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REVIEW ARTICLE

Maxillary Canine Impaction and Its Management - A ReviewPritam Mohanty¹, Swati Saraswata Acharya², Subha Soumya Dany³, Debapreeti Mohanty⁴**ABSTRACT**

Maxillary canine impaction is nowadays a commonly seen condition which is always challenging to the orthodontist to bring the tooth to the normal position and finish the case with proper canine class-I relationship. In many cases it is very difficult to guide the tooth properly into the arch. In this article we will be trying to refresh the different methods of management of impacted maxillary canine. Even though bringing canine to the normal position may increase the treatment duration, it is good to have a good canine relationship at the final outcome of the treatment, which of course has a good aesthetic value.

Keywords: Impaction, Orthodontics, Malocclusion, Aesthetics

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INTRODUCTION

An impacted tooth is defined as the tooth whose roots are 2/3rd or fully developed but never expected to erupt suddenly. Maxillary canine impaction is very common along with mandibular third molar impaction and man-

dibular second premolar is very common after maxillary canine impaction.¹

In maxillary canine impaction cases, palatal canine impaction is seen to be more prevalent than buccal canine impaction.² But Oliver 1989 proved in his study that Asians may suffer from buccally impacted canines more frequently. Females are affected more than males.³

Reason for canine impaction⁴**Generalized causes**

Endocrine deficiencies, febrile diseases, and irradiation.

Localized causes

Tooth size-arch length discrepancies, prolonged retention or early loss of the deciduous canine, abnormal position of the tooth bud

The presence of an alveolar cleft, Ankylosis Cystic or neoplastic formation, Dilacerations of the root

Iatrogenic origin, Idiopathic condition with no apparent cause.⁵

GUIDANCE THEORY - MILLER**Normal Eruption**

When it comes to the path of eruption, canines usually have a mesial development path, which is guided downwards along the distal part of the lateral incisor roots.

First stage Impaction

If there is a loss of guidance due to early loss or missing lateral incisors or delayed eruption of lateral incisors, canine will have mesial and palatal path of eruption. This results in more of horizontal impaction.

First stage impaction and secondary correction

After it reaches the palatal alveolar process, canine is redirected to a reliable favourable path of eruption.

Second stage Impaction

Self correction is not possible if there are late developing lateral incisors (peg laterals) which redirect the tooth further palatally.⁶

Second Stage Impaction and Secondary Correction:

Extraction of primary canines or even extraction of lateral incisors leads to sudden eruption of the impacted tooth.

Diagnosis

Patients with impacted canines should be diagnosed early which may help in reducing the overall orthodontic treatment duration and even future complications.

Visual Inspection

The clinical signs which detect impacted canines are

1. absence of canine bulge by 10 years
2. overretained deciduous canines
3. delayed eruption of permanent canines
4. asymmetrical exfoliation

Palpation

Absence of canine bulge at 10 years is a good indication of ectopic or impacted canines.

In Children older than 10 years, an obvious palpable bilateral asymmetry could indicate that one of the permanent cuspids is impacted or erupting ectopically.

The deciduous canine is checked for mobility. If this test is even mildly positive it suggests that the permanent canine is fairly close to the desired eruption path and that severe displacement is unlikely.⁷

RADIOGRAPHIC EVALUATION^{8,9}**Intra-oral radiograph****1) IOPA**

The first, simplest and most informative X-ray film is the periapical view.

Advantages

- 1) Root development, pattern and integrity, can be evaluated.
- 2) crown resorption can be seen.
- 3) root resorption of adjacent tooth, can be detected.¹⁰
- 4) minimal radiation exposure.

Disadvantages

- 1) Periapical film is a two dimensional representation which gives no information regarding buccal lingual plane
- 2) Overlapping structures cannot be differentiated as to which is lingual and which is buccal.

2) Tube shift technique or Clarke technique (PARALLAX METHOD)

This is based on binocular principle where two periapical views of same object are taken at different angles.

This will depict the position of the tooth in buccolingual position.

