

# Maxillary canine management in the pre-adolescent: A guideline for general practitioners

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## ABSTRACT

This paper focuses on the identification of ectopic eruption patterns of the maxillary canines from the dental ages of approximately 8 to 12 years. The timing and suitability of interceptive treatment in pre-adolescents are discussed.

## INTRODUCTION

Ectopic eruption of maxillary canines refers to canines that have erupted but are displaced, or more importantly are still erupting but show signs of moving in an incorrect direction. This in turn may or may not lead to impaction. An impacted canine is a tooth "whose eruption is considerably delayed, and for which there is clinical or radiographic evidence that further eruption may not take place".<sup>1,2</sup> Orthodontic re-alignment of impacted canines is expensive and may take up to three years after surgical exposure.

The early identification of developing canine ectopia is important, as up to 90% of these cases may be corrected as a result of interceptive treatment.<sup>3</sup>

The objective of this article is to establish practical guidelines to facilitate the early identification of any ectopic paths of erupting maxillary canines. In cases where the diagnosis of developing maxillary canine ectopia is made during pre-adolescence, a decision on the suitability of interceptive treatment may then be taken.

## PREVALENCE OF CANINE IMPACTION

Maxillary canine impaction, which occurs in approximately 1% to 3% of the population, is second only in frequency to third molar impaction.<sup>4,5</sup> It occurs one and a half to three times more frequently in females when compared with the incidence in males.<sup>6</sup> Canines may be impacted buccally (15% of cases) or palatally (85% of cases).<sup>4,6</sup> When compared with the Asian population, buccal canine displacement occurs twice as often among Europeans, whilst palatal displacement is five times more common.<sup>6</sup> Kuroi<sup>7</sup> suggested that the incidence of canine impaction in the U.S. is approximately 50 000 new cases per year. Economically, this represents a considerable drain on funding resources as most, if not all of these impaction cases require surgery followed by correc-

tive orthodontics.<sup>8</sup> The association between canine impaction and maxillary incisor root resorption is common and it should be anticipated in all cases of canine impaction.<sup>9</sup>

## THE RATIONALE OF EARLY TREATMENT

Early identification of canine ectopia is fundamental if interceptive measures are to be explored.<sup>10</sup> The objective of early treatment is to attempt to reverse the disturbance with a view to allowing normal development to proceed. Monitoring of dental development entails checking for all the signs of normal development, for example, the absence of the maxillary canine buccal bulges after the age of 9 years is an early indicator of potential canine ectopia.<sup>11</sup> Should the diagnosis of ectopic eruption be made with or without the potential for impaction, early treatment should be considered as a positive option.<sup>7</sup>

## EARLY INDICATORS OF CANINE ECTOPIA

Clinical management and observation of canine eruption is sufficient to achieve a favourable outcome in 90% of cases.<sup>12</sup> There are key criteria which must be carefully assessed with respect to maxillary canine eruption. See figure 1. These include:

- The presence or absence of the canine bulge.
- The presence of any developmental anomalies.
- Late development of the dentition.
- The morphology, the position or the absence of lateral incisors.
- The space situation.
- The comparative mobility of left and right side primary maxillary canines.

## THE CANINE BULGES

The presence of canine bulges developing at the age of approximately 9 years and enlarging prior to eruption is an important milestone in the development of the dentition.<sup>11</sup> During the early stages of eruption of the canine it appears to move in a mesial direction and at the approximate age of 9 years the canine gradually uprights. The buccal bulge makes its appearance at this stage.<sup>10</sup> These bulges are palpable and located in the maxillary buccal sulcus apical to the root of the primary canine.<sup>8</sup> All patients in the age group 9 to 10 years old should be assessed clinically to de-

