reports

The impacted maxillary canine: revisiting the clinical guideline, with case illustrations

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ABSTRACT

The key to managing canine impaction is early identification, interception and follow-up. In these case reports, we discuss four patients presenting with palatally impacted maxillary canines and their management. Guidelines to aid the early detection of an impacted maxillary canine and a subsequent management strategy are presented.

INTRODUCTION

The maxillary canine is the most frequently impacted tooth after the third molars, with a prevalence of 0.9 % - 3.0 % depending on ethnicity (Dachi and Howell, 1962; Zahrani, 1993; Ericson and Kurol, 1986). It is twice as common in females than males (Dachi and Howell, 1962; Ericson and Kurol, 1987). Canine impaction may be buccal, mid-alveolus or palatal. The reported ratio of palatal impaction to buccal is 12 to 1 (Jacoby, 1979). Unilateral impactions are more common that bilateral impactions (Dachi and Howell, 1962).

The impacted maxillary canine may be associated with unfavourable consequences, the most common of which is external resorption of adjacent teeth (Ericson and Kurol, 1987). Impacted canines are also associated with dentigerous cyst formation, loss of arch length from drifting premolars or incisors, failed exfoliation of the deciduous canine and labially erupted "fang like" canines (Shafer et al, 1963).

Early interception of potentially palatally impacted canine teeth in the form of timely extraction of the associated deciduous canine has been shown to assist in the correction of the eruption path of the canine. Early identification is the key to a successful disimpaction.

CASE REPORTS

Case 1

A 13-year-old female presented with a history of progressive mobility of her lateral incisors. Clinically, she had a Class 1 malocclusion in the late stages of the mixed dentition. The arches were well aligned. The 63 and 53 were clinically firm and there was no evidence of buccal canine bulges. The maxillary lateral incisors were mobile. A maxillary anterior occlusal radiograph and an orthopantomogram (OPG) were taken, and these revealed extensive resorption of the 12, 22 and 11 as a result of aberrantly positioned maxillary canines (Figure 1 and 2).

The patient was referred for an orthodontic opinion. The treatment prescribed included the extraction of the 53, 63, and the surgical exposure of the impacted canines. This was followed by fixed appliance therapy to bring these teeth into occlusion. The lateral incisors were also extracted at the time of surgery due to the extensive root resorption, necessitating their long term prosthetic replacement. External root resorption of the distal aspect of both the 11 and 21 was also observed.

Figure 1. An anterior occlusal view of 12, 11 and 22 displaying extensive resorption from palatally impacted 13 and 23.

Figure 2. An orthopantomogram view of 12, 11 and 22 displaying extensive resorption from palatally impacted 13 and 23.

Case 2

An 11-year-old female presented for a routine dental review. Clinical examination revealed a Class I malocclusion in the mixed dentition with mild crowding in the maxilla. Both deciduous canines were present and firm. Canine bulges were not clinically palpable. There was distal tipping and flaring of the lateral incisors.

A maxillary anterior occlusal radiograph (Figure 3) was taken to investigate the position of the canines. Both maxillary canines appeared to be palatally impacted with associated follicular enlargement.

Upon orthodontic referral, a recommendation was made to attempt to disimpact the unerupted maxillary canine by

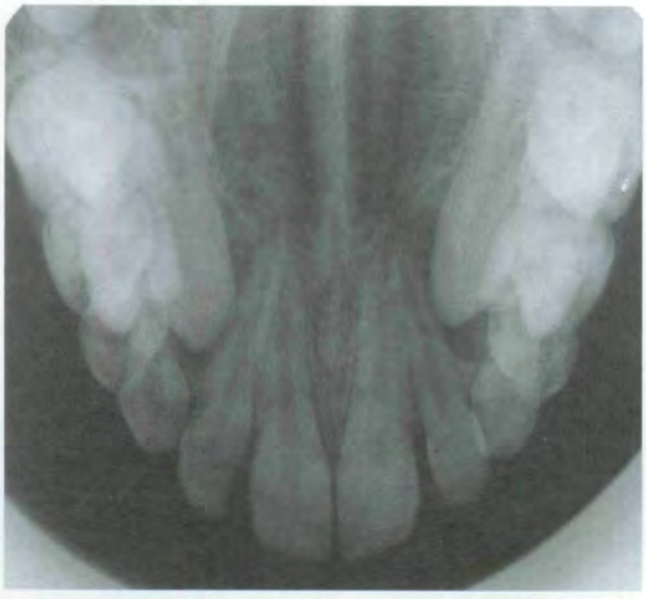

Figure 3. The 13 and 23 appear palatally impacted and each has an associated enlarged follicle.

