CASE REPORT

Surgical and orthodontic management of a horizontally impacted permanent mandibular canine: timing is vital

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SUMMARY

Failure of eruption of the mandibular permanent canine is an unusual event. This case report presents combined surgical and orthodontic management of an impacted permanent mandibular canine of a 10-year-old boy. Treatment considerations for impacted mandibular canines differ in comparison with other teeth. The paper also highlights on various treatment options, timing and biomechanical considerations while dealing with these teeth.

BACKGROUND

Impacted tooth refers to a tooth that fails to erupt into the dental arch within a specific time.¹ Teeth frequently impacted are—third molars, maxillary canines, maxillary and mandibular premolars and maxillary central incisors. Prevalence of impacted maxillary canines is 0.9–2.2% and of impacted mandibular canines is 0.05–0.4%.^{2–3} Failure of eruption of the mandibular canine is an unusual event. It has been suggested that eruption disturbances of a mandibular canine are most often caused by local factors such as mechanical obstruction (supernumerary tooth/cyst/tumour), insufficient space in the dental arch and tooth-arch size discrepancy. Systemic factors such as genetic disorders, endocrine deficiencies and previous irradiation of the jaws also have been suggested to play a role.⁴

Surgical exposure and orthodontic management of impacted canines have been used to bring impacted teeth into occlusion. The following case report presents combined surgical and orthodontic management of an unerupted mandibular permanent right canine.

Figure 2 Occlusal view of maxilla.

CASE PRESENTATION

A 10-year-old boy presented with decayed teeth in the lower right jaw. Careful history revealed occasional pain for the past 1 year that was relieved by use of over the counter pain killers.

On extra oral examination, the patient's profile was convex and lips were competent. Intra oral examination (figures 1–3) revealed:

1. The patient was in late mixed dentition stage. Dental age corresponded to 10–11 years of age.
2. Fair oral hygiene of patient (according to simplified oral hygiene index).
3. Mandibular right deciduous canine and maxillary left deciduous second molar root pieces were over retained and mobile (figure 3).
4. Molar relation was class I bilaterally.
5. The patient had normal overjet and overbite.
6. Premolars were erupting in all four quadrants.
7. Mandibular right permanent lateral incisor had drifted distally.
8. Lower left permanent mandibular canine was completely erupted in contrast to unerupted lower right permanent mandibular canine.

Figure 1 Intraoral view of maxilla and mandible in occlusion.

Figure 3 Occlusal view of mandible.

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Figure 4 Orthopantomographic view displaying horizontally impacted mandibular right canine.

PROVISIONAL DIAGNOSIS

Angle's class I malocclusion.

INVESTIGATIONS

The patient was advised an orthopantomograph (figure 4) and intra oral periapical radiograph (figure 5) to check the status of the canine in the lower right permanent canine region. The orthopantomograph showed horizontally an impacted mandibular right permanent canine impinging on the apical third of the lateral incisor root. A mandibular occlusal radiograph (figure 6) was also advised to evaluate buccolingual position. The occlusal radiograph showed the tooth was placed across the arch with crown portion placed on buccal aspect and root portion placed in lingual aspect.

Study models were prepared (figure 7) and Moyer's space analysis was performed.

Clinical examination and analysis of the diagnostic casts revealed that there was enough space for the eruption of the mandibular right permanent canine.

Figure 5 Intraoral periapical radiographic view displaying horizontally impacted mandibular right canine.

Figure 6 Mandibular occlusal radiographic view displaying horizontally impacted mandibular right canine (canine placed across the arch—crown placed on labial aspect and root lingually).

CONFIRMATORY DIAGNOSIS

Angle's class I malocclusion with horizontally impacted lower right permanent mandibular canine.

TREATMENT AND FOLLOW-UP

Course of treatment

Phase I—presurgical orthodontic intervention: Oral prophylaxis was carried out. Extractions of the over retained 83, 65 and 55 were performed. Lower lingual arch space maintainer was given to maintain the space in lower arch. Lower arch was bonded with 0.018 MBT metallic edgewise brackets. Uprighting of mandibular right lateral incisor was performed and space was created for eruption of the impacted canine. For maxillary arch, authors anticipated minimal to moderate crowding of dental arches based on mixed dentition analysis; for which fixed mechanotherapy was contemplated using MBT metallic edgewise brackets to improve the overall maxillary mandibular relationship enhancing general aesthetics, function and hygiene.