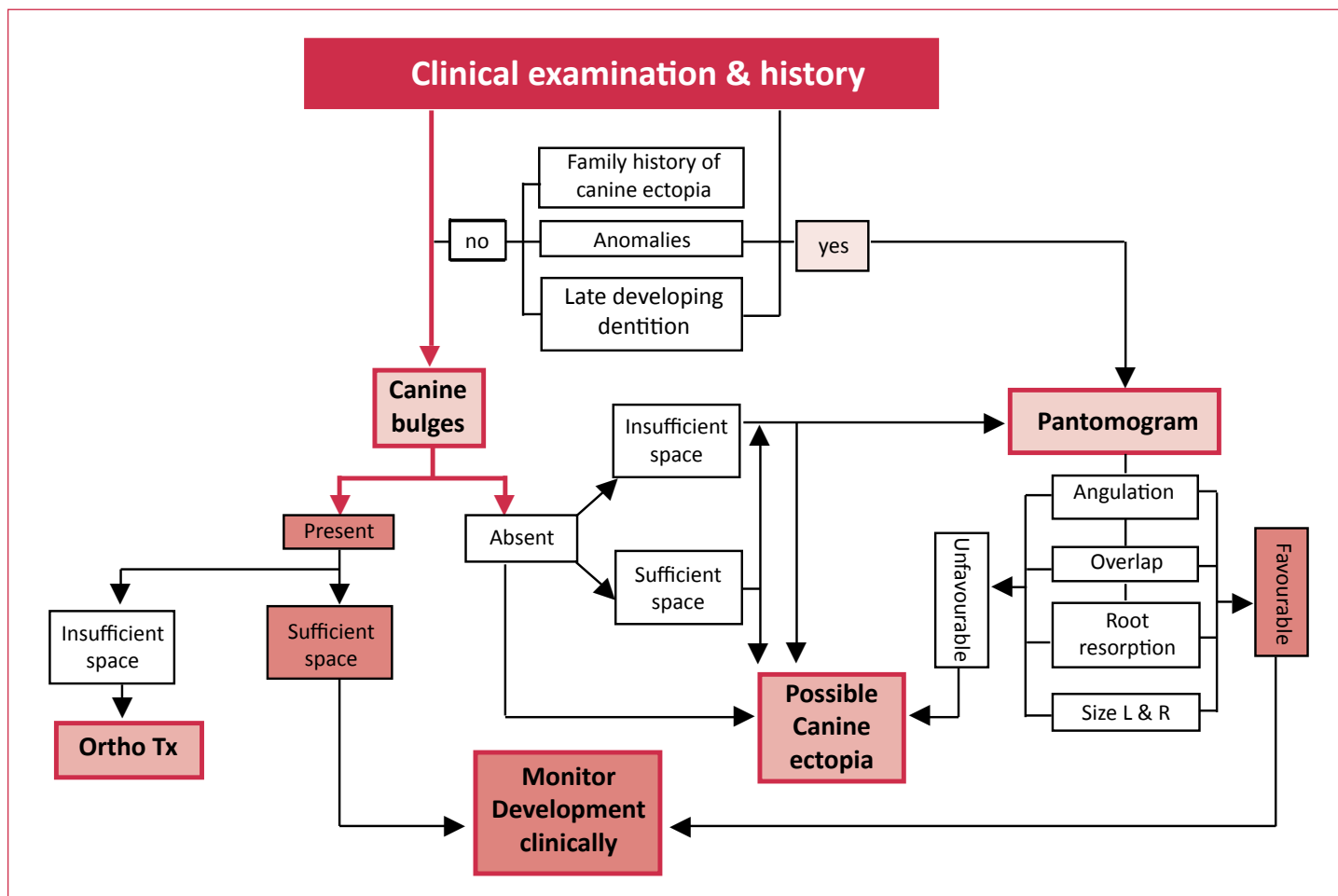


Figure 1: A diagnostic flow chart for identifying ectopic maxillary canines

termine the presence or absence of these buccal canine bulges.<sup>11</sup> The absence of the buccal bulge is an indication that the canine has not uprighted and therefore erupting ectopically.<sup>10</sup> This would necessitate further investigation, especially during the later stages of the mixed dentition.<sup>8,12</sup> Retention of immobile primary upper canines beyond the age of 12 to 13 years in cases where the buccal bulges are not palpable could indicate impaction of the permanent canine.<sup>8</sup>

