What Factors Are Associated With Impacted Canines in Cleft Patients?

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Purpose: It is important to predict and prevent the impaction of canines. The aim of this study was to estimate the prevalence of impacted canines in patients with unilateral cleft lip and palate (UCLP) and to identify factors associated with impaction.

Materials and Methods: This retrospective cohort study included patients with nonsyndromic UCLP. The predictors were pre-eruptive inclination angle, deviation in tooth number (agenesis or supernumerary lateral incisors), and reoperation of bone transplant. The outcome variable was impacted and surgically exposed canines.

Results: The prevalence of impacted and surgically exposed canines in the 68 consecutive patients with UCLP was 20.6%. The pre-eruptive inclination angle was significantly larger (34.4°) for the impacted canines on the cleft side compared with the spontaneously erupted canines on the cleft and non-cleft sides (25.5° vs 15.4; $P < .05$). Reoperation of the bone transplant significantly increased canine impaction (50%; $P < .05$).

Conclusion: The eruption of maxillary canines needs to be supervised carefully in patients with UCLP, because the prevalence of impaction is 10 times higher compared with the general population. Factors associated with canine impaction are a pre-eruptive inclination larger than 30° and reoperation of the bone transplant.

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Dental anomalies, such as crown malformations, and missing or supernumerary lateral incisors are common features in patients with cleft lip and palate (CLP).[1,2] In the general population, the prevalence of impacted maxillary canines is approximately 2%,[3,4] and a higher prevalence of impacted maxillary canines has been reported in patients with unilateral CLP (UCLP).[5-17] Treatment of an impacted canine is complex and usually requires surgical exposure and a fixed orthodontic appliance. Ectopic and impacted canines also increase the risk of root resorption of adjacent teeth. A prevalence of 12.5% root resorption caused by impacted canines has been reported in the general population,[18] with an even higher prevalence (48%) when using new and more accurate cone-beam computed tomographic techniques.[19] Therefore, it is important to be aware of possible predisposing factors.

Many factors can contribute to the higher prevalence of impaction of canines at a cleft site. First, the alveolar cleft per se decreases available space in the jaw and can result in displacement of the developing canine, for which a large pre-eruptive inclination angle has been suggested to be predictive for impaction of the canine.[1] Second, the presence of a lateral incisor has been suggested to be an important guide for the erupting canine or an associated factor for the impaction. Therefore, agenesis of a lateral incisor, which is common in patients with UCLP, will influence the

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position of the impacted canine.[20] Third, lack of bone in the cleft and surgery to replace the bone interfere with normal eruption.[21] Fourth, a mixed dentition bone transplant to the alveolar cleft can fail, requiring a reoperation of the bone transplant.

Thus far, no one has addressed whether reoperation interferes with eruption of the permanent maxillary canine. Taken together, it is still unclear which factors are associated with the impaction of canines in patients with cleft. The purpose of this study was to estimate the prevalence and factors associated with impaction and surgically exposed permanent maxillary canines in patients with UCLP. The authors hypothesized specific factors would be associated with impacted canines. The specific aim was to evaluate the *1)* pre-eruptive inclination angle, *2)* deviation in tooth number (agenesis vs supernumerary incisors), and *3)* reoperation of the bone transplant.

Materials and Methods

STUDY DESIGN

This was a retrospective cohort study. The sample was derived from the regional CLP team at the Umeå University Hospital (Umeå, Sweden). Consecutive patients with nonsyndromic UCLP born from 1984 through 1998 were included in this study. Patients born before 1984 were excluded owing to different treatment programs for patients with UCLP. Ethical approval for the study was obtained from the research ethical board at Umeå University (Dnr 2010/265-31M).

STUDY VARIABLES

Predictor Variables

The predictor variables of interest in this study included the pre-eruptive inclination angle of the maxillary canine, the deviation in tooth number, and reoperation of the bone transplant. Because the patients in this study had UCLP, they had a non-cleft side and a cleft side. The canines and deviating number of teeth were grouped according to side.

Outcome Variable

The primary outcome variable was the presence of an impacted and surgically exposed maxillary canine.

DATA COLLECTION METHODS

Information on gender, adoption status, cleft side, and age at bone retransplantation was collected from clinical records. Clinical records and panoramic radiographs from patients with at least 1 panoramic radiograph at 7 years of age (range, 6 to 8 yr) and 10 years of age (range, 9 to 11 yr) were obtained from the register of the CLP team. Standardized panoramic radiographs were taken at the department of oral and maxillofacial radiology. The pre-eruptive inclination angle of the permanent maxillary canine and the presence of the permanent maxillary lateral incisor on the cleft and non-cleft sides were registered from panoramic radiographs. When a maxillary lateral incisor was absent on the panoramic radiograph, the patient's medical record was cross-checked to exclude extractions. Geometric measurements were made on the panoramic radiographs after tracing on acetate tracing paper by 1 examiner. The canine inclination was defined as the angle between a line drawn through the long axis of the canine and a vertical reference line through the midsagittal plane. If the nasal septum could be identified on the panoramic radiograph, then the vertical reference line was drawn guided by this anatomic structure. If the nasal septum was unidentified, then the vertical line was drawn after an evaluation of the anatomic structures on the panoramic radiograph (Fig 1). At 7 years of age, only the crown of the permanent maxillary canine is developed; thus, the long axis of the tooth was estimated using the cusp and the location of the pulp as reference points. Measurement of the canine inclination was performed by 3 examiners (Alexandra Oldén, DDS; Pernilla Vallin, DDS; and Sofia Tärngren, DDS), and after 1 month the scoring was repeated. Intra- and interexaminer reliabilities were determined using intraclass correlation coefficients (ICCs). The orthodontic clinics responsible for the treatment of each patient included in the study were contacted to obtain information on whether maxillary canines erupted normally or were impacted and had to be surgically exposed.

DATA ANALYSIS

IBM SPSS 17 (IBM SPSS Statistics, IBM Corp, Armonk, NY) or SigmaStat 3.1 (SYSTAT, San Jose, CA) were used for analyzing data with *t* test and paired *t* test when comparing the cleft and non-cleft sides, respectively, and χ^2 test and Fisher exact test when analyzing categorical variables. A P value less than .05 was considered statistically significant. The ICC was used to analyze inter- and intraexaminer reliabilities.

The results are presented according to the Strengthening the Reporting of Observational Studies in Epidemiology guidelines.[22]

Results

The study sample consisted of 68 consecutive patients with nonsyndromic UCLP (27.9% were girls). Approximately 20% of patients were adopted before 3 years of age, before the eruption of permanent teeth and major surgery. Of the 68 patients, 54.4% had cleft on the left side. The prevalence of impacted canines in