoplastic amelogenesis imperfecta,8 the teeth have little or no intrinsic potential for eruption.

Treatment: Attempts to erupt the teeth in PFE and, in some cases with amelogenesis imperfecta, will usually fail, due to defective intrinsic factors that are not well understood. After the surgical elimination of over-retained deciduous teeth and multiple supernumerary teeth in CCD, the application of efficient extrusive mechanics will readily bring about a positive eruptive response on the part of the teeth (**Becker *Et al*, 1997**).

1.3 Indication of removal of impacted teeth

1.3.1 Prevention of Periodontal Disease

Erupted teeth adjacent to impacted teeth are predisposed to periodontal disease The mere presence of an impacted mandibular third molar decreases the amount of bone on the distal aspect of an adjacent second molar (fig. 4). Because the most difficult tooth surface to keep clean is the distal aspect of the last tooth in the arch, patients commonly have gingival inflammation with apical migration of the gingival attachment on the distal aspect of the second molar (**James *et al*, 2019**).



FIGURE (4) : root resorption in the lower seven due to impacted lower third molar (**James *et al*, 2019**).

1.3.2 Prevention of Dental Caries

When a third molar is impacted or partially impacted, the bacteria and other factors that cause dental caries are commonly exposed to the distal aspect of the second molar as well as to the crown of the impacted third molar. Even in situations in which no obvious communication between the mouth and the impacted third molar is visible, there may be enough communication to allow for caries initiation (**James *et al.*, 2019**).

1.3.3 Prevention of Pericoronitis

When a tooth is partially impacted with a large amount of soft tissue over the axial and occlusal surfaces, the patient frequently has one or more episodes of pericoronitis. Pericoronitis is an infection of the soft tissue around the crown of a partially impacted tooth and is usually caused by normal oral flora (**James *et al.*, 2019**).

1.3.4 Prevention of Root Resorption

Occasionally an impacted tooth causes sufficient pressure on the root of an adjacent tooth to cause external root resorption, Although the process by which root resorption occurs is not well understood, it appears to be similar to the resorption process primary teeth undergo during the eruptive process of the succedaneous teeth (**James *et al.*, 2019**).

1.3.5 Prevention of Odontogenic Cysts and Tumors

When impacted teeth are completely within the alveolar process, the associated follicular sac is also frequently retained. Although the dental follicle maintains its original size in most patients, it may undergo cystic degeneration and become a dentigerous cyst (**James *et al.*, 2019**).

1.4 Orthodontic management of impacted teeth

Treatment of orthodontic patients entails the management of a constantly changing occlusion from the early mixed dentition to the permanent dentition. In a majority of patients, transition from mixed to permanent dentition occurs uneventfully, without tooth impaction or lack of tooth eruption.

Orthodontic treatment with traction of a tooth can be divided into three phases, the first phase comprises the beginning of orthodontic treatment to surgical exposure of the tooth lasting from two to five months and varying, depending type of malocclusion and which teeth are involved. The second phase occurs when starting traction, going to the placement of the tooth in the arch, between 12 to 18 months. The third phase is when the orthodontic treatment is finalized with the tooth in the arch. The traction of an unerupted tooth adds between 10 to 18 months to complete orthodontic treatment time **(Kyung-ho *et al*, 1998)**.

Before orthodontic forces are applied, it is necessary to make sure that there is enough space for the tooth to be taken to its desired position in the arch. Also, one must be sure that the correct osteotomy around the crown is made and that there is no present **(Becker, 1988; Andresan, 1997; Peterson, 2003)**.

Complications in treating impacted canines include failure to erupt, periodontal defects, bond failure, and ankylosis. The effect of ankylosis is to prevent tooth eruption. This may cause the anchoring teeth, on the archwire, to tip into the space created for the canine. Ankylosis has also been implicated in some cases where the canine initially moved and then suddenly ceased to erupt. Luxation of the ankylosed tooth has been a recommended treatment in this case however, success is unpredictable **(Kokich and Mathews, 1993; Kasander, 1994)**.

1.4.1 impacted canine

A canine that is prevented from erupting into a normal position, either by bone, tooth or fibrous tissue, can be described as impacted. **Bishara and cooke in 1992 and 2006** respectively reported that Impacted maxillary canines are seen in about 3% of the population. The majority of impacted canines are palatal (85%), the remaining 15% are usually buccal. There is sex bias, 70% occur in females. One of the biggest dangers is that they can cause resorption of the roots of the lateral or central incisors and this is seen in about 12% of the cases(**Jacoby, 1982; Becker, 2007**).

The cause of impaction is not known, but these teeth develop at the orbital rims and have a long path of eruption before they find their way into the line of the arch. Consequently in crowded cases there may be insufficient room for them in the arch and they may be deflected. It seems that the root of the lateral incisor is important in the guidance of upper permanent canines to their final position. There is also some evidence that there may be genetic input into the aetiology of the impaction (**Yusuke , 2019**).

1.4.1.1 Clinical examination of impacted canine

It is easy to miss non-eruption of the permanent canines, but there are some markers which should increase suspicion of possible impaction. Any case with a deep bite, missing lateral incisors or peg-shaped upper lateral incisors needs a detailed examination. Fig. (5) shows such a case and in this instance both canines were

significantly impacted on the palatal aspect. The retained deciduous canine is self evident. Other clues include root and crown positions(**Ericson And Kurol , 1988**).



FIGURE (5) : Typical features which should arouse suspicion of impacted canines
(**Roberts and Sandy, 2004**).

Any general dental examination of a patient from the age of 10 years should include palpation for the permanent canine on the buccal aspect. It is possible to locate the canines with palpation, but this will lead to some false observations. For instance, the buccal root of a deciduous canine, if it is not resorbing, can feel like the crown of the permanent tooth . It is therefore important to back up clinical examination with radiographs. Failure to make these observations will eventually result in patients complaining of loose incisors; inevitably some permanent canines will resorb adjacent teeth with devastating efficiency (**Ericson and Kurol, 2000; Bedoya, 2009**).

