

**Cite this article:**  
Mew J, Mew M.  
Canine impaction:  
how effective is  
early prevention?  
An audit of treated  
cases. Stoma Edu J.  
2015;2(2):114-119.

# CANINE IMPACTION: HOW EFFECTIVE IS EARLY PREVENTION? AN AUDIT OF TREATED CASES

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## Abstract

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**Introduction:** Impacted maxillary canines are a major problem and expense in orthodontic practice. It seems as though their incidence has risen in recent years. It had been noticed that fewer canines appeared to be impacted amongst patients who had been treated by Orthotropics®, a form of treatment which involves proclining the incisors and expanding the maxilla. The objective was to compare the influence of Orthotropics on the ratio of impacted canines with matched averages from other populations.

**Methodology:** Records over a five year period were taken from a practice specialising in Orthotropics. An audit of the incidence of impacted canines was taken and compared with average frequencies.

**Results:** There appeared to be a zero incidence of impacted canines amongst patients from this practice who started treatment before the age of ten. This compares with an incidence of 3½ % in the wider range of older patients from comparative populations.

**Conclusion:** Expansion coupled with proclination of the incisors in children under nine years old, may reduce or eliminate the impaction of maxillary canines.

**Keywords:** canine impaction, incidence, early treatment, incisor proclination, expansion

## Introduction

Patients whose canines fail to erupt are at risk for a range of problems. Not only may dental aesthetics be prejudiced but correction can prove both expensive and traumatic. Healthy incisors may be lost through pathologic root resorption<sup>1</sup> and other teeth may need extracting to provide room. Surgery may be required to expose a canine buried in the palate and this can be a complex procedure involving the removal of a considerable volume of bone. Additional orthodontic treatment may be required, either to pull the canine into position and/or to align the dentition subsequently.

There is also the risk of damaging the periodontum and devitalising the canine during the traction procedure<sup>2</sup>, in addition the force vectors sometimes result in root resorption.<sup>1</sup> Recent costings including, surgery, orthodontics and after care, suggests that a single impacted canine can easily exceed £8000.<sup>3</sup>

Consensus supports a multi-factorial origin for this condition. Possible factors

include: 1/Small or missing lateral incisors, 2/Retruded incisors 3/Lack of maxillary development. 4/Genetic Predisposition. 5/Shortened Arch Length. 6/Tooth size - arch size discrepancy. However evidence to confirm any of these possibilities is weak. For example canine impaction has been attributed to both narrow maxillae<sup>4</sup> and wide maxillae.<sup>5</sup> Other papers have noted a link with a range of dental anomalies<sup>6</sup> such as distally inclined mandibular second premolars<sup>7</sup> suggesting a genetic syndrome but this begs the question of the genetic and environmental contribution to jaw development in the first place.

The percentage of children in industrialised societies, who develop canine impaction is second only in frequency to impacted third molars.<sup>8</sup> This percentage is probably higher in orthodontic offices where such cases are likely to be concentrated. An additional percentage of canines are either buccally or palatally displaced because of a lack of space. In the 1970s the incidence of canine impaction was quoted as between 1½ to 2%.<sup>8</sup> Twenty years later

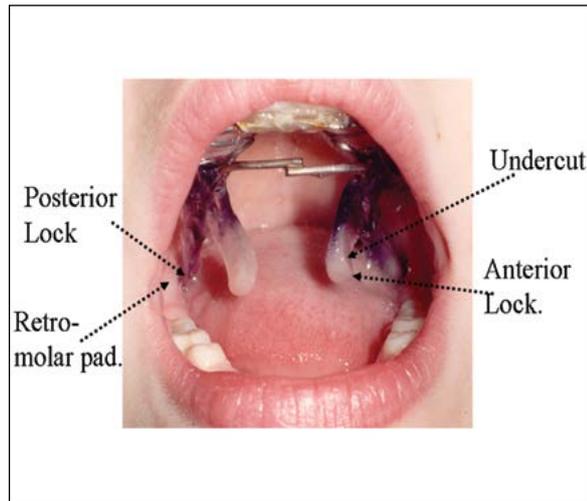
Received: July 15<sup>th</sup>, 2015  
Accepted: August 26<sup>th</sup>, 2015

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**Figure 1.** A nine year old boy with an impacted upper right lateral treated by Orthotropics. His maxilla was expanded and the upper incisors proclined to a pre-determined position related to the cranial vault and his lower incisors protruded to their 'correct' relationship with the mandibular corpus. Following the loss of the deciduous teeth a stage 3 appliance (Fig. 2) was used to close the anterior open bite leaving the permanent teeth in near ideal positions.