Procedure

The first x ray is taken in one angulation. The Second film is placed in the same position but with the X-ray tube shifted mesially or distally around the arch, but held at the same angle at the horizontal plane and directed at the mesially or distally adjacent tooth.

- a. If the object moves in the same direction, it is lingually positioned.
- b. If the object moves in opposite direction, it is buccally located.

Disadvantage

In highly placed canines, and periapical film shows no superimposition of canine with the roots of erupted tooth.

3) Buccal Object Rule Technique

In this technique a first x ray is taken normally and for the second x ray, the vertical angulation of the cone is changed approximately by 20°. The result will buccal will move in the direction opposite to the source of radiation. Lingual object will move in the same direction as source of radiation.

- a. If the object moves in the direction opposite to the source of radiation then the tooth is buccally placed.
- b. If the object moves in the same direction of the source of radiation then it is lingually placed.

4) Occlusal Radiograph (True Occlusal Or Vertex Occlusal)

The procedure for exposure of impacted canines is usually done through the vertex at an angulation of 110 degrees to the occlusal plane.

Extraoral Radiograph¹¹**Lateral cephalograph**

This represents a true lateral view of the skull which defines the mesiodistal position and vertical position of the tooth.

PosteroAnterior view

This represents the vertical position of the tooth. The buccolingual tilt of the tooth is also clearly visible. This view also shows whether the root apex is in line of the arch and how far the crown is deflected in palatal direction. By seeing all these, it is easy to build up a three dimensional picture of the exact position and angulation of the impacted tooth and to plan the treatment accordingly to bring the tooth into alignment.

CT Scanning

Charles and Frank in 2003 stated that all the above mentioned methods were 2 dimensional and it is thus difficult to appreciate the position of canine. So they came up with a 3-dimensional image called computerized tomography (CT). CT Scanning is a method in which clear radiographs are taken at graduated depth in any part of the human body. By viewing serial radiograph slices of the maxilla, the relationship of the impacted tooth to adjacent teeth in all the three planes of can be accurately assessed.

Disadvantage: Expensive.

Interceptive Treatment

In Class I noncrowded cases where the permanent maxillary canine is impacted or erupting buccally or palatally, the preventive treatment of choice is extraction of the primary cuspids when the patient is 10-13 years old.

If permanent canines are buccally impacted then the overretained primary canines should be immediately extracted to create space for the eruption of ectopic canines.

When canines are impacted buccally, overretained primary cuspids should be extracted to create a path and space for the permanent cuspids to erupt into the arch. This is especially important if both the permanent and primary cuspids are visible in the arch at the same time

The surgical orthodontic procedure¹²

Surgical methods for exposing the impacted canine and bringing it to the line of occlusion are:

Surgical exposure, allowing natural eruption, and surgical exposure with placement of an auxiliary attachment.

Surgical intervention with out orthodontic treatment

Exposure only

It is done for a superficially placed impacted canine palpable in the buccal area. Removing the fibrous mucosa covering and resuturing it to leave the incisal edge of the impacted canine exposed will generally cause rapid eruption.

Exposure with pack

The crowns of the permanent canine should be exposed to their widest diameter and a surgical or periodontal pack should be placed over them and sutured in place for 2-3 weeks. This will encourage epithelialization down the sides of the socket and generally, prevent the reformation of bone over the unerupted teeth.

Surgical techniques for exposing impacted canines

They are –

1. Window approach (gingivectomy).
2. Apically repositioned flap (ARF).
3. Flap closed eruption technique (FCET).
4. Tunnel traction (TT).

Window approach

This is essentially a gingivectomy procedure. When used to expose an impacted canine, the procedure involves excision of a full thickness of the tissues that overlies the impacted canine so as to expose the incisal 1/2 to 2/3 of the crown.

Indication

Only in those cases where, after the proposed gingivectomy excision, a collar of attached gingiva measuring at least 2-3 mm will remain for the erupting canine, on the labial side canines, which are located very low, on the palatal side, even canines located 'high'

Drawback:

Window approach is not recommended for 'deep' impactions

Surgical procedures for buccally impacted canines

Circular incision

An incision which is made just over the impacted crown on the buccal aspect exposes the bony crypt above attached gingiva.