### DEVELOPMENTAL ANOMALIES

The presence of any developmental anomalies during the mixed dentition should alert the clinician to the possibility of canine ectopia. There is significant reciprocal association between palatally displaced canines, aplasia of second premolars, small maxillary incisors, infraocclusion of primary molars and enamel hypoplasia.<sup>13</sup> Ectopic eruption of the first permanent molar may be regarded as a warning sign for potential canine ectopia.<sup>14,15</sup> Dental deviations such as invaginations and taurodontism are relevant in the early prediction of potential canine ectopia. Ectopic maxillary canines do, however, occur in dentitions without any dental deviations.<sup>16</sup>

Class II division 2 dentitions are often associated with the occurrence of dental anomalies. One third of all patients having this malocclusion exhibited canine impaction<sup>17</sup> which is significantly associated with a wider palate.<sup>18</sup> See figure 2.

### LATE DEVELOPMENT OF THE DENTITION

Late development of the dentition<sup>6,19</sup>, especially late developing lateral incisors<sup>20</sup> may be more disruptive for canine eruption than

missing lateral incisors. According to Proffitt, the lateral incisor should have erupted by approximately 8 years of age.<sup>21</sup> Zilberman *et al*<sup>22</sup> showed a strong familial association between late developing dentition, absence of crowding, anomalous lateral incisors and palatally displaced canines.

### THE LATERAL INCISOR

Because of the close association between the root of the maxillary lateral incisor and the erupting canine, the lateral incisor may give early clinical clues as to the potential for canine ectopia.<sup>8</sup>

- Palatal canine displacement and anomalous lateral incisors are not causally related, but rather considered to be co-variables under genetic control.<sup>6</sup> The association between these parameters is six times greater than the association between the palatal canine and the normal lateral incisor.<sup>22</sup> As the lateral incisor guides the erupting canine it is thought that the absence of or a diminished root size would fail to offer proper guidance, thereby allowing palatal displacement of the erupting tooth.<sup>4,23</sup>
- Excessive fanning and unusual rotational or inclination irregularities of the lateral incisors are often related to an abnormal path of eruption of the associated canine.<sup>8</sup> In severe cases, the central incisors may also be deflected. Rotations of the lateral incisors<sup>24</sup> can be an indicator as to the path of eruption of the canine. It may therefore be helpful to try to visualize the relationship between the crown of the canine and the root of the lateral incisor which could be the cause of the rotation that is clinically evident. These rotations could be a warning sign that root resorption of the incisor may be occurring as



**Figure 2:** The patient is a class II division 2 and has a dental age of 10 years. **Clinically:** Severe rotations of 12 and 22. **Radiographically:** Bilateral overlapping of the canines and the lateral incisors. The greater overlapping on the left side is less likely to self-correct as a result of interceptive treatment than the right hand side. Note that the primary canines (C) show no signs of resorption.

a result of contact between the canine and the root of the lateral incisor<sup>25</sup> and the case should be investigated further.<sup>12</sup> See figure 3.

- Palatally positioned lateral incisors, irrespective of whether they are in crossbite or not, are a precursor to ectopic canine eruption.<sup>26</sup> Upon eruption in such cases the canine may overlap the labial surface of the lateral incisor.