**Figure 2.** The Stage 3 Orthotropic appliance designed to train a child to keep their mouth closed and improve their muscle tone.

Bishara<sup>9</sup> suggested a figure of between 1 and 3% but provided no supporting evidence for this. In more recent years the suggested percentage has risen following some larger surveys. In 2004, Aydin and his colleagues<sup>10</sup> prospectively reviewed 4500 consecutive panoramic radiographs within a Turkish population. They found the incidence of canine impaction to be 3.58%. However in 2008 Prskalo<sup>(11)</sup> found an even higher incidence in Croatia of 4.71% within a study population of 170. It is possible that these rising figures are a reflection of a general increase in malocclusion reported around the world.

Early prevention is rarely recommended, possibly because of the uncertain aetiology. Although early extraction of the deciduous canines has been popular for many years<sup>12</sup> quite a high proportion of the canines fail to erupt following this procedure, although it does seem more successful in younger patients.<sup>13</sup> It would certainly be a blessing if an effective means of preventing impacted canines could be found.

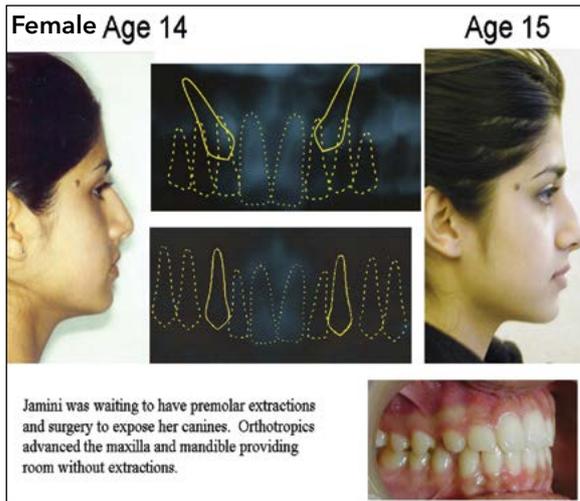
Sadly un-erupted canines frequently escape detection until a child is in their 'teens' when encouraging spontaneous eruption can be difficult. Early diagnosis can do much to reduce the risk of impaction and Sambataro and his colleagues<sup>14</sup> drew attention to the warning features. They studied the incidence of canine impaction for 43 untreated subjects at the age of 8½ and again at 14¼ with frontal head films. Twelve subjects had developed 'impacted' canines. They found that the chance of impaction was increased if the canine was nearer the mid-sagittal plane and if the "posterior portion of the hemi-maxilla was larger". They suggest "the

use of techniques to widen the anterior part of the maxilla without increasing the posterior part of the upper jaw", recommending a "fan" screw but offered no clinical evidence to justify this approach. However this suggestion is in line with the findings of Schindel and Duffy<sup>4</sup> who found that "patients with a transverse discrepancy are more likely to have an impacted canine than those patients without a transverse discrepancy". While expansion appliances are frequently used to provide additional space for teeth in the maxilla there seems to be little published evidence to suggest that this effects the timing or incidence of canine eruption whether impacted or not.

Most surgeons and some clinicians<sup>(15)</sup> take the maxilla forward in severe malocclusions, but the majority of orthodontists retract it. The possibility that the maxilla would benefit from being moved forward led to the development of a treatment called Orthotropics<sup>®</sup> which involves expansion to move the maxilla and incisors forward and provide more space for the teeth.

It is not easy to establish the correct sagittal position of the maxilla or of the upper incisors but it is possible to estimate this by measuring their relationship with the Cranial vault, using the Frontal and Nasal bones as reference points<sup>16</sup> and procline the incisors accordingly.

The maxilla is then expanded at a semi-rapid rate (precisely one eighth of a millimetre per day) for eight to ten millimetres, preferably before the age of nine. In the short-term this moves the whole maxilla forward and creates an anterior open bite (Fig. 1) which may remain until the loss of the buccal deciduous teeth but the procedure takes



**Figure 3.** A girl who was waiting for the extraction of her upper first pre-molars and exposure of her canines. She was treated non-extraction by Orthotropics instead.

the mid-face forward providing considerable room in the canine area and at the same time the forward growth and reduction in facial height often improves the appearance.

Subsequently a Stage 3 appliance (Fig. 2) is used to train the child to keep their mouth closed and generate muscle tone to improve long-term stability.

### Aim

The present study wished to establish "The effect of early maxillary expansion coupled with incisor proclination on the ratio of impacted canines within a given population".