1.4.1.2 Radiographic examination of impacted canine

Most patients undergoing routine orthodontic screening will have a dental pantomogram (fig6A). To identify the position of impacted canine(Nohadani and Pohl 2008). 2 or more periapical radiographs taken at different angles can confirm the position of the impacted tooth by utilizing the principle of the SLOB or Clark's rule. The SLOB rule means "Same Lingual, Opposite Buccal". If the beam angle moves mesially, then the image of the impacted canine moves mesially too. This means the impacted tooth might be located on the lingual or palatal side . (fig6B) (Hunter , 1981)

On the other hand, if the beam angle moves distally and the image of the impacted canine moves mesially, the tooth is likely located on the buccal side. This principle has been useful to locate the position of the tooth. Approximately 90% of the time, clinicians can identify the position of an impacted tooth on the labial or palatal, However, there are many limitations including measuring the exact distance from the impacted tooth to the adjacent teeth and identifying the presence or absence of root resorption on adjacent teeth (Mason, 1982).

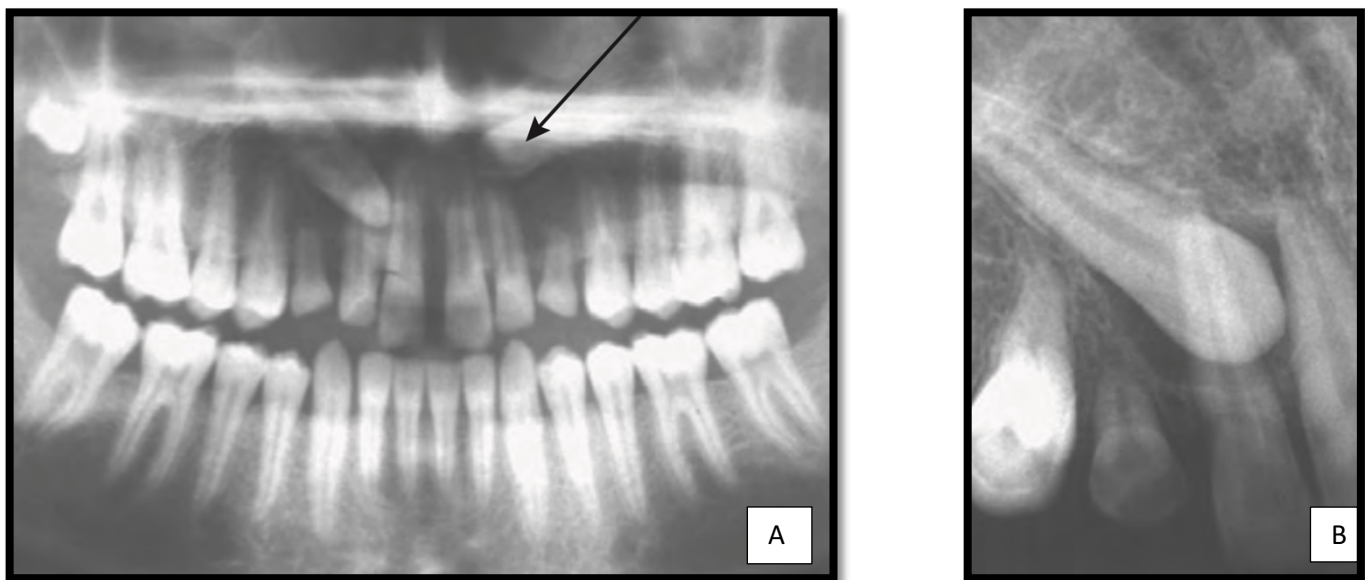


FIGURE (6) : A, The panoramic film shows the left canine very high and above the root apices of the incisors, **B**, The periapical views show the left and right canines overlapping one-third and two-thirds of the incisor roots(**Becker , 2007**).

Orthodontists and surgeons need to be aware of the precise position of the tooth in order to generate appropriate treatment plans. Three dimensional analysis with cone beam computed tomography (CBCT) has significantly improved our ability to localize the position of the tooth accurately (**Mah, 2004**). After obtaining a CBCT scan, a panoramic radiograph can also be recorded, The customized arch is made on the panoramic view, and the customized slice view can be used for accurate detection of tooth position, In addition to those sliced views, a 3D reconstructed view can be useful in identifying the exact location of an impacted canine (**Walker *et al*, 2005**).

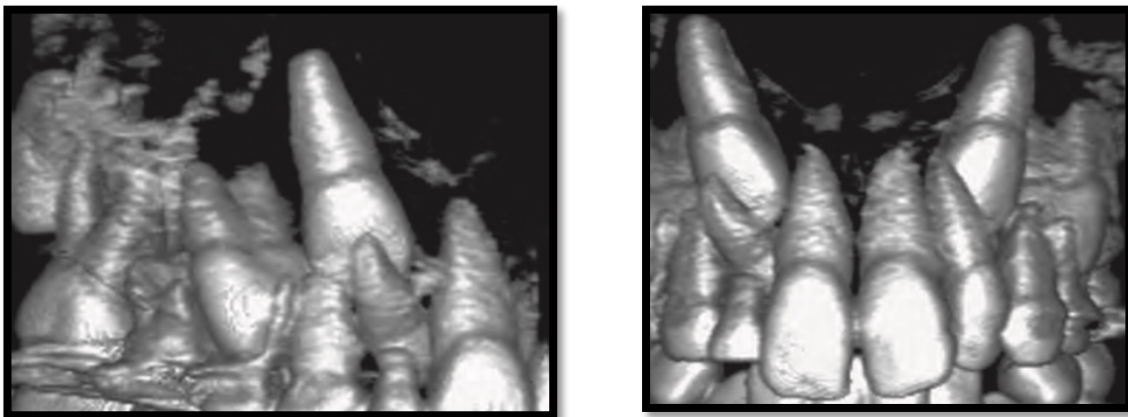


FIGURE (7) : 3-D views from the right side, the front and the palatal aspect, to determine the root of the lateral incisor to be protruding labially and its crown palatal to the central incisor (**Becker, 2007**).

1.4.1.3 Classification of impacted canines

Canine impactions are broadly classified based on their labio-palatal positions in relation to the alveolar ridge, the axial inclination and the depth of the impacted tooth. (**Chapokas *et al*, 2012; Gashi and Kamberi , 2014**). Several classification systems have been formulated describing the location of the impacted canines, thus guiding the clinician in choosing the most predictable treatment option.