### SPACE EVALUATION

Crowding in the mixed dentition is associated with canine ectopia,<sup>4</sup> which often leads to displacement of the canine in a buccal direction.<sup>23,27</sup>

In the case of an excessive space situation, an erupting canine may be palatally placed.<sup>6,22,23</sup> This space excess is often the result of the presence of lateral incisor microdontia or aplasia. A small but significant number of cases of buccal canine ectopia without crowding were shown to have a strong association with anomalous lateral incisors.<sup>27</sup>

### MOBILITY OF THE PRIMARY CANINES

An important clinical assessment is to monitor the comparative mobility of primary teeth on opposite sides of the mouth. Asymmetrical mobility could be an indicator of a problem with root resorption on the less mobile side and further investigations would be necessary.<sup>12</sup> Since bilateral palatal ectopia may occur, age is an important factor to take into consideration. Retained deciduous canines or the non-resorption of the roots of these teeth should be viewed as a consequence of canine ectopia and not the cause.<sup>6</sup>

### FAMILY HISTORY

Patients having a family history of canine ectopia or impaction may be considered to be susceptible to maxillary canine ectopia in the mixed dentition.<sup>6</sup> It has been concluded that the eruption pathway is genetically programmed and does not depend on pressure from the erupting tooth.<sup>28</sup>

### RADIOGRAPHIC ASSESSMENT

In cases where maxillary canine eruption is perceived to deviate from the norm, the patient should undergo radiographic investi-



**Figure 3:** The patient has a dental age of 10 years. **Clinically:** The crown of tooth 22 is distally inclined and displays a disto-labial rotation. **Radiographically:** The pantomogram and the occlusal radiograph show contact between the 23 and 22. The angulation of the 23 suggests that it has not uprighted. The size of 23 compared to 13 is indicative of palatal ectopia of the 23. Tooth 63 (C) is showing no signs of root resorption. Note the anomalous eruption of the 34.

gation or, if possible, cone beam computed tomographic investigations.<sup>12</sup> However, the pantomogram is also a good screening tool for canine ectopia<sup>29</sup> as it gives an indication of the relationship between the erupting canine and the surrounding teeth. The pantomogram allows the clinician to determine the presence of any of the dental anomalies mentioned earlier. Peri-apical, occlusal and cephalometric views can give the clinician more information as to the precise location of the canine.<sup>24</sup>

### Factors to assess on the pantomogram with a view to understanding the location of the canine are:

- Overlapping between the crown of the erupting canine and the permanent lateral incisor may be considered normal prior to the lateral incisor reaching Nolla stage 9, i.e. full root length with an open apex. Canine up-righting appears to coincide with this stage of development of the lateral incisor. In a patient whose maxillary lateral incisor has reached Nolla stage 9, overlapping of the lateral and canine as seen on a pantomogram, may be interpreted as a sign that the canine is erupting ectopically.<sup>10</sup> See figure 3.
- Cusp tip location of the canine on a pantomogram is a significantly accurate indicator of potential canine impaction. The amount of overlap between the cusp tip of the canine and the root of the lateral incisor was found to be a more accurate indicator of potential impaction than the angulation of the erupting canine.<sup>5</sup> See figure 2.
- In the maxilla, the absence of a clinically palpable buccal bulge and radiographic evidence of an overlap between the crown of the permanent canine and the root of the primary canine substantiates the likelihood of a deflection of the eruption pathway of the maxillary canine. Resorption of the roots of the primary canines should be visible around 8 to 10 years of age.<sup>30</sup> Non-resorption may be associated with mesial, distal, palatal or buccal deflection of the permanent canine. In all of these cases, canine ectopia may be anticipated.<sup>6</sup> There is no correlation between permanent incisor root resorption and the amount of resorption of the primary canine root.<sup>31</sup>
- The permanent canine may present as mesially inclined, upright or distally inclined. A favourable inclination for the normally positioned canine in the arch is at no more than 30° to the mid-sagittal plane.<sup>32</sup> The mesio-distal angulation of the developing canine is not, however, considered a reliable indicator especially in the canine premolar region.<sup>29</sup>

- A radiographic image of a canine enlarged by comparison with its opposite number and surrounding teeth indicates palatal position of the tooth<sup>24,33</sup> (see figure 3).