### Material

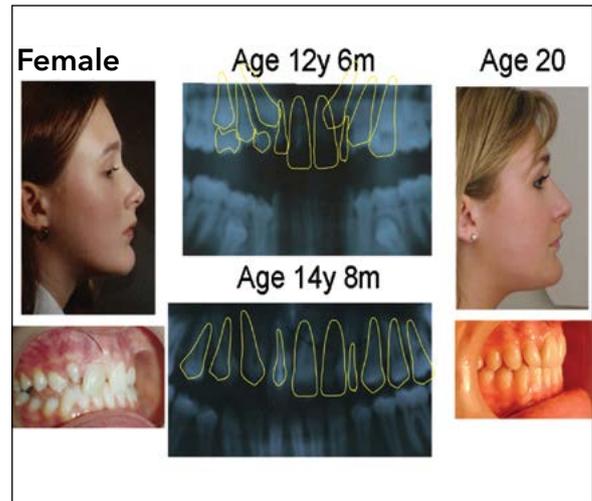
One clinic has for many years treated most of their patients by Orthotropics in the early mixed dentition and it was noticed that impacted canines were rare.

This prompted a comparative study and an audit was undertaken of these patients to see if they demonstrated a different pattern of canine impaction to the norm. Ethical approval was not considered necessary for this retrospective study, but all the subjects whose photographs are shown were asked to give their approval.

Impacted canines tend to be a memorable feature of orthodontic treatment because of the problems they generate and hence are unlikely to be forgotten.

Approximately 1,500 patients had been treated by Orthotropics over this recorded 5 year period and yet there was not one incidence of a child who had started orthotropic treatment before the age of ten developing an impacted canine.

Some impacted canines were found in patients who started treatment at a later age, four of whom are shown below.



**Figure 4.** A girl who had been recommended for the extraction of her upper first pre-molars and peg laterals, followed by surgical exposure of the canines and fixed appliances to bring them into position. She was treated non-extraction by Orthotropics instead.

### Control

These observations would have limited value without some form of control. It would seem logical to compare the incidence of canine impaction in untreated patients within the general population with the incidence in patients who had received early orthotropics. Fortunately there have been several surveys of untreated patients showing a range between 1½% and 4½% the largest being by Aydin and his colleagues (10) who found an incidence of 3.58% in 4500 patients (about 160 impactions).

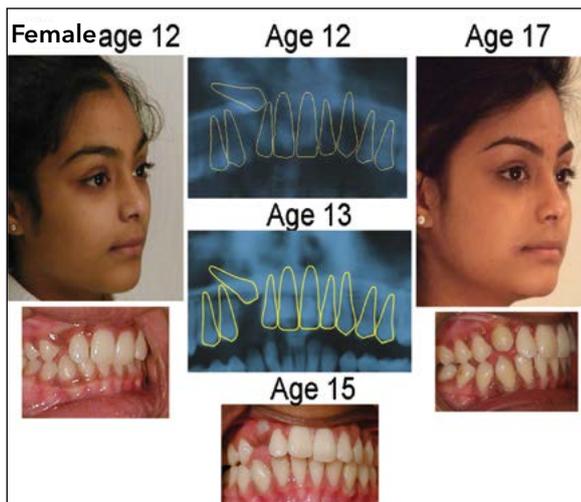
### Results

A normal statistical analysis would not be appropriate here but, if the 3½% ratio of impactions suggested by Ayden had been reflected in the 1,500 patients attending this clinic, then there would have been over 50 impacted canines but there were none. This difference in probability, if true, would be considered 'highly significant' on the basis of any statistical analysis.

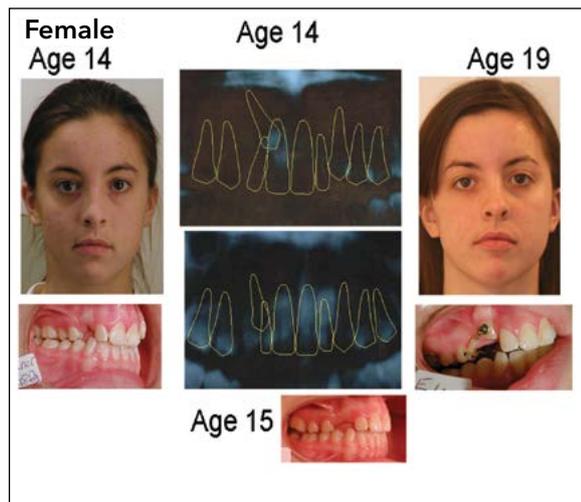
### Discussion

A retrospective study such as this is open to selective memory and possible bias. However it tends to be quantities and values that are forgotten not absolutes and the traumatic consequences of impacted canines are so great that it seems unlikely that all five clinical staff would have forgotten every such incident. It could be argued that the 3½% ratio of impactions in the Turkish population might not be reflected in Britain but the evidence suggests (17) that skulls from Eastern Europe are likely to be wider than in the UK, presumably reducing the chance of canine impaction.

