

Maxillary incisor root resorption in relation to the ectopic canine: a review of 26 patients

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SUMMARY A retrospective study of 26 patients with maxillary incisor root resorption relating to the presence of an ectopic canine was undertaken from case records. The group consisted of nine male and 17 female patients with a mean age of 12.5 years. There was a total of 35 resorbed teeth, 26 lateral and nine central incisors, and these were related to 32 ectopic canines. The resorption tended to be extensive, 30 teeth had pulpal involvement. In two-thirds of cases the pattern of resorption involved both apical and middle thirds of the root. Despite the extensive nature of the involvement there were few clinical signs and symptoms reported by patients. 43.8 per cent of canines were lying palatal to the arch, 18.7 per cent were in the line of the arch and 37.5 per cent were buccal. Significantly 15.6 per cent were buccal and erupted. The path of canine eruption was mesio-horizontal in 21 cases. No relationship could be found between resorption and the retention or loss of the deciduous canine. The canine root formation was virtually complete in 31 of the involved canines. The study indicated that the problem is often diagnosed late both in relation to the patient's age and the extent of resorption present. It is suggested that the problem may be underestimated by dental practitioners.

Literature review

The incidence of ectopic maxillary canines in the population has been estimated at between 0.9 and 2 per cent (Dachi and Howell, 1961; Thilander and Jakobsson, 1968; Ericson and Kurol, 1987a). The majority are displaced palatally, but 20 per cent occur buccally (Ericson and Kurol, 1987a).

Early screening and diagnosis has been advocated (Kettle, 1957) as this may allow complications to be detected earlier. Ericson and Kurol (1986a,b) advocated investigation if the canine could not be palpated in the correct position to erupt by the age of 10 years. Knight (1987) in a review of six patients with buccally-displaced canines associated with maxillary incisor resorption, stated that the ability to palpate canines buccally or the presence of erupted buccal maxillary canines, did not preclude incisor root resorption.

Secondary complications due to ectopic maxillary canine eruption are said to be rare (Ericson and Kurol, 1986b), however root

resorption is not an uncommon complication associated with ectopically erupting canines. This occurs most commonly in relation to maxillary lateral incisors, central incisors may also be involved, but rarely first premolars (Ericson and Kurol, 1987b; Postlethwaite, 1989).

The reported incidence of incisor root resorption varies widely. Townend (1967) found three cases in 3000 patients referred for routine orthodontic assessment over a 3-year period whilst Hitchin (1956) in a study of patients referred with ectopic canines found 6 per cent of patients affected. Ericson and Kurol (1987a) found 12.5 per cent of ectopic canine cases had demonstrable root resorption, and their study indicated a prevalence of 0.7 per cent in 10–13 year olds. This variation probably relates to the use of different methods of identifying resorption. A number of studies have found that females are more likely to be affected (Sasakura *et al.*, 1984; Ericson and Kurol, 1988; Brin *et al.*, 1993).

It has been shown that whilst close contact

between the canine crown and incisor root is a common finding, where this occurs pressure from an enlarged follicle is not a factor (Ericson and Kurol, 1988). Earlier studies suggested that the area of root involved in resorption was most likely to be the apical third (Kettle, 1957). More recent work has indicated that the middle third is more affected than the cervical third or apical areas (Ericson and Kurol, 1987b). Brin *et al.* (1993) have described an oblique pattern of resorption occurring in 40 per cent of cases. They also speculate that the normal-sized and early developing lateral incisor root has a greater chance of being damaged since it is more likely to obstruct the deviated eruption path of the canine.

The position and inclination of the unerupted canine has also been shown to be a factor (Howard, 1971; Ericson and Kurol, 1988). Howard (1971) described three paths of eruption; lateral, horizontal and lateral-horizontal, which could lead to a genuine impaction, although this was in a small sample. In a larger study Ericson and Kurol (1988) found an association between a more medial position and a mesial horizontal path of eruption and the development of incisor root resorption. There appears to be an association between more advanced canine root formation and the development of incisor root resorption (Ericson and Kurol, 1988). The presence of normal physiological deciduous canine root resorption does not rule out the development of pathological incisor root resorption (Ericson and Kurol, 1988).

