

# External root resorption of the maxillary permanent incisors caused by ectopically erupting canines

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*In this study, we analyzed the root resorption of 10 maxillary permanent incisors (two central and eight lateral incisors) in seven cases associated with ectopic eruption of adjacent canines. Two incisors were extracted because of marked root resorption. Two erupted after traction, whereas, five erupted after surgical exposure or without any treatment, although one lateral incisor submerged due to ankylosis. This suggests that self-correction of the ectopic canine occurs in some cases.*

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## INTRODUCTION

There have been many reports on eruption disturbance of the maxillary permanent canine.<sup>1-8</sup> Ectopically erupting canines cause not only tilting, but also sometimes root resorption of the lateral and/or central incisors.<sup>6,7,9-14</sup> When the resorption is localized on the surface of the incisor root, natural healing of the lesion can be expected,<sup>6</sup> whereas if the root resorption extends to the dental pulp, complicated treatments are needed, such as an extraction of the resorbed incisor or an auto-transplantation of the ectopic canine after traction.<sup>15-17</sup> Early diagnosis for possible root resorption seems to be essential to avoid undesirable extraction of the incisor adjacent to the affected canine.

The purpose of the present study was to investigate cases of incisor root resorption caused by ectopically erupting canines and to clarify the relationship

**Table 1.** Distribution of the patients

Case No.	Sex	Age	Affected incisor (Side)
1	F	10y5m	Central (Left)
2	M	11y7m	Central (Right)
3	F	10y1m	Lateral (Left)
4	F	11y0m	Lateral (Right)
5	F	9y10m	Lateral (Bilateral)
6	F	10y2m	Lateral (Bilateral)
7	M	10y4m	Lateral (Bilateral)

between the prognosis of the resorbed incisor and the condition of the ectopic canine.

## MATERIALS AND METHODS

One hundred and forty-seven maxillary permanent canines of 128 patients were diagnosed and/or treated in the Pedodontic Clinic of Niigata University Dental Hospital during the 20 years between 1979 and 1999. Out of them, 10 canines of two males and five females caused root resorption of the adjacent lateral or central incisor. The root resorption was detected in two central incisors of two cases and in eight lateral incisors of two unilateral and three bilateral cases (Table 1). There was no case in which both central and lateral incisors simultaneously showed root resorption.

The diagnosis of the root resorption was confirmed by periapical radiographs and orthopantomograms. The resorptive area of the affected tooth was estimated on the periapical radiograph by dividing into the following three parts; apical third, middle third and cervical third of the root.

According to Ericson and Kuroi's classification<sup>2</sup> of ectopically erupting canines utilizing orthopantomograms, the length to the occlusal plane and the mesial inclination of the canine were measured (Figure 1-A).

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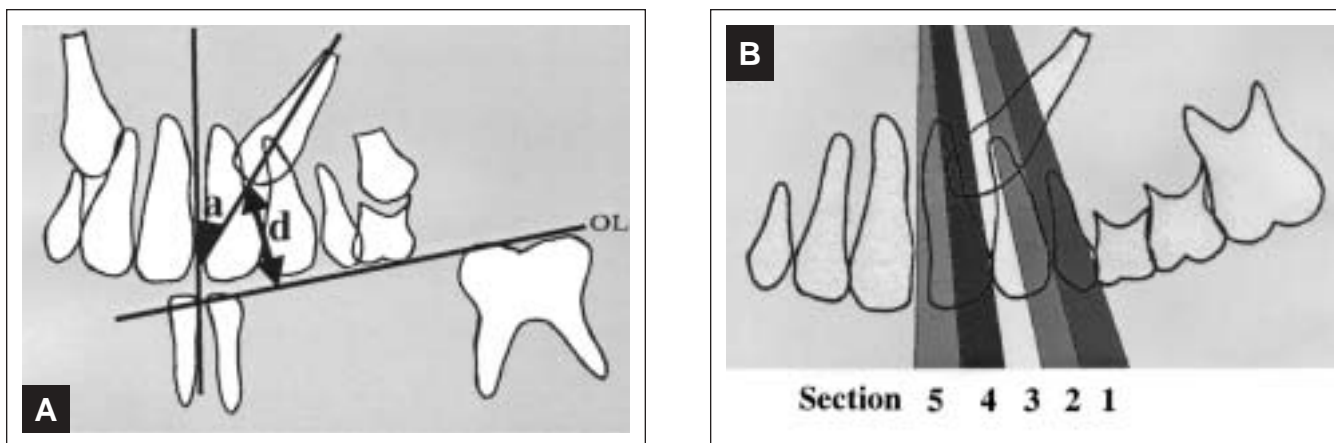
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**Figure 1.** Measurement and estimation of the crown top of ectopically erupting canine on orthopantomogram. In A; the method of measurement of the vertical distance (d mm) to occlusal line (OL) and the mesial inclination (a degrees) to midline. In B; to what extent the ectopic canine overlaps the root of the lateral or central incisor (Section 1 to 5). In A and B, Ericson and Kuroi's methods<sup>10-12</sup> are somewhat modified.