The position of the impacted tooth is usually classified per their relation to the neighboring teeth and anatomical structures. Similarly, mandibular impacted canines

were classified based on their labial and unusual anatomical positions. The presence of the ectopic maxillary canine based on the location of impaction and relation to the neighboring lateral incisor root was classified by Chapokas, as: Class I- palatal location, Class II- center of the alveolar ridge or labial to the alveolar crest, without labial superimposition to the root of the adjacent lateral incisor and Class III labial to the long axis of the adjacent lateral incisor root, (**Chapokas *Et al*, 2012**).

This classification was specifically formulated to guide the clinician in deciding the most optimal surgical interventional technique for their eruption(**Kokich, 2004**).

1.4.1.4 TREATMENT OF CANINES

The treatment of buccally or palatally impacted canines involves exposure and then a form of traction to pull the tooth into the correct position in the arch. Palatally impacted teeth can be exposed and allowed to erupt. This tends to form a better gingival attachment since the tooth is erupting into attached mucosa. This cuff may be lost on the palatal aspect as the tooth is brought into line. Some operators prefer to raise a flap, attach a bracket pad with a gold chain to the tooth in theatre and then replace the flap. Traction is subsequently applied to the chain and the tooth pulled through the mucosa (fig8) (**Roberts and Sandy, 2004**).

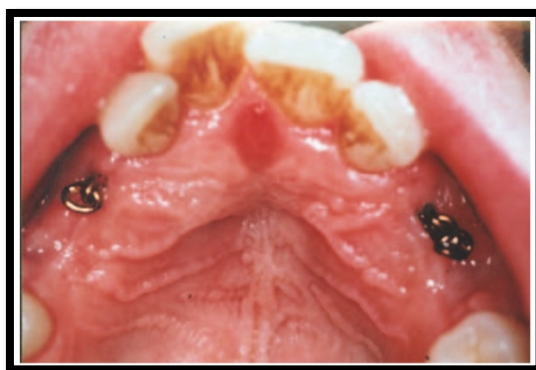


Figure 8 Palatally impacted canines which have had a flap raised and gold chain bonded to the crowns of the permanent canines (**Roberts and Sandy, 2004**).

There is some evidence that this procedure is less successful than a straight forward exposure. It also has a disadvantage that if the bonded attachment fails then a further operation, either to expose or reattach, is needed. The advantage with this technique is

that the root usually needs less buccal torque once the crown is in position.

(Roberts and Sandy, 2004).

If the canine is moderately high and buccal, it will not be possible to expose the tooth since it will then erupt through unattached mucosa and an apically repositioned flap should be considered. If it is very high, it is not possible to apically reposition the flap and therefore it is better in this situation to raise a flap and bond an attachment with a gold chain. It is critical that the chain passes underneath the attached mucosa and exits in the space where the permanent canine will eventually be placed. If it is not placed in this situation and exits out of non-keratinised mucosa the final gingival attachment will be poor **(Roberts and Sandy, 2004).**

1.4.1.5 Interceptive Treatment

Interceptive treatment has been proposed by some researchers to promote self-correction and autonomous eruption of a labially impacted canine. Williams **(Williams, 1981)**. has suggested that extraction of the maxillary primary canine as early as 8 or 9 years of age will enhance the eruption and self-correction of a labial or intra-alveolar maxillary canine impaction. Bonetti et al **(Bonetti et al., 2010)**. found that extraction of both the primary canines and the primary first molars proved to be a more effective interceptive procedure compared with single canine extraction in improving the intraosseous position of an impacted canine.

Olive **(Olive, 2002)** .has suggested that opening space for the canine crown with routine orthodontic mechanics may allow for spontaneous eruption of an impacted canine. O'Neill **(O'Neill, 2010)**. on the other hand, has shown that the prevalence rates for successful eruption of maxillary canines were significantly improved in patients who had palatal expansion to increase the maxillary arch length.

However, in some situations, even these techniques may not work, and the orthodontist will need to refer the patient to have the labial impaction uncovered surgically. There are three techniques for uncovering a labially impacted maxillary canine: excisional uncovering, an apically positioned flap (APF) and the closed eruption technique **(Kokich and Mathews, 1993).**

1.4.1.6 Criteria for Appropriate Uncovering Technique

Four criteria must be evaluated to determine the appropriate method for surgical uncovering(**Kokich, 2014**) :

A. The labiolingual position of the impacted canine crown. If the tooth is impacted labially, then any of the three techniques could be used, because generally there is little, if any, bone covering the crown of the impacted canine. However, if the tooth is impacted within the center of the alveolus, then an excisional approach and an APF are not recommended, because extensive bone may need to be removed from the labial surface of the crown(**Kokich, 2014**).

B. The vertical position of the tooth relative to the mucogingival junction. If the majority of the canine crown is positioned coronal to the mucogingival junction (fig 10), then any of the three techniques can be used. However, if the canine crown is positioned apical to the mucogingival junction), then an excisional technique would be inappropriate, because it will result in a lack of gingiva over the labial of the tooth after it has erupted. In addition, if the crown is positioned significantly apical to the mucogingival junction, then an APF also would not be appropriate, because it would result in instability of the crown and possible reintrusion of the tooth after orthodontics (**Williams, 1981**) ,in the latter situation, a closed eruption technique will provide adequate gingiva over the crown and doesn't result in long term reintrusion of the tooth (**Bonetti et al ., 2010**).

C. The amount of gingiva in the area of the impacted canine. If there is insufficient gingiva in the area of the canine, then the only technique that will predictably produce more gingiva is an APF. However, if there is sufficient gingiva to provide at least 2 to 3 mm of attached gingiva over the canine crown after it erupts, then any of the three techniques could be used (**Kokick, 2010**).

D. The mesiodistal position of the canine crown. If the crown is positioned mesially and over the root of the lateral incisor, then it could be difficult to move the tooth through the alveolus, unless it is completely exposed with an APF. In this latter situation, closed eruption or excisional uncovering generally would not be recommended (**Kokich, 2010**).

An APF procedure should be used when the canine is impacted ectopically (ie, mesial to the lateral incisor or distal to the first premolar). This will allow the orthodontist access to apply appropriate mechanics to “jump” the tooth over the lateral incisor or premolar without damaging these adjacent teeth (**Kokich, 2010**).