Phase II—surgical intervention: The patient's fitness to undergo the surgery was evaluated. Prior to the surgery prophylactic antibiotics and analgaesic were started. A small triangular-shaped full-thickness mucoperiosteal flap was elevated after careful localisation, utilising the radiographs as guide (figure 8). The impacted permanent right mandibular canine was exposed surgically by employment of a crevicular incision and vertical relieving incision distal to the lateral incisor. Part of the labial surface of the canine was made visible by slight bone guttering after elevation of the flap. Bleeding was controlled. Begg's

Figure 7 Pretreatment orthodontic models.

Figure 8 Triangular-shaped full-thickness flap with canine exposed and ligated to main arch wire with use of a Begg's bracket.

bracket was bonded on labial aspect of exposed tooth surface after achieving proper isolation from surrounding bleeding from surgical site (figure 8). Following this, a ligature wire was passed through this bracket and twisted and attached around a nickel titanium (Ni-Ti) main arch wire (figure 8). The flap was replaced and sutured (figure 9). Postoperative instructions were given.

Phase III—postsurgical orthodontic intervention: The patient was recalled after a week for removal of sutures (figure 10) and to tighten the ligature wire around the Ni-Ti wire (activation of ligature wire). With the help of the shape memory property of Ni-Ti wire, once every 15 days the ligature wire was tightened around the Ni-Ti wire until the Ni-Ti wire got deformed. After 2.5 months, the tooth was visible clinically (figure 11). At this stage the ligature wire, which was twisted around the Ni-Ti wire, was cut-off. The Ni-Ti wire was directly engaged to the Begg's bracket on the canine and stabilised with ligature wire. At the end of 4 months the canine came in to its proper position in the arch (figure 12). The patient was evaluated until the end of the retentive phase of orthodontic therapy. A positive vitality test and good periodontium with respect to the mandibular canine warranted the success of our treatment approach (figure 13).

DISCUSSION

Several papers are available in the literature regarding the treatment of maxillary impacted canines, but there are limited numbers of studies revealing frequency of occurrence of mandibular canines. Chu *et al*⁵ reported five mandibular impacted canine (0.07%) teeth in 7486 patients. A study by Rohrer,² examining 3000 patients radiographically, found 62 impacted maxillary canines (2.06%) and only 3 impacted mandibular

Figure 10 One week postoperative view showing completely healed wound.

canines (0.1%).³ Grover and Lortan⁶ found only 11 cases of mandibular impaction in the mandible in 5000 individuals (0.22%). In other study by Aydin *et al*⁷ involving 4500 Turkish patients, reported incidence of mandibular canine impaction was a meagre 0.44%. Maxillary canine impaction is definitely more frequent than mandibular canine impaction. There are limited numbers of studies revealing mandibular canine impaction with regard to the frequency of gender and side of occurrence ratios. Aydin *et al* reported a ratio of 1 male to 1.22 females in impacted mandibular canines but did not report a ratio between right and left side occurrences in impacted mandibular canines. Most of the impacted mandibular canines are unilateral and located on the labial aspect of the dental arch.⁷ None of these articles discuss treatment of mandibular canines in particular. Although treatment of an impacted tooth is not common, this article serves an important clinical lesson in treating impacted mandibular canines.

A wide array of treatment options are proposed for impacted canines, which are—(1) asymptomatic teeth only requiring observation, (2) surgical extraction, (3) combination of surgical exposure and orthodontic alignment and (4) surgical transplantation.^{4–8} Several authors have already reported on treating impacted maxillary canines,^{1,4,9} but very few have reported on mandibular canines.² Although the options for treating an impacted permanent mandibular or maxillary canine are the same, the authors are of the opinion that four major factors have to be considered, which are—Density of the mandibular bone is very high in comparison to the maxillary bone, especially around the mandibular anterior region that possesses the

Figure 9 Flap being replaced and sutures positioned.

Figure 11 Canine being clinically visible, 2.5 months postoperatively.

