

Effect of surgical exposure technique, age, and grade of impaction on ankylosis of an impacted canine, and the effect of rapid palatal expansion on eruption: A prospective clinical study

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Introduction: This study had 2 aims: (1) to assess whether the surgical exposure technique, the patient's age, and the grade of impaction are associated with ankylosis of the impacted canine; and (2) to investigate the effect of rapid palatal expansion on an impacted canine's automatic eruption. **Methods:** The sample for this prospective longitudinal study consisted of 118 orthodontic patients (72 female, 46 male) who were treated surgically and orthodontically by the first author (S.I.K.) over 18 years. The patients' ages at the beginning of therapy ranged from 11.2 to 46.1 years. They had 157 impacted canines (150 maxillary, 7 mandibular), grouped in 7 categories (grades I-VII) according to their radiographic position in the orthopantomogram at the onset of treatment. Univariate and multivariate generalized estimating equation logistic regression analyses were used to assess the effect of the predictors of interest on ankylosis. (In this research, a broad definition of "ankylosis" was used, to include impacted canines immobilized a priori or during traction, due to all the possible causes that could contribute to immobilization, such as all types of external tooth resorption and other known or unknown factors.) **Results:** Thirty-eight canines erupted spontaneously after space gaining, and the other 119 were treated surgically with an open (57 cases) or a closed (62 cases) exposure technique. Eleven canines of the 119 that were treated surgically had ankylosis, either a priori or during orthodontic traction. The percentages of ankylosis were 3.5% in the open technique and 14.5% in the closed technique. Evidence of statistical association was found between age and ankylosis, grade of impaction and ankylosis, and rapid palatal expansion and automatic eruption of the impacted canine. **Conclusions:** Evidence of an association between exposure technique and ankylosis was found. Additionally, there was evidence that the grade of impaction and the patient's age are significant predictors of ankylosis, as is the use of rapid palatal expansion a predictor of automatic eruption. (Am J Orthod Dentofacial Orthop 2013;143:342-52)

There are numerous surgical procedures to expose an impacted canine and to bring it to its proper position in the dental arch.¹⁻¹¹ The open exposure technique allows natural eruption of the impacted canine; the closed exposure technique involves placement of an auxiliary attachment, which is then used for orthodontic traction. When the neighboring teeth are intruded and the canine remains

immobile despite the application of orthodontic force, this is commonly recognized by clinicians as an indication of "ankylosis."¹²

The term *ankylosis* is generally associated with resorption (replacement root resorption).¹³ In ankylosis-related resorption, immobilization is observed clinically, since the root surface (cement or dentin) of the tooth is fused with the alveolar bone. In this study, we broadened the definition to include impacted canines immobilized a priori or during traction, due to the many possible causes that could contribute to immobilization, such as all the types of external tooth resorption^{13,14} and other known^{12,15,16} or unknown factors.

In the literature, the failure in the therapy of the impacted canine has been studied,^{12,15,16} but there are aspects of this failure that have yet to be considered. Indicatively, an unusual a priori ankylosis in the form

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