The extent by which the crown top of the affected canine overlapped the resorbed root of the lateral or the central incisor was also classified into five categories (Section 1 to 5) (Figure 1-B).<sup>2</sup>

**RESULTS**

Resorptive areas were detected in the apical third of the affected root of one incisor, in the middle third of five incisors and in the cervical third of four incisors (Table 2 and Figures 2 to 4).

Two affected incisors were extracted. The central incisor in Case 2 was extracted because of the extreme extended resorption and the canine was aligned in the arch instead of the central incisor. The lateral incisor in Case 4 was also extracted because of a failure in traction of the canine, and the canine was aligned in place of the lateral incisor.

Out of the remaining eight incisors, seven were erupted and aligned spontaneously after traction or no treatment of the adjacent canines (Table 2). The right lateral incisor in Case 7 submerged under the gingiva and tooth ankylosis might have occurred, although the neighboring canine erupted spontaneously.

As shown in Table 2, the mesial inclination of the ectopically erupting canines ranged between 0 and 37 degrees and the vertical distances to the occlusal line ranged between 4 and 20 millimeters, except for one canine, which was erupting. In both extraction cases of the affected incisor, the adjacent canine exhibited extreme aberrant inclination and location (Section 3 and Section 4) according to the section classification. Although the ectopic canine in Case 1 showed the worst inclination and location, the central incisor was saved from extraction.

**DISCUSSION**

Ectopic eruption of maxillary permanent canines occurs in approximately 1.5% to 2% of the population.<sup>1,2,4,6,18</sup>

Among the ectopically erupting canines, about 12 % resorb the incisor root.<sup>3,6,10</sup> In the present materials, ten (7%) of 147 ectopic canines resorbed the incisor roots and the occurrence rate seemed to be less than in the previous studies. Since we did not take the computed tomography (CT) that was recommended for precise diagnosis of the root resorption,<sup>3,19</sup> surface and moderate resorption might have been overlooked in the present materials.

It is well known that ectopic eruption of maxillary canines is more prominent in females than in males.<sup>18</sup> It was also shown that the incisor root resorption caused by ectopic canines was more common among girls.<sup>3</sup> In our previous studies<sup>8,20</sup> on lack of eruption of maxillary canines in Japanese children, the male-to-female prevalence rate ratio was M1:F1.6.

The present result exhibited an occurrence of incisor root resorption in females was 2.5 times greater than that in males. These results may support the hypothesis<sup>3</sup> that a genetic factor is related to the occurrence of not only ectopic eruption of the canine but also incisor root resorption caused by the ectopic canine.

Ericson *et al.*<sup>11</sup> reported that 40 (85%) out of 47 incisors resorbed by the ectopic canine were the lateral incisors, six (13%) were the central incisors and one was the bicuspid. These statistics resembled the present result in which two of 10 resorbed incisors were central and eight were lateral.