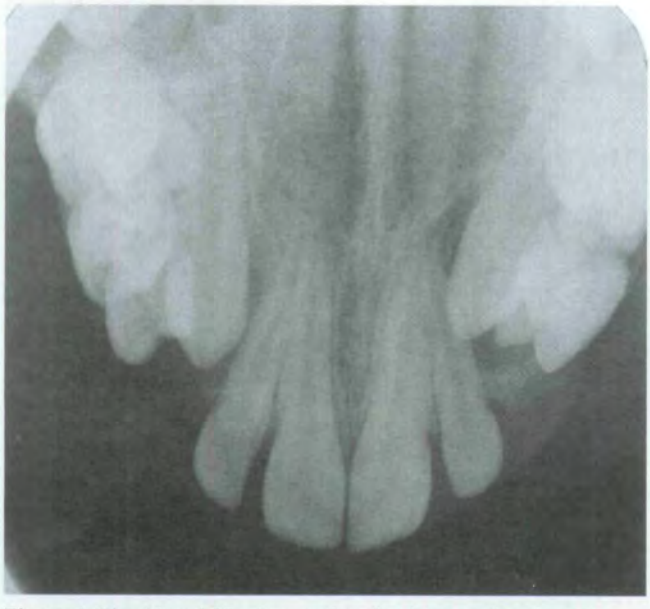

Figure 4. The 13 and 23, six months after interceptive therapy.

extracting both maxillary deciduous canines. This was carried out and the patient placed on a 6 monthly review programme to monitor progress (Figure 4 and 5). Both maxillary permanent canines erupted over a period of 18 months.

Case 3

An 11-year-old female attended for routine orthodontic review. She first presented to the orthodontist at age 9 due to concerns about the unerupted maxillary lateral incisors. Teeth 53 and 63 were extracted with a favourable outcome.

A routine OPG (Figure 6) raised suspicion of root resorption on both lateral incisors as adjacent canines were vertical and close to the lateral incisor roots. Further radiographic investigation was scheduled with her dentist. However, the patient failed to attend numerous scheduled appointments. She eventually presented to the dentist after an 8-month delay and a periapical radiograph was taken (Figure 7). There was extensive root resorption of the 12

Figure 5. The 23, twelve months after interceptive therapy.

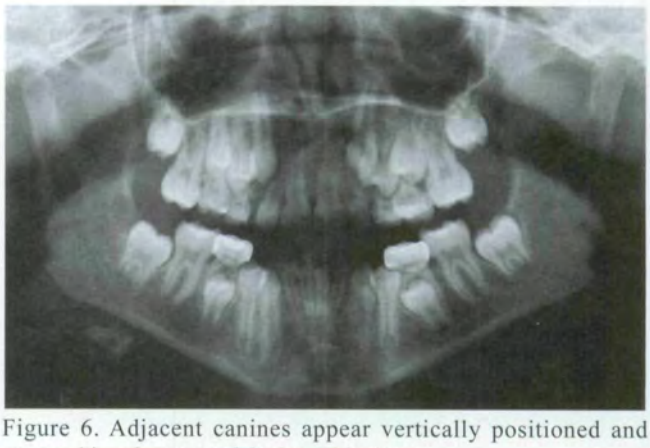

Figure 6. Adjacent canines appear vertically positioned and approaching the roots of the lateral incisors.

Figure 7. Extensive root resorption of the 12, eight months after bilateral impacted canines were first suspected.

from the impacted 13. The OPG showed the contralateral 22 displaying a similar fate (Figure 8).

The prognosis of the maxillary lateral incisors was regarded as poor, and the suggested treatment was extraction of the resorbed 12 and 22, fixed orthodontic appliances and surgical exposure of the canines.

Figure 8.Orthopantomogram taken subsequently indicates extensively resorbed 11 and 22.

Figure 9. Impacted 13 appears to be lying palatal to the 12 and is associated with an enlarged follicle.

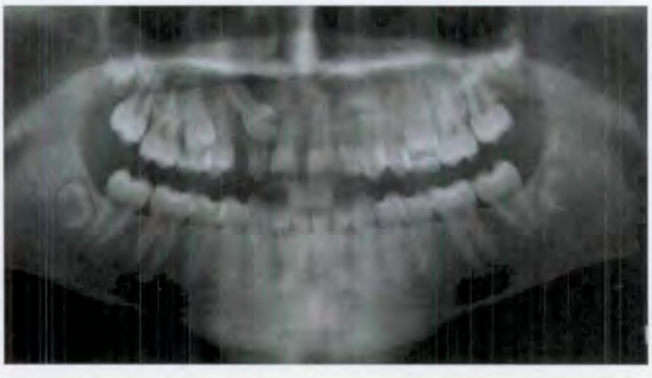

Figure 10. The 13 is displaced further palatally one year after interceptive therapy.