Subjects and methods

A retrospective study of 26 patients with incisor root resorption in relation to the presence of ectopically-placed maxillary canines was undertaken. The cases were drawn from four hospitals in the Trent region of the UK. The sample consisted of nine males and 17 females, aged 9–16 years at the time of referral. A total of 35 resorbed teeth were involved. Cases were selected on the basis of adequate radiographic and clinical records, from which the data was collected.

For each patient a note was made of the age at initial referral. The referral letter was checked for details relating to root resorption affecting maxillary incisors and also reference to the presence of an ectopic maxillary canine. The available films were examined for each patient. There was no standardization between units in the types of films taken. A combination of orthopantomographic (OPG) and periapical or OPG and upper standard occlusal films were examined to determine whether resorption occurred in the apical, middle or cervical third of the root. Visible pulpal involvement was recorded as being present or absent. The notes were checked for records of loss of vitality and mobility of involved teeth. The technique used was similar to that described by Ericson and Kurol (1988). The position of the canine in relation to the arch was recorded using a vertical parallax technique (Southall and Gravely, 1989). The inclination of the canine was assessed by two examiners as falling into one of three categories; horizontal, vertical or mesio-angular. The size of the follicle assessed by two examiners, was recorded as normal or enlarged. A follicle was deemed enlarged where it was dilated to 3 mm on the OPG or anterior occlusal film. This is the point defined by Shear (1983) at which a dilated follicle may become potentially cystic. The degree of root development in the unerupted canine was noted, the root was considered to be well formed when it was two-thirds or more complete. The presence or absence of the deciduous canine was noted. Where present the deciduous root was examined radiographically for normal physiological root resorption. Other predisposing factors such as earlier orthodontic treatment or trauma to the incisors were also noted.

The object of the survey was to identify the distribution, outcome and any predisposing factors associated with root resorption and to relate our findings to previously published work.

Results

The material consisted of 26 patients with maxillary incisor root resorption all of whom



Figure 1 Intraoral periapical film showing apical root resorption of upper left lateral incisor in relation to ectopically erupting maxillary canine.

had ectopically erupting maxillary canines. There were 17 females and nine males with a mean age at referral of 12.5 years (range 8.4–16.0 years, SD 1.9 years). A total of 35 incisors exhibited root resorption and these were related to 32 ectopically positioned canines.

An examination of the dentists' referral letters revealed that 15 mentioned either root resorption specifically or concern about unerupted canines, five letters included details of resorption. Eight cases had non-specific referral letters and of these two patients were referred with radiographs clearly showing root resorption (Figure 1). One patient was referred because of a pink spot on a lateral incisor, another patient developed resorption at a later date (Figure 2).

Teeth resorbed and areas of involvement

A total of 35 teeth exhibited root resorption. These comprised 26 lateral incisors (nine on the right, 17 on the left) and nine central incisors (seven on the right and two on the left). The full results are shown in Table 1.

Five patients had bilateral involvement of lateral incisors, one of these also had a central incisor involved. Two patients had unilateral involvement of a central and lateral incisor, one had one tooth on either side involved. In all, 18 patients had involvement of one tooth only.

Of the 35 incisors the area of root affected by the resorption in the vertical plane is shown diagrammatically in Figure 3. A total of 21 teeth