Advantages

Access is easy.

Eruption in many cases occurs naturally.

Disadvantages

Periodontal result is poor.

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Elongated clinical crown

Apically repositioned flap¹³

Indication

High & superficially placed canines on the labial side.

Technique

A pedicle flap containing sufficient amount of attached gingiva, overlying the impacted tooth is raised using

two vertical incisions and a small transverse incision. This flap is reflected and repositioned apically so as to expose 1/2 to 2/3 of the crown. The repositioned flap is then sutured to the periosteum of the adjacent regions. Care must be taken to ensure that the CE junction of the crown is not exposed. This was introduced by *Vanarsdall and Corn*.

In the absence of the deciduous canine, the mucogingival flap is raised from the crest of the ridge that includes the attached gingiva.

If the deciduous tooth is present then the entire area of buccal gingiva that invests it is included in the flap and the deciduous tooth itself is extracted.

Limitations of ARF:

- Difficult when the canine is located very high.
- This technique is not ideally suited for canines, which are very deep in the bone (midalveolar or infraosseous canines).

The apically repositioned flap can be either a full thickness flap or a split thickness flap.

Disadvantages of full thickness flap

Gingival scarring and atypical gingival contour.

Full Flap Closure: (Closed eruption technique)

This technique is indicated for canines which are located very 'high' (palatal as well as labial) and 'deep'.

This procedure was proposed by *MC Bride* (1979), and can be used regardless of the height of the canine. The tooth erupts towards and through the attached gingival area, which then becomes attached to the tooth and the surrounding alveolar process.

The tooth erupts towards and through the attached gingival area, which then becomes attached to the tooth and the surrounding alveolar process.

Disadvantages

A significant problem with the closed eruption technique is sometimes caused by a poor choice of banded orthodontic attachment. Since the mid-buccal portion of the tooth is easy to expose and bond, the orthodontist may be tempted to use a conventional bracket in this instance (*Wong lee & Wong, 1985*) because of the buccal prominence of the tooth, lack of the buccal bone, and the relative tightness of the replaced flap.

Thus damage may be caused to the muco gingival tissue by the bulky, wide and high profile conventional brackets, which may lead to breakdown of the overlying tissues to cause dehiscence or "buttonholing".

The orthodontist should evaluate 4 criterias to determine the correct method for uncovering the tooth.

(*Vincent kokich Ajo Sep 04*)¹⁴

- Assess the labiolingual position of the impacted canine crown.
- The vertical position of the tooth relative to the mucogingival Junction
- The amount of gingiva in the area of the impacted canine.
- Mesiodistal position of the canine crown.

Tunnel traction

The indications for tunnel traction are the same as those for flap closed eruption technique i.e, high and deep canines. This technique is particularly indicated in cases where the deciduous canine is retained.

The various steps in tunnel traction are:

- Reflect a full thickness mucoperiosteal flap over the impacted canine. Cut a window on the cortical bone to expose 1/2 to 2/3 of the crown of canine. Do not expose CE junction. Bond an orthodontic attachment to the exposed crown. Extract the retained deciduous canine
- Introduce a long, thin, surgical bur into the socket of the deciduous canine and create an intrabony tunnel to reach the exposed crown tip of the permanent canine. This tunnel, therefore, forms an extension of the socket of deciduous canine.

During the surgical procedure care should be taken not to completely remove the dental follicle but to conserve it as much as possible by just removing the area where the attachment is to be bonded.

If the follicle is removed completely and spontaneous eruption occurs, the oral epithelium will grow down the sides of the opening. It will then attach more apically on the tooth than normal, and a compromised gingival attachment will result. The erupted tooth will have a longer clinical crown and reduced alveolar height.

If follicle is there, it merges with oral mucosa mimicking normal eruption leading to the establishment of a normal gingival attachment (*Crescini et al 1995*).