Case 4

A 12-year-old female was referred to the orthodontist for further management of impacted tooth 13. Clinical examination revealed she was in Class I occlusion with spacing in the upper anterior segment. The 53 was firm and no canine bulge palpable. The OPG (Figure 9) showed a palatally impacted 13 lying palatal to the 12, and had an associated enlarged follicle.

Treatment involved the extraction of tooth 53 to attempt disimpaction of tooth 13. The patient was reviewed a year later with an OPG (Figure 10) which showed 13 displaced further palatally.

DISCUSSION

Aetiology

The maxillary canine has a long eruptive path which is thought to play a role in its predisposition to becoming impacted (Dewel, 1949). It develops high in the maxilla, just lateral to the piriform fossa, migrating forwards and downwards as it descends towards occlusion. It comes to lie slightly buccal and distal to the root apex of the lateral incisor, which is then used as a guide for eruption. Pressure from the unerupted canine lying against the root of the lateral incisor causes the incisor crown to tilt distally (Becker, 1978). This resolves once the canines fully erupt. The permanent canine can usually be palpated as a bulge of the alveolar process on the buccal sulcus from as young as 8 years of age (Williams, 1981; Ericson and Kurol, 1986).

The eruption of the canine can be influenced either by local factors, which directly affect the tooth, or by genetic factors. Local factors are regarded as the most common cause of impaction. A reduced lateral incisor size has been strongly implicated. A study of patients with palatally impacted canines showed that 47.7 % of cases of impaction were associated with either a missing, peg shaped or short rooted lateral incisor (Becker et al, 1981). These findings support the Guidance Theory; that canine impaction occurs due to lack of eruption guidance from the lateral incisor root (Becker et al, 1981; Becker, 2007). The guidance theory may also explain the higher prevalence of impacted canines in females, as these lateral incisor size anomalies are more common in this group (Becker et al, 1981). Furthermore, females commence canine eruption earlier, prior to the completion of the guiding influence of the permanent upper lateral incisor teeth (Becker, 2007).

Other local factors may include crowding, prolonged retention of the deciduous canine displacing the permanent canine buccally, cyst formation involving the tooth (i.e. dentigerous cyst), position of the unerupted canine, and the occurrence of supernumeraries (Thilander and Jakobsson, 1968). A genetic predisposition has been implicated with familial inheritance cited (Peck et al, 1994). Impacted canine teeth have also been associated with the presence of other dental anomalies such as hypodontia and microdontia. There is a higher prevalence among Europeans compared to other racial groups.

Case Series

All the patients featured in this series were in the mixed dentition and the absence of the canine bulge led to suspicion of an impacted canine. Hence, it is essential for clinicians who treat children to be aware of the potential for such aberrant development in the mixed dentition and to refer when required.

As illustrated from the case histories, the most common complication from an impacted maxillary canine is external root resorption of adjacent lateral incisors. It is estimated that this phenomenon affects 48% of children with an impacted canine between 9-15 years of age (Ericson and Kurol, 2000). The resorption may be so severe as to ultimately cause loss of the affected tooth, as illustrated in Case 1. The loss of both lateral incisors may have been avoided had the ectopic canines been identified earlier. This emphasises the value of early detection.

After interceptive treatment, ongoing review of the patient's developing occlusion is vital to assess the efficacy of the intervention. It can take time before results are seen, such as in Cases 2 and 4. Timely extractions of the deciduous canines were carried out as recommended by Ericson and Kurol (1986). Case 2 produced a desirable outcome but unfortunately this was not the case for Case 4.

Parents must be made aware of the potential sequelae of an impacted canine and the importance of diagnostic measures such as radiographs and regular reviews. Case 3 received

early diagnosis and referral. However, failure to attend ongoing appointments led to an unfortunate outcome.

Diagnosis

I. Clinical

Ericson and Kurol (1986) evaluated 505 Swedish school children's maxillary canine eruption in a longitudinal clinical study. They concluded that radiographic investigation should be performed in children above the age of 10 years displaying any of the following clinical signs:

1. Advanced occlusal development and yet the canine bulge are not palpable
2. Asymmetry on palpation or pronounced difference in eruption of the canines on either side
3. The lateral incisor eruption is delayed or shows an unusual inclination

There is a strong indication of canine impaction if these signs are accompanied by a non-mobile deciduous canine or prolonged retention of the deciduous canines. In the event of a mobile deciduous canine, allow for natural exfoliation and review until the full eruption of permanent canine.