Some labially impacted teeth are located closer to the midalveolar position and are treated with the closed eruption technique. These are the easiest to access, so a chain can be bonded directly to the tooth to erupt the tooth through the crestal area. This movement mimics the natural eruption pathway the tooth would normally have taken (**Kokich, 2010**).

1.4.1.7 Choosing of the uncovering technique

A. Closed eruption technique

The closed eruption technique involves the elevation of a mucoperiosteal flap, exposure of the palatally impacted canine crown, removal of sufficient bone to allow tooth movement, attachment of a gold chain (which will exit through the palatal flap), and repositioning of the flap to re-cover the tooth. The tooth can be orthodontically guided into the dental arch after the area has healed. For many years, the closed eruption technique has been used successfully to erupt palatally impacted canines. However, the eruption process can cause root resorption of the adjacent lateral incisor, bone loss, and adverse periodontal effects(**Kokich, 2010**).

The eruptive force should be directed lingually and away from the root of the lateral incisor. This force direction avoids canine-to-palatal bone contact and would therefore prevent root damage to the lateral incisor. After the crown erupts into the oral cavity, it can be orthodontically moved to the proper canine position (**kokich 2010**).

Many orthodontists simply pull the tooth laterally toward the edentulous ridge instead of erupting the impacted canine distally and palatally away from the adjacent central and lateral incisors. This often causes the canine crown to compress against the adjacent palatal bone. The enamel of the crown cannot resorb the adjacent bone physiologically, so this crown-to-bone contact leads to pressure necrosis, which will

result in bone resorption as the impacted canine moves laterally. In addition, bone remodeling occurs behind the canine crown as the advancing crown erupts. This type of forced movement has been shown to result in bone levels and attachment levels on the distal of the lateral incisor and mesial of the previously impacted canine that are more apical than the contralateral lateral incisor and nonimpacted canine (**Crescini et al., 2007**). Therefore, the esthetics are negatively impacted. However, the closed eruption technique does not have to result in bone resorption or poor attachment levels around the previously impacted canine. Therefore, the direction of eruption pathway of the canine crown beneath the palatal tissue is critical. For the most predictable outcomes with the closed eruption technique, the impacted tooth should first be erupted lingually and then moved laterally so as not to compromise the bone levels or cause root resorption of the lateral incisor(**Kokich, 2010**).

B. Tunnel approach Technique

An interesting variant of the closed technique was introduced by (**Crescini et al. 1994**). The impacted canine is drawn downwards through the evacuated socket of the simultaneously extracted deciduous canine. This modification is aimed at ensuring the preservation of the buccal plate of the alveolar bone and the principal indication of this technique is for impacted canines that are located high in the maxilla and in close proximity to the line of the arch. The choice of surgical procedure is decided in relation to 3D location of impacted tooth(**Kokich, 2010**).

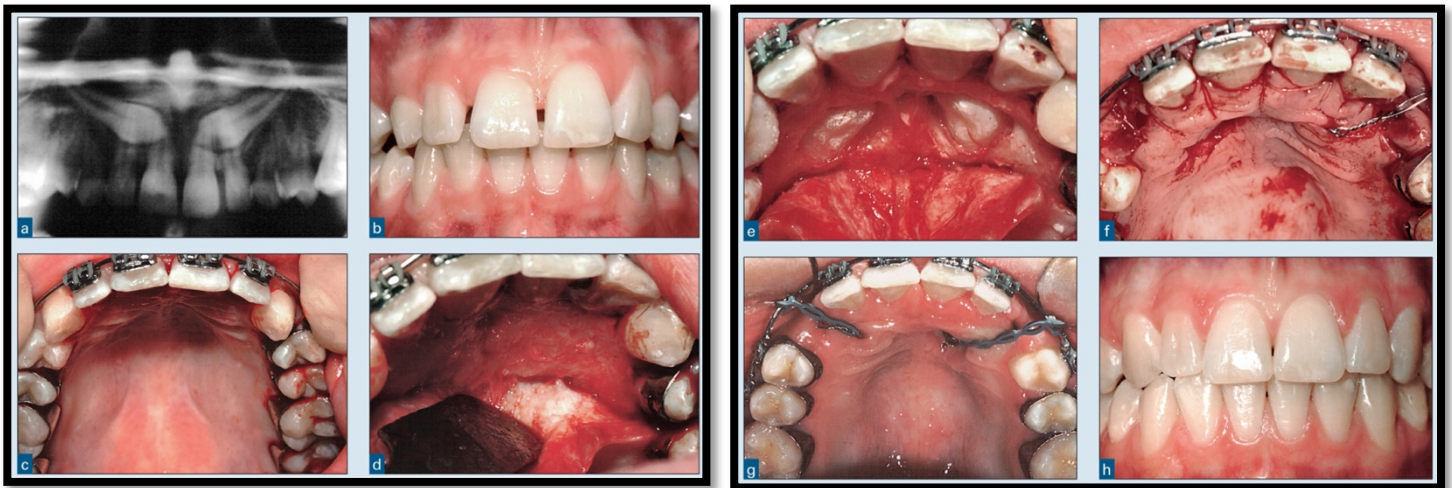


FIGURE (9) : Palatally impacted maxillary canines near the nasopalatine foramen (**kokich, 2010**).

1.4.1.8 Other treatment options

A. Accept and observe

Leaving the deciduous canine in place and either observing the impacted canine or removing it. Long term, the deciduous canine will need prosthetic replacement (**Robert and sandy, 2004**).

B. Extract the impacted canine

If there is a good contact between the lateral incisor and the first premolar then it has to be carefully considered whether this should be accepted. The purists of occlusion will argue that the premolar is not capable of providing good canine guidance. Aesthetically there are problems since the palatal cusp hangs down. This can be disguised by grinding or rotating the tooth orthodontically so that the palatal cusp is positioned more distally. The placement of a veneer on the premolar is another way of improving the appearance (**Ericson and Kurl, 1988**).

C. Transplantation

Canine transplantation has received poor press in the past. Many of the problems arose because the canines were transplanted with a closed apex. These teeth were seldom followed up with root fillings on the basis that they would revascularise. This is unlikely through a closed apex and it is preferable to treat them as if they were non-vital. Transplantation is an option which should only be reserved for teeth that are in almost an impossible position and where there is extensive hypodontia or other tooth loss (**Perciaccante, 2007**).