Computed tomography (CT) investigations, if available, give more detail with regard to the relationship between the canine and the incisors. This allows a more accurate diagnosis to be made and can therefore have an impact on the determination of the required treatment.<sup>34</sup>

## COMPLICATIONS ASSOCIATED WITH CANINE ECTOPIA

Canine ectopia may result in incisor root resorption. This resorption “can be swift, silent and devastating”<sup>3</sup> and may already be present by the age of 9 years. Peak incidence of root resorption occurs between 11 and 12 years of age.<sup>35</sup> Root resorption of adjacent incisor teeth has been found to occur in up to 50%<sup>35</sup> cases. This serious complication is difficult to detect radiographically because of the overlapping of the crown of the canine and the root of the lateral incisors.<sup>34</sup> Up to 60% of these teeth demonstrate resorption into the pulp chamber.<sup>35</sup> This root resorption is not caused by the follicle of the developing canine but rather due to actual contact between the teeth, the eruptive force of the canine and cellular activity at the contact point.<sup>25,35</sup>

## INTERCEPTIVE TREATMENT

In Class I mixed dentition cases with sufficient space and ectopic eruption of the maxillary canines, the intervention of choice is extraction of the primary canine.<sup>4</sup> This decision should be based on the dental age of the patient.<sup>19</sup>

### Important considerations for interceptive treatment are:

- Early detection in the mid to late mixed dentition stage<sup>36</sup> at 10 to 13 years of age.<sup>4</sup> Chronologic age alone is not a good indicator of when treatment should begin. In cases of suspected canine ectopia, extraction of the maxillary primary canine should be performed after the eruption of but prior to full eruption of the permanent mandibular canine.<sup>37</sup>
- There should be reasonable space available in the arch prior to extraction. This space needs to be maintained and managed as there can be up to a 12-month wait before the succedaneous tooth erupts.<sup>36</sup> During this time, the ectopic canine needs to be monitored clinically and radiographically. Specialist advice should be sought if the position of the ectopic canine does not appear to be normalizing.<sup>36</sup>
- If the crown of the canine is higher than the apex of the adjacent incisor root, extraction of the primary canine will probably not be a successful solution to the problem.<sup>36,38</sup> These cases would be best referred for specialist opinion.
- The amount of overlap between the crown of the canine and the root of the lateral incisor should ideally be less than 30%. At a 50% or more overlap the chances of success are significantly less. Clinical studies show that 91% of cases resolve favourably when the canine crown-lateral root overlap is distal to the midline of the lateral incisor. The success rate drops significantly to 64% should the canine overlap be mesial to the midline of the lateral incisor<sup>4</sup> (see figure 2).
- There should be an angle of 30° or less between the long axis of the canine and the mid-sagittal plane.<sup>35</sup> This assessment, however, appears to be less significant than the amount of overlap between the crown of the canine and the root of the lateral incisor.<sup>5</sup> Compare left and right canines in figure 3.

- In cases where there is evidence of incisor root resorption, treatment needs to be instituted as soon as possible with the aim of distancing the canine from the resorbing root. There is evidence to suggest that this is sufficient to arrest the resorptive process occurring on the root of the incisor.<sup>39</sup>

## CONCLUSION

The family dentist is well-positioned to do routine mixed dentition canine screening and perform interceptive treatment in cases where it is indicated. All parents should be warned that even though the success rates for interceptive treatment are high, it does not always go according to plan. A mandatory aspect of interceptive treatment is the regular follow up of all cases, so that self-correction of the ectopia can be monitored.

It is important that the dentist takes the wider orthodontic picture into consideration and that all cases are fully analyzed. In cases where the patient may require other orthodontic treatment (especially Class II and III malocclusions and cases of dental crowding) it would be wise to consult with a specialist orthodontist.

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