

Predisposing factors for severe incisor root resorption associated with impacted maxillary canines

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Introduction: Severe incisor root resorption (SIRR) associated with impacted maxillary canines is rare but has important implications. Early diagnosis and treatment are imperative. In this investigation, we aimed to identify predisposing factors for impacted canine-linked SIRR. **Methods:** Clinical and radiographic data of 55 consecutive patients (77 canines) with SIRR of 96 incisors were compared with data from 57 consecutive control subjects (72 canines). The studied variables were age, sex, position of the impacted canine, size of the dental follicle, and incidence of anomalous lateral incisors. **Results:** Lateral incisors were more often affected than central incisors, and bilateral SIRR was common. When each variable was examined separately, SIRR was significantly associated with female sex, severely mesiodistally displaced and vertically positioned canines in the middle third of the adjacent incisor root, dental follicles wider than 2 mm, and normal lateral incisors. The multivariate statistical analysis showed that the risk for SIRR was significantly higher in female subjects (4.2 times) with enlarged dental follicles (8.3 times) and normal lateral incisors (5.8 times). **Conclusions:** SIRR should be carefully screened in female patients with enlarged dental follicles and normal lateral incisors. A greater degree of canine displacement might also be associated with SIRR. (*Am J Orthod Dentofacial Orthop* 2015;147:52-60)

Early studies with plain film radiography indicated that canine-related incisor root resorption occurs in approximately 12% of patients.¹ Yet the authors were at pains to point out that with plain film radiography, it was impossible to properly assess the buccolingual aspects of the incisor roots. With the advent of more advanced imaging techniques such as computerized tomography scanning, detectable root resorption was diagnosed in 38% of resorbed lateral incisors and 9% of central incisors.² Moreover, from the study of Walker et al³ using cone-beam computed

tomography (CBCT), detection capability increased to 67% of cases of which 11% were central incisors and 4% were premolars.^{3,4}

Congenitally missing, small, and peg-shaped maxillary lateral incisors are highly correlated with maxillary canine palatal impaction.⁵ Whereas resorption of maxillary incisor roots is a well-recognized phenomenon that can occur in patients with impacted canines,⁶⁻¹¹ these anomalous lateral incisors with reduced size or abnormal shape have been reported to be less at risk to develop severe root resorption, compared with patients with normally shaped and sized lateral incisors.¹¹

Fortunately, severe incisor root resorption (SIRR) associated with impacted maxillary canines is rare, but when it appears, it threatens the long-term survival of the affected teeth. Early diagnosis and treatment are imperative to save the affected tooth.^{12,13} At present, evidence-based information regarding potential predisposing factors for SIRR is lacking.

The aim of this study was to identify predisposing risk factors for SIRR associated with impacted maxillary canines.

MATERIAL AND METHODS

The study group included 55 consecutive patients with impacted maxillary canines and SIRR, and the

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All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and none were reported.

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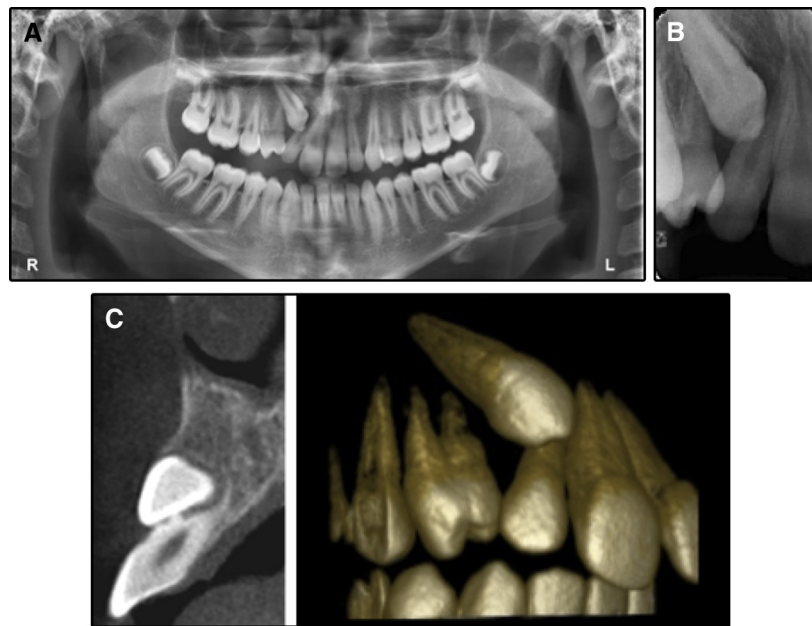


Fig 1. A 14-year-old boy with severely resorbed maxillary right lateral incisor associated with canine impaction: **A**, panoramic view; **B**, periapical view; **C**, transaxial and 3-dimensional CBCT views.

control group included 57 consecutive patients with impacted maxillary canines without SIRR from the Department of Orthodontics of the Hebrew University in Jerusalem, Israel, and the Medical University of Warsaw in Poland and from the private practices of 2 authors (S.C. and A.B.).

The inclusion criterion for the study group was SIRR of at least 1 maxillary incisor associated with an adjacent impacted canine in untreated healthy patients. Diagnosis of SIRR was made from the available panoramic and periapical radiographs that had been taken earlier with the intention of commencing orthodontic treatment (Fig 1, A and B). For most of the patients (75%) in the study group, CBCT images were also available for examination (Fig 1, C). CBCT was considered superfluous for patients in whom SIRR could be diagnosed on plain films alone. When CBCT was unavailable for a patient, the buccolingual position of the ectopic canine was determined using the routine tube-shift method and confirmed by the treating orthodontist or surgeon during surgical exposure. In the control group, CBCT had been available for all subjects to exclude any signs of root resorption. The radiographs were examined by 2 authors (S.C. and A.B.) using an x-ray viewer with standard light intensity.

The CBCT examinations were performed with an i-CAT scanner (12-bit; Imaging Sciences International, Hatfield, Pa) with the following parameters: 26.9 seconds scan time, 120 kV, 5 mA, field of view size of 13 (height) × 16 (diameter) cm, and 0.2-mm voxel. The

resultant slice image data were converted to 3-dimensional images in DICOM format, reconstructed by XoranCat software (version 3.1.62; Xoran Technologies, Inc, Ann Arbor, Mich) and imported to be evaluated in i-CATVision (2008 version 1.8.1.10; Imaging Sciences International). The reconstructed image had a 2-mm slice thickness.

Traditionally, root resorption has been described elsewhere as horizontal shortening of the root.¹⁴ The pattern is different for SIRR associated with impacted maxillary canines, where the resorption is mostly oblique rather than horizontal (Fig 2). Root resorption was measured on the radiographs, and it was considered severe when it affected more than a third of the length of the root, but not specifically its apical part (Fig 3). The exclusion criteria for the sample were root resorption of maxillary incisors less than one third of their expected root length, root resorption secondary to trauma or pulp pathology, or the presence of cysts and other pathologies.

The numbers of involved central vs lateral incisors, and unilateral vs bilateral cases, were recorded.

The associations between SIRR and the following variables were evaluated: (1) age; (2) sex; (3) buccolingual location: palatally, buccally, or in the line of the arch; (4) mesiodistal location: sector⁷ (Fig 4, A); (5) angulation to the midline^{14,15} (Fig 4, B); (6) overlap of the adjacent incisor^{14,15} (Fig 4, C); (7) vertical crown height relative to the adjacent incisor root: apical, middle, or coronal¹⁶ (Fig 4, D); (8) maximum width of the

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