D. Implants

Implants are also an option and as single tooth implants improve, this may become more favoured in future. It is important to remember that implants in a growing child will ankylose and appear to submerge as the alveolus continues to develop. These are not therefore an option until the patient is at least 20 years of age (**Armstrong et al, 2003**).

1.4.2 Impacted lower premolar

1.4.2.1 Introduction

The mandibular second premolar is highly variable developmentally. Agenesis, abnormal tooth germ position, and distal inclination of the developing tooth are among the reported developmental (**Backer, 1988**).anomalies . In addition, the second most frequently impacted tooth was found to be the mandibular second premolar, excluding third molars, in some (**Backer, 1988; Andreasen, 1997**) .populations .The mandibular premolars erupt after the mandibular first molar and mandibular canine; thus if the room for eruption of premolars is inadequate, one of the premolars usually the second premolar remains un-erupted and chances of getting (**Petersen, 2003**).impacted are more . The prevalence of impacted premolars varies according to age. The overall prevalence for impaction in adults has been reported to be 0.5% the range being 0.2% to 0.3% for mandibular (**Backer, 1988; Andreasen, 1997; Petersen, 2003; Mariano, 2006**) .

The main etiological factors for premolar impaction appear to include arch length deficiency, lack of space, ectopic position of tooth germ, obstacles to eruption such as an ankylosed primary molar, and the presence of supernumerary teeth or odontomas. Some systemic and genetic factors involved include cleidocranial dysplasia, osteopetrosis, Down's syndrome, hypothyroidism, and hypo- pituitarism (**Andreasen, 1997; Mariano, 2006**).

Genetic and environmental factors involved in tooth development may be disturbed at any stage of tooth (**Andreasen, 1997**). development . Tooth germ of mandibular second premolar is ideally positioned between roots of second deciduous molar. Normally the path of eruption follows resorption of roots of deciduous molar with no major deviations. The mandibular premolars erupt after the mandibular first molar and mandibular canine; thus if the room for eruption of premolars is inadequate, one of the premolars usually the second premolar remains un-erupted and chances of getting impacted are more (**Oikarinen and Julku, 1974; Brunch et al., 1994**).

1.4.2.2 Diagnosis and treatment scheme for unerupted premolars

A number of critical observations help select the proper treatment approach for a specific patient. These **include**:

- a) Diagnosing missing succedaneous teeth
- b) Whether the condition is generalized or localized
- c) Whether the succedaneous teeth have viable form, eruptive potential, and viable orientation
- d) Whether the delayed eruption is related to over retained primary molars such as ankylosis and incomplete root resorption
- e) The amount of space available
- f) The presence of overlying soft tissue or bone. (Fig14) (James *et al.*, 1994).

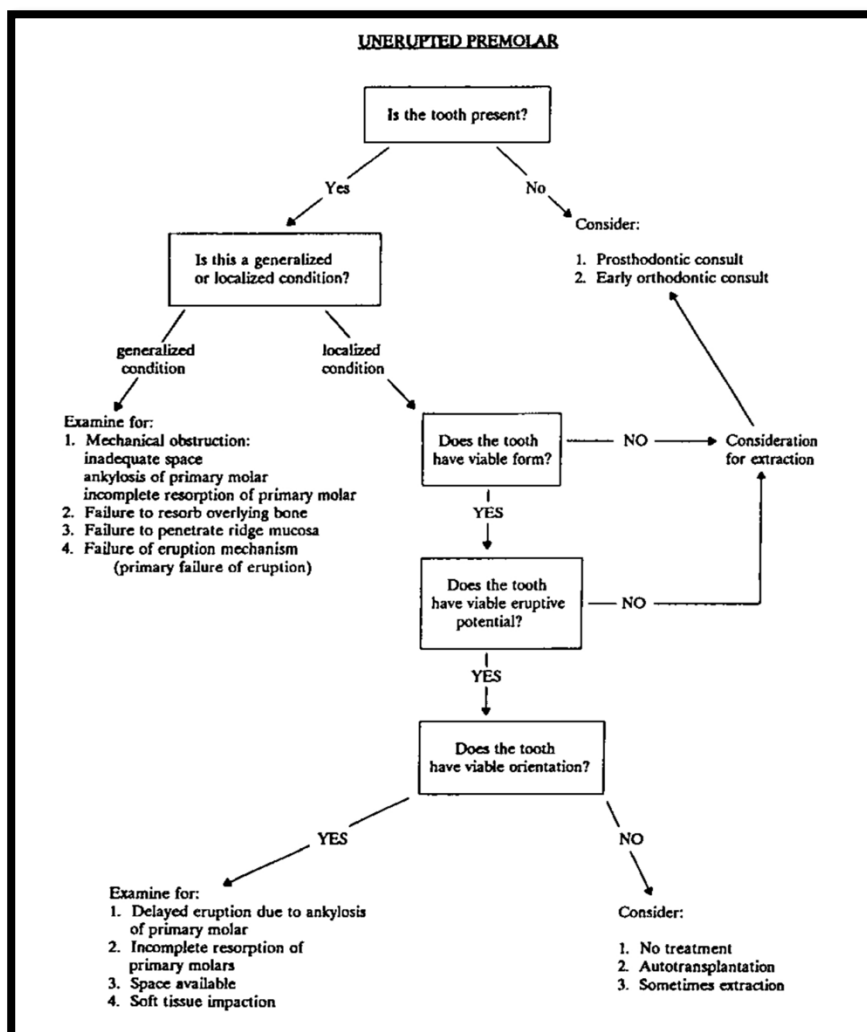


FIGURE (10) : diagnostic and treatment scheme for unerupted premolars

(James *et al.*, 1994).

1.4.2.3 Treatment of impacted lower premolar

When a mandibular premolar is impacted lingually, a full-thickness lingual flap is reflected from the canine to the mesial of the second molar (Fig 11e). Occasionally, a vertical incision will be needed when the impacted tooth is positioned near the apices of the adjacent teeth. Careful bone removal is accomplished to create an access wider than the dimension of the impacted crown so that it can be extricated from its bony crypt. This must be performed carefully, because the tooth may be impacted near the mesial root of the first molar (Fig 11d)(**kokich, 2010**).