II. Radiographic

1. Periapical parallax view (Clark 1909)

Based on Clark's parallax 'SLOB -Same Lingual Opposite Buccal' principle, two periapical radiographs are taken of the canine in the same horizontal plane, at different mesial-distal angulations. The object that moves in the same direction of the cone is located towards the lingual or palatal.

2. Upper standard anterior occlusal view

The beam is placed centrally and aligned at a 60° downward angulation through the bridge of the nose. This view is convenient to take in children and the parallax principles described above can be utilized in conjunction with an orthopantomogram (OPG), utilizing the vertical parallax method to locate the position of the canine.

3. Orthopantomogram (OPG)

This view is not only useful in monitoring dental development of the late mixed dentition but also in picking up anomalies such as impacted canines (Ericson and Kurol, 1986). However, the position of the canine cannot always be reliably diagnosed on the OPG and will require additional radiographic views as mentioned above. The view of an overlapping canine crown over the root of the lateral should arouse suspicion, particularly if the image size of the canine appears larger than the contralateral side. A buccally positioned and horizontally inclined canine may have a similar appearance, but is easily detected clinically.

4. Cone Beam Computed Tomography (CBCT)

This is now the gold standard for dental imaging. The technology allows accurate 3D representation of the impacted canine and the resorption damage of adjacent roots which may not be detected on plane films. The radiation absorption dose from CBCT is commonly 40-80 μSv depending on the machine, which is a 98 % dose reduction compared to conventional CT which ranges from 1320- 3324 μSv (Hatcher et al, 2003).

CBCT allows clinicians access to high quality images at a radiation dose equivalent to the probable sum of all the dental films required to diagnose and manage an impacted canine (Robertson et al, 2009).

Clinical Guidelines

The following are suggested guidelines for the management of impacted canines.

Up to 10 years of age

There is a good prognosis for normal canine eruption if the buccal canine bulge is palpable, as most buccally positioned canine teeth erupt, even in the presence of space shortage (Ericson and Kurol, 1986; Becker, 2007). It has also been shown that children in this age group displaying the signs of potential ectopic eruption may later go on to produce a normal eruption path (Jacobs, 1994).

Asymmetrical canine bulges can be due to vertical differences in eruption on either side of the maxilla or unilateral buccal displacement. Therefore any radiographic intervention in young children is contraindicated and only ongoing review is necessary.

Older than 10 years of age

Radiographic investigation is recommended in this age group if there are any clinical signs suggestive of an impacted canine. The clinician should also have a high level of suspicion of palatal impaction if there is a positive history of familial inheritance and peg (or otherwise diminutive) lateral incisors (Becker et al, 1981). Radiographs would be required to confirm canine location.

Palatally impacted canines may benefit from early interception. A longitudinal study carried out by Erickson and Kurol demonstrated that 78% of 46 palatally impacted canines treated with early extraction of the deciduous canine resulted in correction of the canine eruption path over an 18-month period (Ericson and Kurol, 1988). Early extraction of the deciduous canine is the treatment of choice for patients in the 10-13 years of age group provided that there are favourable space conditions for the canine to erupt.

These patients are reviewed for 12 months at 6 months intervals post-extraction. If the canine position does not improve, alternative treatment plans should be considered. Both patient and parent must be aware of potential failure for the canine to erupt in spite of intervention. The success of this technique decreases with the severity of the displacement. Thus it is prudent for the clinician to seek an orthodontic opinion before carrying out interceptive therapy.

Older than 13 years of age

Patients over the recommended age group for interceptive treatment are best referred for orthodontic opinion and management. It is unlikely that extraction of the deciduous

canine would facilitate eruption of a permanent canine. Treatment options may include removal of the impacted canine depending on the degree of the displacement or surgical exposure of the canine with subsequent orthodontic traction.

CONCLUSION

This paper reported four patients presenting at different stages of canine development resulting in different clinical outcomes. The key to managing canine impaction is early identification, interception and follow-up, as recommended in the clinical guideline. It is important for clinicians to be vigilant when treating children in the late mixed dentition, not only to care for their oral health but be aware of their developing dentition. Early identification of canine impaction may reduce the need for complex, lengthy and costly multidisciplinary management.

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