Deciduous-dentition malocclusion predicts orthodontic treatment needs later: Findings from a population-based birth cohort study

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Introduction: Estimating orthodontic treatment need in the permanent dentition using information from the deciduous-dentition malocclusion may assist in defining the time for appropriate orthodontic intervention. Our objective was to investigate whether malocclusion in the deciduous teeth predicts orthodontic treatment need in the permanent dentition. **Methods:** Two oral health studies nested in a birth cohort were carried out at ages 6 (n = 359) and 12 (n = 339) years. Open bite, crossbite, and canine malocclusion were assessed in the deciduous teeth. Orthodontic treatment need was determined in the permanent dentition using the dental esthetic index. Prevalence ratios were estimated using 2 dental esthetic index cutoff points: highly desirable/mandatory orthodontic treatment and only mandatory orthodontic treatment. We tested all combinations of the deciduous malocclusion and the outcomes, controlling for confounders. **Results:** Children with only open bite and those with concurrent open bite and canine malocclusion were more likely to have either highly desirable/mandatory orthodontic treatment or only mandatory orthodontic treatment needs by age 12. The combination of crossbite and open bite in the deciduous teeth was associated with the highest risk of need for mandatory orthodontic treatment. **Conclusions:** Malocclusion in the deciduous teeth is a risk factor for orthodontic treatment need in the permanent dentition. Children with malocclusion at a young age should be monitored regularly, and caregivers may be able to better prepare for possible orthodontic treatment. (Am J Orthod Dentofacial Orthop 2015;147:492-8)

Severe malocclusion in the permanent dentition has been associated with bullying,[1] poorer oral health–related quality of life,[2] and self-dissatisfaction with appearance characteristics.[3] Malocclusion in the permanent dentition can be measured indirectly through the estimation of treatment need. For example, the dental aesthetic index (DAI) was developed as an indicator of the social acceptability of occlusal conditions and as a screening tool to assist in prioritizing the need for orthodontic treatment, thereby assisting in the allocation of scarce public resources.[4]

Our understanding of the complex and multifactorial etiology of malocclusion remains limited. Skeletal pattern, genetically determined, is considered its most important determinant.[5] On the other hand, anthropologic studies on secular trends suggest that environmental factors—for instance, changes in feeding habits toward a more refined diet, premature deciduous tooth loss caused by caries,[6] nonnutritive sucking habits,[7] bottle feeding,[7,8] and early weaning[7]—also contribute to variations in occlusal traits.[6,9] Moreover, a few cohort studies have suggested that malocclusion in the deciduous dentition is a determinant of a permanent-dentition malocclusion.[10-12] For example, an Angle Class I molar relationship was found

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to be more common among Nigerian children who had had an initially flush terminal plane and mesial step relationships in the deciduous dentition.[10]

Identification and classification of the risk for orthodontic treatment need in the permanent dentition using information on deciduous-dentition malocclusions may assist in defining the most appropriate intervention stage and providing the appropriate orthodontic therapy, thereby minimizing costs. The few studies that have investigated whether a deciduous-dentition malocclusion is a risk factor for malocclusion or need for orthodontic treatment in the permanent dentition have not controlled for confounding using multivariable analysis or taken life-course characteristics into account.[10-12] Moreover, they have not investigated the role of the number and type of different deciduous-dentition malocclusions. The most favorable research design for investigating such issues is a prospective cohort study.

The aim of this study was to investigate whether malocclusion in the deciduous dentition is a risk factor for orthodontic treatment need in the permanent dentition using a prospective longitudinal approach.

MATERIAL AND METHODS

The Pelotas 1993 birth cohort is a study of a cohort of babies born in 1993 in Pelotas in southern Brazil. The study was developed to evaluate the trends in maternal and child health indicators, and to assess the associations between early life variables and later health outcomes. In 1993, all hospitals in Pelotas were monitored daily by the research team, and mothers of all 5265 newborns were invited to join a prospective study.[13] Of these, 5249 (99.6%) agreed to take part in the study. Soon after delivery, the mothers were interviewed about demographic, socioeconomic, and health-related characteristics. The children were weighed, measured, and examined at birth by a team of doctors and medical students. For the 1-month and 3-month visits, a systematic sample of 13% of the cohort participants was randomly selected and also followed at 6 months, 1 year, and 4 years. In 1998, a sample of 1460 eligible children from the original cohort was reassessed at age 5. Of them, 87% (1270 children) were located. In 2004, all cohort members were again sought for a follow-up visit at age 11 years. The home visits included questionnaires administered to mothers and anthropometric assessments of the children. The details of the methodology have been described elsewhere.[13]

The first dental assessment of the cohort participants was carried out at age 6 in a sample of 400 children, randomly selected from a follow-up study (n = 1270) conducted in 1998. Because the proportion of low birth weight children in the follow-up study was 29.7% (in the original cohort, it was 9.7%), it was necessary to calculate a weighting factor to perform the statistical analysis. Accordingly, a weighting factor of 0.34 was used for children with low birth weight, and 1.27 was applied for the others.

The sample size was calculated to estimate prevalence; the sample size calculation and the power to test associations were done a posteriori and have been shown to be sufficient to test hypotheses related to early life influences on dental emergence, dental caries, and malocclusion.[14-16]

A pilot study involving 40 children was carried out before the fieldwork. All dental examinations were performed between December 1998 and July 1999 at the children's homes by 3 dentists and 3 interviewers. Scores for the measures of agreement, calculated on a tooth-by-tooth basis,[17] were high (minimum kappa value was 0.7). The 1997 World Health Organization criteria were used for diagnosing dental caries in deciduous teeth.[18] In addition, the occlusion was also examined.[16] Malocclusion was considered as the presence of (1) open bite (lack of contact between mandibular and maxillary central incisors when in centric occlusion), (2) unilateral or bilateral crossbite (at least 1 tooth) considered as reverse buccal overjet with or without a midline shift, and (3) bilateral deciduous canine relationships (Class I, Class II, and Class III), according to the criteria of Foster and Hamilton.[19] Children who had lost their anterior teeth were excluded from the sample. The participation rate was 89.7% (n = 359). Nonresponses were mainly due to families having moved out of the city.

All 359 children who were assessed at age 6 were visited at their homes, dentally examined, and interviewed in 2005, when they were 12 years old. Dental caries diagnosis followed the World Health Organization criteria.[18] In addition, the criteria of the DAI were adopted for the recording of malocclusion characteristics and the normative need for orthodontic treatment.[18] Headlamps were used to improve visualization.

A structured interview was undertaken; this included questions about use of dental services (time since last visit, types of dental services, orthodontic treatment) and oral behaviors (toothbrushing, flossing).

A pilot study was carried out with 40 children who did not participate in the main study. The fieldwork team included 4 pairs of examiners and interviewers. Calibration was performed among the 40 children aged 11 to 13 years following methods previously described.[17] Interexaminer reliability was measured using simple and weighted kappa statistics (categorical variables) and intraclass correlation coefficients (numeric variables). The minimum reliability score was 0.6 for gingival bleeding (not assessed in this study), and most values were 1.0.

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