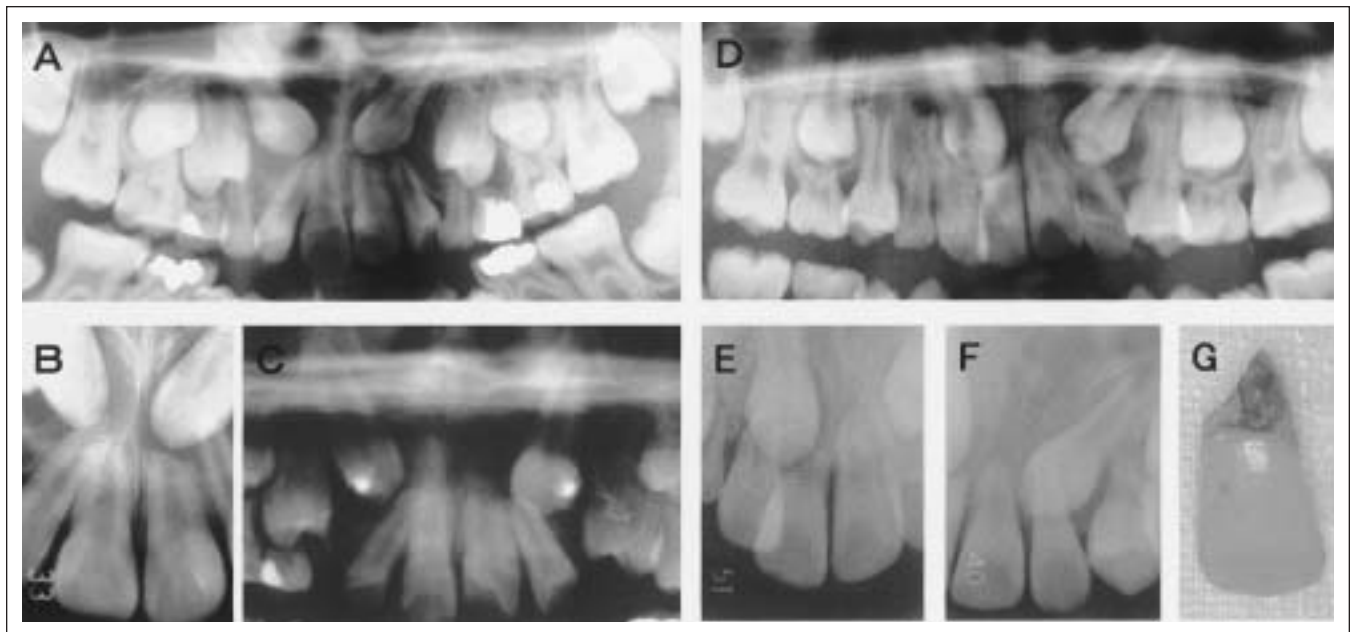
As to the location of the root resorption, it was reported that the middle third of the root was the most likely to be attacked by resorption (82%) associated with ectopic eruption of maxillary canine, followed by the apical third (13%) and the cervical third (5%) of the root.<sup>3,11</sup> The present result also showed many (50%) of the resorptive areas to be in the middle third of the incisor root, although 40% were in the cervical third. It is unclear due to relative small sample whether the dissimilarity is related to the racial difference between Caucasian and Asian samples or not.

**Table 2.** Conditions and treatments of the affected incisors and canines

Case No.	The affected incisor		The ectopically erupting canine			
	Resorptive area*	Treatment**	Mesial inclination (degrees)	Distance to OL (mm)	Section	Treatment**
1	Apical	—	37	20	5	Traction
2	Cervical	Extraction	24	14	4	—
3	Middle	—	0	12	1	Exposure
4	Middle	Extraction	32	12	3	Traction
R 5	Middle	—	19	Oral emergence	1	—
L	Cervical	—	18	10	1	Traction
R 6	Middle	—	0	7	1	—
L	Cervical	—	0	7	1	—
R 7	Middle	—	12	13	1	—
L	Cervical	Endodontics	4	4	1	—

\* Root was divided to three areas; apical third, middle third and cervical third.