Once the tooth has been isolated, a gold chain is bonded to the coronal aspect (Fig 15h). The flaps are repositioned and sutured. The chain will exit through the incision at the midcrestal region and should be attached to an adjacent bracket (Fig 11i). An eruptive orthodontic force can be applied 1 to 2 weeks later. If the premolar is in the midalveolar position, it will erupt quickly with application of a Ballista spring (**kokich, 2010**).

Infrequently, the impacted premolar will be locked under the root of the first molar. In this case, special orthodontic mechanics will be needed to erupt it, In such cases when the tooth is badly impacted near the apex of the first molar, some root resorption may occur as the tooth is moved. The orthodontic force and direction are critical in extricating the tooth from beneath the crown of the first molar without causing damage to its already resorbed mesial root. This resorption will cease after the tooth is erupted because the premolar will no longer be putting pressure on the mesial root of the molar (Fig 11r)(**kokich, 2010**).

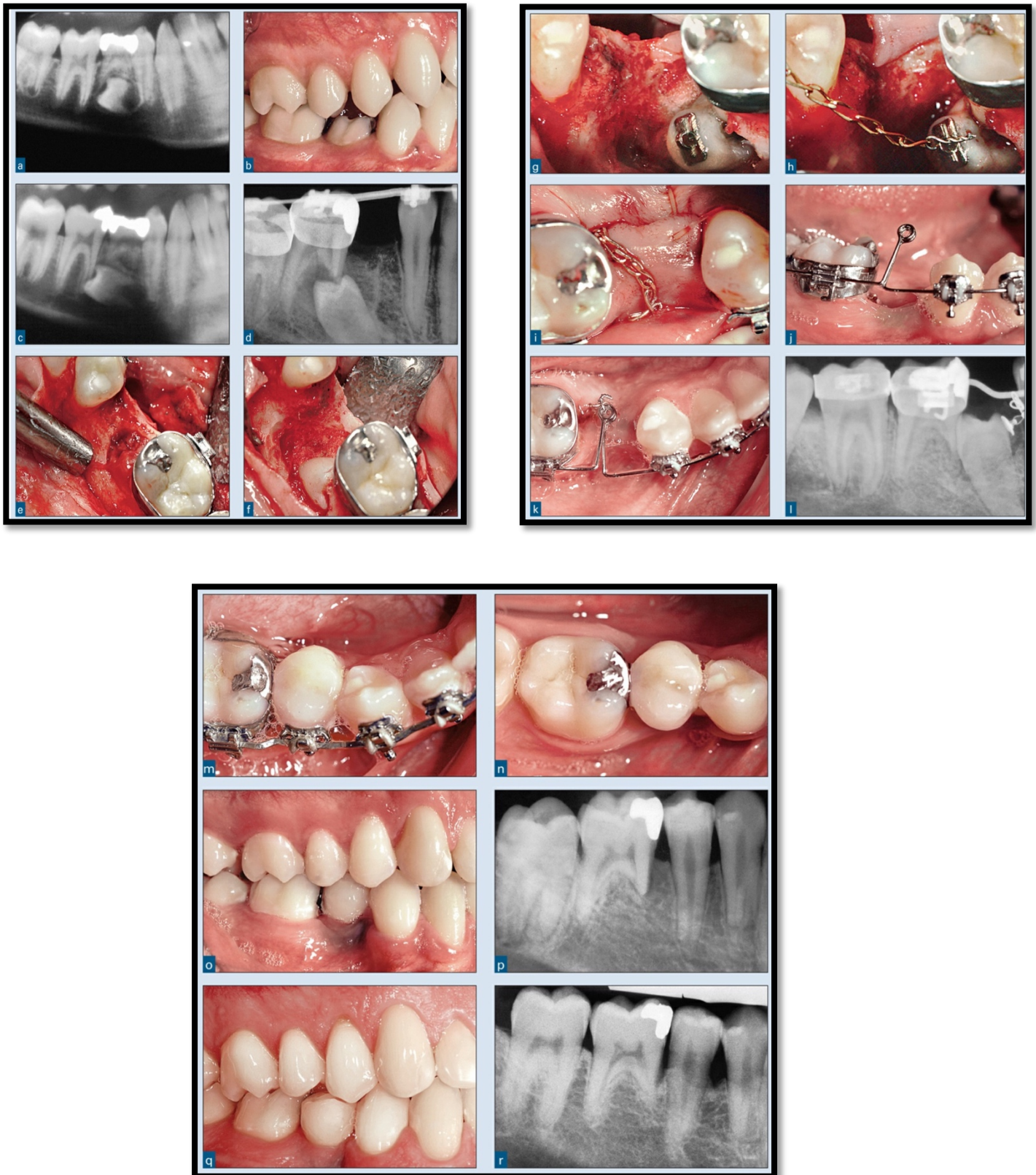


FIGURE (11) : A-R, Use of a gold chain to erupt an impacted premolar (Kokich, 2010).

1.4.2.4. Other treatment options

A. Autotransplantation

limited situations, the second premolar may be impacted in such a position that attempting to erupt the tooth orthodontically could be difficult or impossible or could jeopardize adjacent teeth and bone, In these situations, autotransplantation should be considered to move the tooth into its proper position (**McNarman, 2004**).

To autotransplant the second premolar, a midcrestal incision is made, and full-thickness flaps are reflected. The buccal bone is cautiously removed to locate the impacted tooth with its follicle. A crestal osteotomy is created to house the transplanted tooth, tooth and follicle are carefully enucleated and positioned properly but in infraocclusion (**Murray and Brown, 2003**).

The flaps are repositioned and sutured. Orthodontic movement can be initiated in 3 months. This is an extremely difficult surgery fraught with risk of injuring the follicle and the mandibular nerve. Fortunately, in this patient there was no nerve damage or paresthesia. However, because of slight trauma to the follicle during this difficult enucleation, the tooth may become ankylosed (**Rubin et al., 2002**).

B. Extraction of Impacted Premolars

It is rare that an impacted maxillary or mandibular second premolar cannot be surgically uncovered and orthodontically erupted into its proper position. However, if the surgical exposure or the orthodontic movement is deemed counterproductive for a specific patient, there is another option: extraction of the impacted premolar and closure of the edentulous space (**Schwartz, 1997**).