METHODS OF ATTACHMENT

Attachments used

- Eyelet welded on band material backed with stainless steel mesh, cut and turned to the size of a small bracket.
- Standard Orthodontic brackets
- Lasso wires
- Threaded pins.
- Orthodontic Bands
- Hole drilled on the cuspids tip
- Magnets

- Ligature wires
- Gold Chain

Lasso wires (Shapria & Kuffinec-Angle 1981)

Prior to mid 1960's a lasso wire twisted lightly around the cemento-enamel junction was used as attachment.

Drawback:

- Causes irritation of the gingiva.
- Prevents reattachment of the healing tissue
- Causes external resorption & ankylosis in the area of the cemento-enamel junction.

Threaded pins

The different system of threaded pins for giving retention to amalgam & composites were used in the past (Kettle, 1958), (Becker & Zilberman, AJO1978)¹⁵ but has been superseded.

Disadvantages

- Dentally invasive necessitating subsequent restoration.
- Due to difficulties in accessing different impacted teeth there was loss of orientation of the long-axis causing pulpal damage.

Orthodontic Bands

Preformed orthodontic bands replaced the lasso wires. But their implementation dictated a very wide surgical clearance of tissues, adequate control of hemorrhage & contamination.

With the advent of enamel bonding this method became obsolete.

Standard Orthodontic Brackets

The standard edgewise or Begg brackets can be used as attachments. But the base of the conventional bracket is wide & rigid, and thus bonding elsewhere on a tooth apart from mid-buccal region results in bonding failure (Becker 1996)

Elastic Ties and Modules

When tying the elastomeric thread, the knot tends to loosen and much of the original force of the tie is lost in this loosening. The force required for tooth movement decreases over a period of 1 to 3 weeks depending upon the amount of tension applied according to Lu et al {1993} and Stone et al {1994}.

The application of both a flexible arch wire and an elastic ligature is counter productive, since the elasticity of the one that exerts the stronger force will be effectively neutralized and will offer no physical advantage over steel ligature. (Shapira & Kuffinec {1981})¹⁶

Magnets

Sandlerb and Vardimon used magnets in the treatment of impacted canines.

Advantages

- Low continuous physiologic force
- Eruption in all three planes
- Mimics normal eruption
- Reduces gingival inflammation
- Reduces bone recession.

Orthodontic considerations¹⁷

The prognosis of a palatally impacted tooth depends on several factors, such as the position of the impacted tooth relative to neighboring teeth, its angulation, the distance the tooth has to be moved and the presence of ankylosis.

In general, horizontally impacted or ankylosed canines are the most difficult to manage and have the poorest prognosis.

Auxiliary springs for canine movement

*Ballista Spring (Jacoby 1979)*¹⁸

Rectangular wires are used to make the Ballista Spring. It moves forward and then bent vertically down and ends in a small loop. This in turn provides an extrusive force for the canines to erupt.

If the impacted tooth is resistant to movement or if the distance for the tooth to move it is more it will lead to lingual molar root torque thus leading to loss of anchorage. Hence a TPA is used.

Active palatal arch [Becker1978]

Its made of 0.020 inch palatal arch wire with an omega loop inserted in it bilaterally. Thus activation of this wire is done by elevation of downward activated palatal wire and then ligation with pigtail ligature.

Light Auxiliary Labial Arch [Kornhauser1996]

It is made up of 0.014 inch round SS wire with vertical loops in the area of impacted canine on both sides. This loop has a small helix. This is tied with the basal arch wire in piggyback fashion. If basal arch wire is not used it will lead to extrusion of adjacent tooth and cause alteration of occlusal plane

Cantilever System Jco 00 Nov

A typical cantilever design is a wire fully engaged in the bracket of one tooth and tied in a point contact to another tooth. A moment and a force are created at the tooth in which the wire is fully engaged, whereas only a single force is developed at the other end of the cantilever—the single-point contact side.