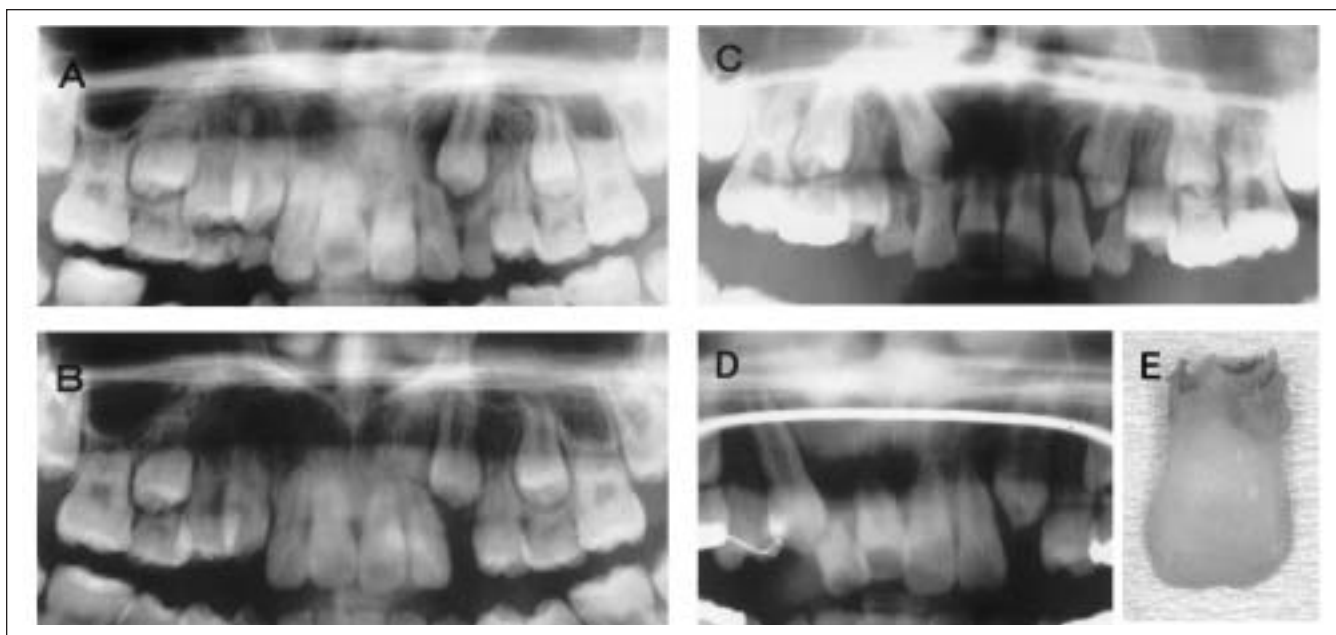
\*\* No treatment;-.



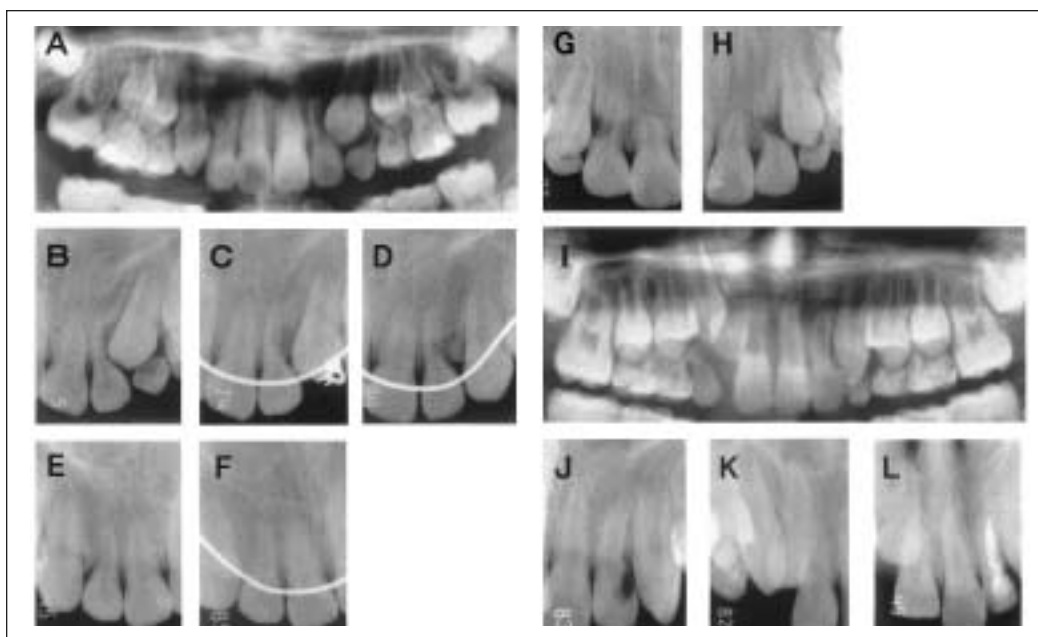
**Figure 2.** Cases 1 (A-C) and 2 (D-G) with root resorption of the central incisor. The orthopantomogram (A) and the periapical radiograph (B) showed root resorption in the apical third of the left central incisor of Case 1, but no resorption of the other three incisors. Four months after beginning the traction, bilateral ectopic canines corrected the mesial inclination and the resorption seemed to be arrested (C). The orthopantomogram (D) and the periapical radiographs (E, F) showed root resorption in the cervical third of the right central incisor of Case 2, being extracted at the next visit (G), but no resorption of the other three incisors.