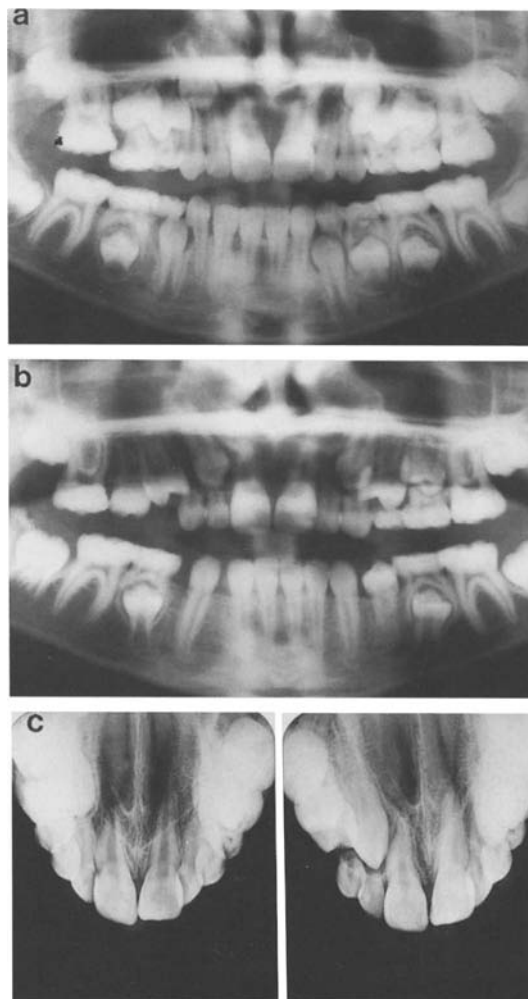
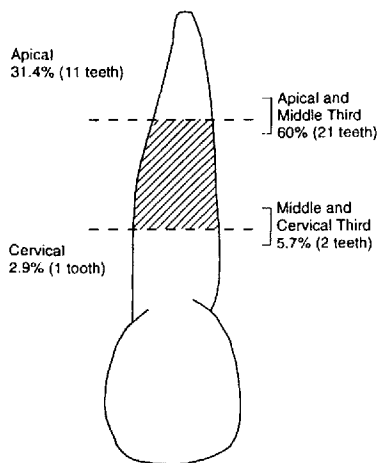


Figure 2 (a) orthopantomographic (OPG) radiograph prior to the development of root resorption of both maxillary lateral incisors; (b) OPG radiograph taken 26 months later showing root resorption of both maxillary lateral incisors by erupting canines; (c) upper standard occlusal films taken at the initial assessment (left) and following the development of resorption

had apical and middle third involvement, two had middle and cervical involvement, one had cervical involvement only and 11 had apical involvement only. In all, 30 teeth were deemed radiographically to have pulpal involvement, i.e. the resorption involved the root canal, of these only one was recorded as non-vital in the clinical notes. In the majority of cases no record had been made of vitality testing.

Table 1 Distribution of resorbing maxillary incisor teeth.

	Right	Bilateral	Left	Total
Central incisor	5			5
Lateral incisor	3	8	10	21
Central and lateral incisor	2	5	2	9
Totals	10	13	12	35

**Figure 3** Area of root involved in resorption in the vertical plane.

Canine involvement

A total of 32 canines were related to the 35 resorbing maxillary incisors, of these five teeth were erupted and buccal to the arch, the remaining 27 canines were unerupted. The inclination of the canine was judged to be mesio-angular in 21 cases, vertical in eight cases and horizontal in one case. In one patient two canines were erupted but the inclination of the canine could not be determined from the radiographs available.

The unerupted canines were distributed as follows: 14 palatal, seven buccal and six in the line of the arch (Table 2).

Of the 27 unerupted canines there were 17 cases in which the follicle was considered enlarged. Canine root formation was complete in

Table 2 Distribution and position of unerupted canines associated with incisor resorption.

	Number	Percentage
Palatal	14	43.8
Line of arch	6	18.8
Buccal erupted	5	15.6
Buccal unerupted	7	21.9

31 teeth, of these three did not have apical closure but exhibited more than two-thirds of root development. Only one canine was judged to have less than two-thirds of the root formed.

A total of 22 deciduous canines were missing at the time of initial examination, and of those retained only three showed no normal physiological resorption.

Outcome

Of the patients in this study, nine had the ectopic canine removed and retained the resorbed incisor, in one patient although the canine was removed the incisor was lost later due to pain and mobility. A further 10 patients had the resorbed teeth removed (13 teeth), five patients had the unerupted canine exposed and aligned and one patient retained both the resorbed incisor and the ectopic canine; 16 patients proceeded to orthodontic appliance therapy. Only one patient had the resorbed incisor root treated.