Unfortunately, if the extraction is unilateral, there could be significant compromises to the esthetics and occlusion as a result of closing the extraction space. In these situations, it could be advantageous to utilize the anchorage provided by a strategically positioned miniscrew. This adjunct could provide sufficient anchorage to move the first and second molars mesially, thus closing the posterior edentulous space without altering the dental midline or the anterior or posterior occlusion. After the space is closed, the miniscrew can be removed (**Kokich, 2010**).

1.4.3 Mandibular third molar

1.4.3.1 Theories of third molar impaction

A. Arch Length Discrepancy

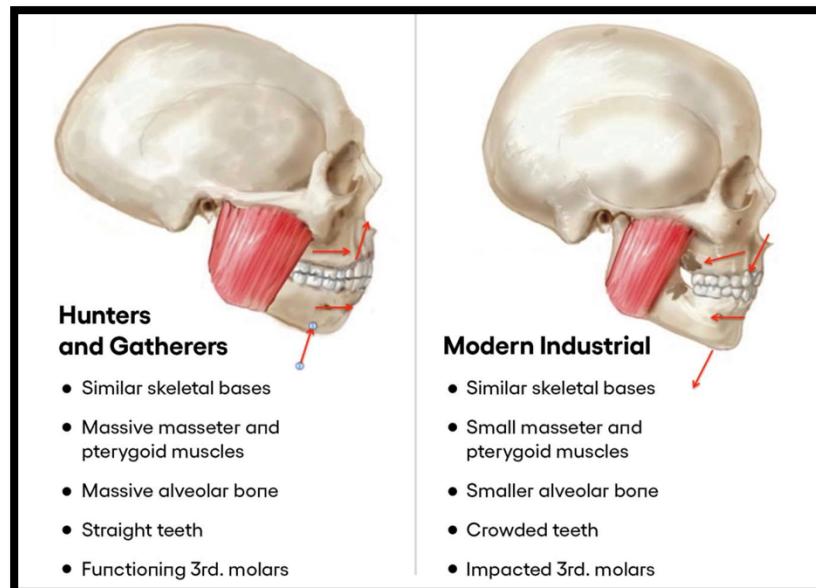
Arch Length Discrepancy is the difference between the space available, generally determined by the bony dental alveolus, and the space required or the sum of all mesiodistal tooth widths. If the space available is larger than the sum of the widths, this is known as spacing. If the space available is less than the sum of widths, this is known as crowding (**James *et al.*, 2019**).

B. Differential growth of mesial and distal roots

Impaction may be occur due to differential growth of the tooth roots, as the the mesial root is shorter than the distal root, As a result, the mesial root act as a pivot for the tooth tipping which become gradually mesially angulated (**James *et al.*, 2019**).

C. Evolution theory

Lack of development of jaw bones due to consumption of more refined food which causes lack of functional stimulation to the growth of jaw bones (**James *et al.*, 2019**).



**FIGURE (12) : difference between hunter and modern industrial humans
(WWW.Apexdental.com)**

1.4.3.2 Treatment options

In the past, the ‘prophylactic’ removal of third molars was carried out almost blindly and, in many cases, in the belief that this would prevent secondary incisor crowding in the post-retention period (**Richardson, 1989; Zachrisson, 2005**).

there are positive indications that an effort should be made to bring these teeth into the dental arch and make them useful functional dental units. This is particularly pertinent in the latter stages of the treatment of a premolar extraction case when excess space is closed by drawing the first and second molars mesially. This potentially opens up space at the distal end of the arch, which may sometimes be adequate to accommodate an erstwhile impacted third molar. In these instances, successful conservative treatment of the impaction, by orthodontic alignment, provides the maxillary third molar with an antagonist. This in turn allows both teeth to assume the same functional rating as any other tooth in the dentition (**Becker, 2012**).

The decision to upright a mesially inclined and impacted third molar must be made taking into consideration its prospective final position in relation to the ascending ramus of the mandible and its thick soft tissue investment. Should the final position of the tooth be at the expense of a localized resorption of the anterior border of the ramus or in the exuberant and inflamed soft tissue covering it, then the effort will have been wasted. Given adequate space at the end of the arch, however, there are often good indications for this treatment (**Becker, 2012**).

Treatment is very similar to that described for mandibular second molars above. Distally inclined and impacted third molars are much more of a problem, since control of root movement is poor at the end of the arch and extraction is often to be advised (**Becker, 2012**).

1.4.4 Maxillary central incisors

Unerupted or clinically missing maxillary incisors can have a major impact on dental and facial aesthetics of an individual. As missing upper incisors are regarded as unattractive, this may have an effect on the self-esteem and social well-being of the individual. Some speech difficulties associated with missing upper incisors have been reported (**Snow, 1961**). Thus, it is important to detect and manage the problem as early as possible to achieve a functioning dentition and a pleasing appearance. Early diagnosis is essential for a successful outcome and reduces the necessity for appliance therapy in some cases (**Scheiner and Sampson, 1997**).

1.4.4.1 Aetiology

The possible causes of maxillary incisors failing to erupt include:

a) Congenital

Unerupted incisors may be considered part of a spectrum of inheritable dental anomalies (**Bartolo *et al*, 2010**).

- Presence of supernumerary tooth is a common cause of failure of eruption. 42% to 62% of midline supernumeraries are associated with unerupted permanent incisors. Maxillary incisor that fails to erupt due to the presence of a supernumerary tooth has a better prognosis than those with other etiology (**Von, 1992; Betts and Camilleri, 1999; Foley, 2004**).
- Ectopic development such as severe malposition and/or impaction against another tooth may inhibit the permanent incisor from erupting (**Kobayashi *et al*, 1999**).
- Other pathologies such as cysts and odontomes may also prevent eruption of the permanent incisor (**Betts and Camilleri, 1999**).
- Generalized delay or failure of eruption are associated with certain conditions such as cleidocranial dysostosis, gingival fibromatosis and some clefts lip and palate (**Profitt *et al*, 1993**).

b) Environmental

- Retained deciduous teeth(**Bergstorm, 1977; Shelton et al, 1997**).
- Dilaceration of the permanent maxillary incisor resulted from trauma to the deciduous predecessor (22%) and the remaining were probably developmental in origin (71%) (**Stewart, 1978**).
- Ankylosis, where the root of the maxillary incisor becomes fused to the alveolar bone (**Jones and Hussain, 1996**).
- Dense mucoperiosteum can occur during development or due to the formation of scar tissue following surgery (**Jones and Hussain, 1996**).
- Thickened or enlarged follicles around the unerupted incisor

1.4.4.2 Clinical Examination

An intra-oral examination should be conducted for the presence of the following:

- Retained deciduous teeth
- Buccal or palatal swelling
- Availability of space for the incisor (about 9 mm for a central incisor and about 7 mm for lateral incisors) (**Clinical practice guidelines, 2015**).