Management of Palatally Impacted Canines

Correction of palatally impacted canines requires two separate actions: eruption out of the palate followed by buccal movement into position. A cantilever can be inserted into the auxiliary buccal molar tube and crossed over the occlusal plane to reach the canine, occlusal interference can be avoided by attaching the cantilever to the molar on the lingual side. An .032" X .032" edge-wise bracket welded to the lingual of the molar band, as advocated by Burstone, makes an excellent attachment for the cantilever.

Bilateral Cantilever

In cases requiring more anchorage, such as bilaterally impacted canines, an .0175" X .025" TMA composite cantilever can be welded directly to an .032" .032" TMA transpalatal arch between the .032" lingual molar brackets. As with the unilateral cantilever, activations can be made to generate extrusive forces followed by buccal movement. The combination of a stiff buccal arch wire and the transpalatal arch provides superior control of the reactive forces and excellent anchorage.

Eruption of Impacted Canines with an Australian Helical Arch wire – Christine Hauser

The Australian helical arch wire is placed in the bracket slots and activated by passing the steel ligature through the incisal helix. The ligature is then twisted until the correct deflection is achieved and the desired force is applied to the impacted tooth.

The force should not exceed 200g. Further activation is done every two weeks by twisting the steel ligature a few turns until the tip of the crown is exposed. This should keep the eruptive force between 150g and 200g—enough to overcome the resistance from soft tissue and bone.

Once the clinical crown is visible, the force can be reduced to between 60g and 150g, and the patient can then be seen every four weeks. Final eruption can be accomplished with either a nickel titanium wire or an elastomeric thread.

The K-9 Spring for Alignment of Impacted Canine – (Varun kalra Jco Oct 00)¹⁹

The K-9 spring is made of .017" X .025" TMA wire, which can be activated twice as much as stainless steel before it undergoes permanent deformation, while producing less than half the force. The horizontal arm of the spring is inserted into the first molar buccal tube and the premolar brackets. About 7mm mesial to the first premolar bracket, the horizontal arm is bent 90°

downward to form a vertical arm, which is about 11mm long and ends in a helix.

Vertical Intra-Arch Eruptive Forces

A stainless steel ligature tied to a Monkey Hook is directed vertically through this helix. The ligature is then tied to the eyelet of a superelastic closed-coil spring attached to the first molar.

If anchorage requirement is unavailable from the opposing arch, vertical intra-arch eruptive forces can be achieved using superelastic coil springs. A horizontal helix is bent

Canine versus premolar extraction

The prognosis for the successful exposure and guidance of the canine to its proper position in the dental arch is often guarded. This is because the canine may be ankylosed, undergo resorption, or become nonvital. The prognosis for a successful outcome will depend on the position of the impacted canine (i.e., whether horizontal or vertical) and the relationship of the impacted tooth to the roots of the adjacent teeth.

Avoid canine extraction if at all possible.

If the overall orthodontic treatment plan involves the removal of bicuspid, it is advisable to postpone their removal until the canine is surgically exposed and orthodontic forces are given.

Avoid canine extraction if at all possible.

WHEN TO EXTRACT AN IMPACTED CANINE²⁰

The extraction of the canine, although seldom considered, might be a workable option in the following situations: (1) If it is ankylosed and cannot be transplanted, (2) if it is undergoing external or internal root resorption, (3) if its root is severely dilacerated, (4) if the impaction is severe (e.g., the canine is lodged between the roots of the central and lateral incisors and orthodontic movement will jeopardize these teeth) (5) if the occlusion is acceptable, with the first premolar in the position of the canine and with an otherwise functional occlusion with well-aligned teeth, (6) if there are pathologic changes (e.g., cystic formation, infection), and the patient does not desire orthodontic treatment.- Bishara AJO 1992 Feb

CONCLUSION

Success of the management of impacted canine starts from proper diagnosis. Other parameters playing important roles are Age of patient, patient cooperation, Level of canine impaction, Inclination and Depth of

impaction, Amount of root formation, Type of exposure of tooth, Amount of bone removal, Type of attachment and Orthodontic traction.

Thus any orthodontist who does all the above things rightly will most definitely taste success in his treatment.

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