Other factors

Three patients had undergone orthodontic treatment with general dental practitioners, two with removable appliances to push teeth over the bite and one with a fixed appliance for alignment purposes. One patient had root resorption elsewhere in relation to erupting permanent teeth and one patient had a history of trauma to his maxillary incisors. Two patients had peg-shaped lateral incisors.

Discussion

It has been reported previously that root resorption in relation to the ectopic maxillary

canine is an underestimated problem (Ericson and Kurol, 1987b). The cases reported in this study support this view. In the majority of patients the resorption was found at a late stage of dental development (mean age 12.5 years) with 66 per cent of involved teeth having two-thirds of the root resorbed.

In common with other surveys more females than males were found to have the problem with an approximate 2:1 female to male ratio compared with 4:1 reported by Ericson and Kurol (1987b) and 10:1 by Sasakura *et al.* (1984). In contrast to Ericson and Kurol (1987b) who reported that five out of six patients developing central incisor root resorption were male this group contained nine patients with central incisor involvement, six of whom were female.

The region of the root affected by resorption was most commonly the middle third, although no cases were found with this region of the root affected in isolation, the adjacent cervical or apical thirds were also involved and this may reflect the advanced stage of resorption observed in the majority of cases. The most common pattern was a combination of middle and apical third resorption (60 per cent). In many cases the root was obliquely resorbed. Brin *et al.* (1993) found that 40 per cent of affected lateral incisors displayed this pattern of resorption in a group of patients of a similar mean age (12.3 years) to the patients in this survey. Ericson and Kurol (1987b) found that 82 per cent of resorption was found in the central part of the incisor root, however they were detecting cases very early by using a polytomographic technique. Standard radiographic techniques do not detect early palatal or labial resorption, detection tends to be at a more advanced stage of the resorption.

The permanent maxillary canine was in most cases unerupted with the majority lying palatal to the arch. A significant number however had erupted buccally (15.6 per cent). Knight (1987) in a report of six cases of buccally-erupting canines associated with root resorption, stated that the presence of a buccally-erupted or palpable unerupted maxillary canine should not necessarily be considered a normal developmental feature. The material in this study confirms this, with a total of 33 per cent of the canines

associated with root resorption being buccal to the line of the arch. The findings in relation to canine inclination were in broad agreement with the work of Ericson and Kurol (1988), who described a pattern of more mesial horizontal eruption in a group of patients with incisor root resorption when compared with a control group of patients with ectopic canines with no resorption. As the patients in this study were drawn from more than one centre there was no standardisation of radiographic material, which meant that the direction of eruption was assessed subjectively.

In this study the follicle was judged enlarged in 53 per cent of cases. In previously reported cases this has been found to be lower (Ericson and Kurol, 1988; Brin *et al.*, 1993), Ericson and Kurol, reported an incidence of 23 per cent. They also compared the resorption group to a control group with ectopically positioned canines that did not develop incisor root resorption and found that the incidence of follicular enlargement was not significantly different to the resorption group from which they concluded that follicular enlargement was not a factor in the aetiology. There was no relationship between the retention or loss of the deciduous canine and the occurrence of incisor root resorption, nor where it was retained to normal physiological root resorption.

In three patients the root resorption observed could be related to the failure of the general dental practitioner to properly assess the position of the canine prior to commencing orthodontic appliance therapy. It was also evident that in some cases the films submitted with the referral letter had not been adequately assessed by the referring practitioner as no mention was made of clearly visible resorption on the film submitted with the letter (Figure 1).

Despite the extensive nature of the resorption in the majority of involved teeth, the patients had a low incidence of pain or mobility. Only one patient had root treatment, and two-thirds of resorbed incisors were retained.

This study indicates that resorption is often identified late both in terms of patient age and in relation to the degree of resorption which has occurred. It would seem that it is a problem

which is underestimated by referring practitioners.

Whilst in the majority of cases the ectopic canine was palatal to the arch, a significant proportion were buccal, and of these a number were erupted.

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