1.4.4.3 Radiographic Investigations

The following radiographs may aid in the diagnosis and management:

- An anterior occlusal radiograph for general assessment purposes (**Jacsob, 1999**).
- Two periapical radiographs should be taken using the parallax technique for detailed assessment of the position, root and crown morphology (**Isaacson and Thom, 2001; Armstrong et al, 2003**) .It has been shown that the use of horizontal parallax technique is better than vertical parallax in localization of impacted canines
- If an anterior occlusal and a panoramic radiograph are already available, the vertical parallax can also be used for assessment (**Jacsob, 1999**).

1.4.4.4 Orthodontic management

A. Open Eruption Technique

The impacted tooth is left exposed to the oral environment following surgery and surrounded by the incised palatal or labial mucosa. An attachment may be placed during or after the procedure. This technique is termed open eruption technique or exposure and can be performed in two ways (**Clinical practice guidelines, 2015**) :-

I. The window technique

This direct technique involves removal of the overlying mucosa and the exposed tooth will have a non-keratinized labial gingival mucosa (**Koutzoqlou, 2013**).

II. The apically repositioned flap

The procedure involves apically repositioning the raised flap that incorporates attached gingiva overlying the impacted tooth and is expected to provide adequate width of attached gingiva (**Cean et al, 2000**).

B. Closed Eruption Technique

The closed eruption technique has been favored by many clinicians who claimed that the aesthetic and periodontal outcome is far more superior when compared with the apically positioned flap (**Vermette, 1995**).

With this method, a labial or palatal flap is raised and an attachment with gold chain or a bracket/eyelet with ligature wire is bonded to the enamel surface of the tooth using acid-etch technique, preferably with a light cured adhesive, before the flap is replaced Orthodontic traction is then applied (**Hunt, 1977; Oliver and Hardy, 1986**).

CHAPTER TWO : DISCUSSION

2.1 Discussion

The important question for the clinician is whether one of the two commonly used surgical techniques is less harmful to long-term periodontal health. Unfortunately, a review of the relevant literature failed to produce a clear answer to this question. Most investigations have been limited to retrospective studies in which only one of the two surgical methods have been evaluated (**Burden *et al*, 1999**).

Parkin et al performed a review of the literature concerning the use of open versus closed surgical exposure of palatally impacted canines. This review revealed that currently, there is no evidence to support one surgical technique over the other in terms of dental health, aesthetics, economics and patient factors. Until high quality clinical trials with participants randomly allocated into the two treatment groups are conducted, methods of exposing canines will be left to the personal choice of the surgeon and orthodontist (**Parkin *et al*, 2008**).

Crescini et al evaluated the prognostic role of the pre-treatment radiographic features on the post-treatment periodontal status of intra-osseous impacted maxillary canines. They concluded that these parameters measured on the pre-treatment radiograph did not represent valid prognostic indicators of final periodontal status of impacted canines treated by the combined surgical-orthodontic approach (**Crescini *et al*, 2007**).

Kokich describes the surgical and orthodontic management of impacted teeth and identifies the position and angulation of the impacted tooth, length of treatment time, available space and the presence of keratinized gingival as critical factors that where surgical intervention was essential will affect prognosis and treatment outcome (**Kokich *et al*, 1993**).

Andreasen suggests that surgical exposure with or without orthodontic intervention should be confined to cases with no more than 45 % tilting and limited deviation from the normal position (**Andreasen, 1997**).

Wasserstein and Shalish failed to find a significant correlation between premature loss of mandibular second primary molar and malposition of mandibular second premolar (**Wasserstein and Shalish, 2002**).

Becker advocated that by whichever method space is made, the tooth will normally erupt with considerable speed, without further assistance, if teeth are with moderately disturbed axial angulations. If sufficient space exists or created in the dental arch, impacted mandibular premolar then has a high potential for self-alignment from the normal position. and eruption without orthodontic intervention (**Becker, 1988**).

Profitt states that a tooth will erupt into its correct position after obstacles to eruption have been removed by surgical exposure, but after root formation is completed eruption of tooth rarely occur. Even a tooth that is aimed in the right direction usually requires orthodontic force to bring in to position (**Profitt, 2000**).

CHAPTER THREE: CONCLUSION

3.1 Conclusion

From our review we can conclude the following

- Impaction could occur due to numerous reasons like Primary displacement of the tooth bud, space inadequacy, local obstruction, trauma and general conditions
- There are many line of treatment are available to relief the impaction the orthodontic traction, extraction of the offending tooth, transplantation, implant or just leave in situ.
- orthodontic management of impacted teeth is a highly specialized treatment approach that requires a thorough understanding of dental anatomy, tooth eruption patterns, and the underlying causes of tooth impaction.
- It is a comprehensive process that involves a combination of orthodontic and surgical techniques to ensure the proper alignment and function of the impacted tooth. Early detection and intervention are crucial for successful outcomes, as timely treatment can prevent potential complications and improve the long-term prognosis of the impacted tooth.
- It can be a challenging and time-consuming process that requires significant patient commitment and cooperation. Despite these challenges, the benefits of successful orthodontic management of impacted teeth include improved dental health, improved bite function, and an enhanced aesthetic appearance. Therefore, it is important for patients to consult with an experienced orthodontist to determine the best treatment plan for their individual needs

3.2 Suggestion

We suggest for

1-survey study to know the prevalence of teeth impaction in different samples of iraqi population

2- further review study to know the correlation between malnutrition and teeth impaction

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