Figure 12 Canine in its correct position in the arch, 4 months postoperatively,.

highest bone density in comparison to all other tooth bearing regions of the jaws.¹⁰ These differences have a bearing in treatment planning, which is (1) greater forces are required to move an impacted mandibular anterior tooth, (2) greater time is required to move an impacted mandibular tooth, (3) more anchorage is required to achieve these movements, (4) there is a difference in biomechanics and (5) severely displaced teeth cannot be easily moved, as in the maxilla, leaving extraction as a better option.

A horizontally impacted tooth is considered tedious because of the following reasons—(1) unfavourability of eruption, (2) high anchorage requirements and (3) loss of vitality due to movement of teeth over further places. A horizontally impacted tooth in the mandible is even more problematic compared to maxillary teeth because of high density of bone requiring greater force and greater time duration compared to maxillary bone.

The authors in the present article utilised a combination of surgical and orthodontic techniques in treating the horizontally impacted mandibular canine. The orthodontic appliance should already be in place before the impacted tooth is exposed, so that orthodontic force can be applied immediately.^{2 7 11 12} There are different orthodontic approaches to bring an impacted tooth in the oral cavity. Some examples are: A gold chain connecting bracket and arch wire.¹⁰ A special alignment spring either soldered to a heavy base arch wire or a cantilever spring from the auxiliary tube on the first molar.¹⁰ Removable appliances with traction, mainly used in patients having multiple teeth missing, when the use of fixed appliances is not recommended.¹¹ Single arch versus two arch treatments (in this the maxillary arch is mainly used as the source of anchorage to move the mandibular impacted canine).^{2 10-12} Elastic threads and elastomeric chains (E chains).¹¹ Placement of magnets (a small magnet placed on

the impacted tooth and larger magnet placed within the removable plate).¹⁰

Complications of surgical/orthodontic management are nonvital pulps, ankylosis and root resorption. The periodontal complications are gingival recession, delay in periodontal healing, gingivitis, bone loss and decrease in the width of keratinised gingiva.^{10 13} But these periodontal complications can be reduced by raising the crevicular full-thickness triangular apical repositioned flap for exposing the impacted tooth and covering the tooth and attachment with the maximum amount of attached gingiva, which was performed in the present case.¹⁰ Absence of any of the mentioned complications were also confirmed after the end of the orthodontic retentive phase.

The authors would especially like to emphasise the advantages of choosing correct timing in treating impacted mandibular canines. These teeth require the earliest intervention because of the following reasons—(1) bone in children is less calcified compared with the dense bone in adults,¹⁴ requiring less time and force for achieving correction, (2) a smaller amount of root formed needs less force to move the canine (in contrast to the long roots of a mature canine),¹⁵ (3) open apices of canines in children result in less tendency towards devitalisation of teeth¹⁵ and (4) early intervention leads to prevention of complications associated with impacted teeth, such as disturbances to adjacent teeth and adjoining structures.¹⁶

CONCLUSIONS

Horizontally impacted mandibular canines are very rare and difficult to manage. Asymptomatic teeth should be kept under observation and symptomatically impacted teeth require surgical extraction or surgical exposure and orthodontic management. Surgical and orthodontic management of impacted teeth is the most appropriate way to give functional and aesthetically acceptable occlusion.

Learning points

- ▶ Timing of treatment initiation for impacted teeth is very important and the present article highlights the following points regarding treatment of mandibular impacted teeth in children:
- ▶ Timing of treatment initiation should not be delayed to utilise the immature mandibular bone to allow faster repositioning of teeth.
 - Timing of treatment initiation should not be delayed to utilise the smaller root surface area of the canine to allow faster repositioning of teeth.
 - Timing of treatment initiation should not be delayed to utilise the open apices that can prevent devitalisation of teeth and which is a common complication of moving teeth over greater distances.
- ▶ The only negative factor while treating a severely displaced horizontally impacted mandibular canine during a mixed dentition period is the limited number of anchorage teeth—1st permanent molar and incisors only.
- ▶ Virtuous use of surgical and orthodontic therapy by the clinician in children. Optimal utilisation of biomechanics and successful use of the limited anchorage available was done in moving a horizontally impacted canine in an anteroposterior plane and in the correction of its buccolingual position.
- ▶ Rare report of horizontally impacted mandibular canines.

Figure 13 Postoperative view of completed orthodontic therapy.

Competing interests None.

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