It is interesting to speculate why patients treated by this method might have a reduced ratio of canine impactions.



**Figure 5.** A girl with a horizontally placed canine. Surgical removal through her nose was considered followed by fixed orthodontic treatment, but she subsequently received Orthotropics to create room for the canine which spontaneously up-righted and erupted.



**Figure 6.** A girl whose upper right canine was lying over the central incisor. Her upper incisors were assessed as being 9 millimetres down and back from their ideal relationship with the cranial vault. Surgery had been planned but instead the incisors were moved forward with Orthotropics and she was trained to keep her mouth closed with her tongue on her palate. The canine then erupted without further assistance.

To some extent the reason is obvious because the forward movement of the incisors coupled with the expansion creates a large amount of space in the canine region (Fig. 1). In addition, if the incisors were distally placed to begin with (see Fig. 4), then the canines are more likely to erupt on top of them as suggested by Lüdicke and his colleagues.<sup>18</sup> As is shown in figures 3, 4, 5, and 6 older patients may also benefit from Orthotropics although eruption can be quite slow. These four patients were referred for second opinions after being told that their canines would need to be exposed by surgery. Instead they were treated by Orthotropics and it was thought that their progress might illustrate why impactions may not occur in younger patients. Of interest no fixed archwires were used for any of these patients.

### Conclusions

It would seem that expansion and proclination of the incisors before the age of ten, coupled with postural training, may reduce and perhaps prevent the impaction of maxillary canines. It is hoped that this presentation will encourage clinicians, to take preventive measures before the age of ten if the canines look as though they may become impacted.

### Case Examples

**Case 1** (Fig. 3) was fourteen years old and premolar extractions had been recommended followed by surgery to expose her bi-laterally impacted canines. Instead a short course of Orthotropics encouraged her teeth and mid-face to grow

forward and this provided room for the canines to erupt spontaneously without any extractions.

**Case 2** (Fig. 4) This twelve year old girl attended for a second opinion because her canines were palatally impacted against her right lateral and left central. She had been advised to have her peg laterals and first pre-molars extracted, followed by surgery to expose the permanent canines. She had also been warned that she might lose the upper left central. Instead she was treated by Orthotropics without any extractions, using expansion to widen and move forwards her maxilla and incisors. Enough space was created to avoid the premolar extractions, enabling her peg laterals to be crowned. In our experience it is wise to open a space one and a half times the width of the canine crown as this helps it to rotate lengthwise.

**Case 3** (Fig. 5) This patient aged 12 arrived with her right canine horizontally impacted. The possibility of extracting it through her nose was considered, but she was referred to the school for Orthotropics for a second opinion and a course of treatment encouraged the canine to erupt without either surgery or extractions.

**Case 4.** (Fig. 6) Her upper incisors and maxilla were measured to be nine millimetres down and back from their 'ideal' relationship with the cranial vault. As the radiographs show, the canine was lying high in the palate and surgery had been arranged to expose it. Instead she was given a course of semi-rapid expansion together with forward movement of the labial segment and the canine erupted just palatal to the lateral and was guided into position without the need for surgery or extractions.

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## CV

John Mew graduated in dentistry at University College London, and then trained in Orthognathic surgery. Seeking alternatives to facial surgery he moved to the speciality of orthodontics in 1965. Since then he has been developing non-surgical methods of correcting unattractive vertical growth in children's faces, using 'orthotropics' to encourage horizontal growth. A practising clinician, his principal research interests are the aetiology of malocclusion and the guidance of facial growth. Currently he is Clinical Director of the London School of Facial Orthotropics, and Visiting Professor at the "Victor Babeş" University of Medicine and Pharmacy, Timișoara, România. He was honoured with life membership of the British Dental Association in 1999.

## Questions

### Which are the factors that may influence canine impaction?

- a. Small or missing central incisors;
- b. Protruded incisors;
- c. Genetic predisposition;
- d. Mesially inclined mandibular first pre-molars.

### What does Orthotropics treatment involve?

- a. Expansion to move the maxilla and incisors forward;
- b. Move maxilla backward;
- c. Expansion to move the incisors forward;
- d. Expansion to move the jaw forward.

### Which is the semi-rapid rate of maxilla expansion?

- a. Half of millimeter per day;
- b. One quarter of a millimeter per day;
- c. One millimeter per day;
- d. Eighth of a millimeter per day.

### Which is the best age for starting Orthotropics procedure?

- a. Before the age of fourteen;
- b. Before the age of ten;
- c. Before the age of twelve;
- d. Before the age of seven.