The ectopic canines in Cases 2 and 4, resulted in lateral incisors being extracted. They were located in severely aberrant positions and showed markedly mesial inclination, whereas, the central incisor was saved from extraction in Case 1 despite the worst position and inclination of the canine among the present

cases (Figures 2 and 3, Table 2). The two extracted incisors in Cases 2 and 4 exhibited severe resorption in more than half of the root, extending even to the pulp. The crown top of the ectopic canine was positioned against the root of the incisor and made a firm lock between the affected teeth. Since the ectopic canine of



**Figure 3.** Cases 3 (A, B) and 4 (C-E) with root resorption of the single lateral incisor. The orthopantomogram (A) showed root resorption in the middle third of the left lateral incisor of Case 3 and a cystic lesion around the ectopic canine. Two months after surgical exposure (B), the affected canine moved toward eruption and the cystic lesion almost disappeared. Since the orthopantomogram (C) showed root resorption in the middle third of the right lateral incisor of Case 4, traction of the ectopic canine had been performed for three months but did not succeed (D). The lateral incisor was extracted due to excessive mobility (E).



**Figure 4.** Cases 5 (A-F), 6 (G,H) and 7 (I-L) with bilateral root resorption of the lateral incisors. In Case 5, although root resorption of the left lateral incisor advanced to the pulp (A, B), the resorption was arrested by traction of the ectopic canine (C, D). The right lateral incisor had already erupted but root resorption was detected (E) to have healed spontaneously (F). In Case 6, the periapical radiographs accidentally revealed traces of root resorption of lateral incisors (G, H). Although the patient refused any treatment, both incisors were confirmed by telephone not to exfoliate without symptoms for 7 years to date. In Case 7, a mild root resorption was detected on the right lateral incisor (I, K) which submerged after eruption of the ectopic canine. The left lateral incisor was suffered from root resorption extending to the crown (J). In order to combat the resorption, hydroxide calcium dressing was performed and the resorption was arrested (L).

Case 1 was positioned deeply, close to the root apex of the central incisor, it may have been rather easy to succeed in traction of the canine and to release the lock of both teeth.

Two types of ectopic eruption of the maxillary first molars have been distinguished; an irreversible type (40 %) requiring some treatment and a reversible type which erupts spontaneously.<sup>21</sup> The present results may imply that there is also a reversible type of ectopic eruption of canines. In Cases 3, 5(R), 6(R, L) and 7(L), progress of the root resorption of five lateral incisors was arrested and the ectopic canine was released from the lock without traction. Recent studies<sup>22,23</sup> have shown that the normal canine erupts, increasing the mesial inclination until a maximum is reached, at about 9 years of age, after which the tooth begins to progressively upright itself. This may be the reason why the self-correction of the ectopic canine occurs. It has been reported that the ectopic first molars can be predicted to belong to irreversible or reversible type.<sup>24</sup> Further investigation will be needed to predict the self-unlocking between the ectopically erupting canine and the resorbed incisor.

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