SHORT COMMUNICATION

Sucking habits and facial hyperdivergency as risk factors for anterior open bite in the mixed dentition

Paola Cozza,[a] Tiziano Baccetti,[b] Lorenzo Franchi,[c] Manuela Mucedero,[d] and Antonella Polimeni[e]
Rome and Florence, Italy

Introduction: The aim of this study was to evaluate sucking habits and hyperdivergency as risk factors for anterior open bite in mixed-dentition subjects. **Methods:** Anamnestic and pretreatment cephalometric records of 1710 mixed-dentition subjects were assessed for sucking habits, dental open bite, and facial hyperdivergency. **Results:** The rate of anterior open bite was 17.7%. Multiple logistic regression showed that both prolonged sucking habits and hyperdivergent vertical relationships significantly increased the probability of an anterior dentoalveolar open bite, with a prevalence rate of 36.3%. This was 4 times the prevalence of sucking habits and facial hyperdivergency in subjects without anterior open bite (9.1%). **Conclusions:** Prolonged sucking habits and hyperdivergent facial characteristics are significant risk factors for anterior open bite in the mixed dentition. (Am J Orthod Dentofacial Orthop 2005;128:517-9)

Sucking habits at a very early age (until 3 years) are normal, but persistence of these habits beyond 3 significantly increases the probability of developing undesirable dental arch and occlusal traits at the end of the deciduous dentition stage.[1] Prolonged sucking habits create a mechanical obstacle for the eruption of anterior teeth, in association with tongue-thrust swallowing. These alterations often result in an anterior open bite.[2-5] However, studies on the extent to which sucking habits impact dental occlusion and lead to open bite are contradictory. A few clinical contributions from the past affirm that digit sucking cannot cause skeletal malocclusions, but it can add dentoalveolar problems to existing skeletal problems.[6,7] Fukuta et al[8] also investigated the relationship between sucking habits and malocclusion in the deciduous dentition, demonstrating a higher prevalence of open bite in the thumb- or finger-sucking group compared with age-matched controls without oral habits. Farsi and Salama[9] studied the effect of sucking habits in Saudi Arabian children aged 3 to 5 years and found a strong correlation between the oral habit and open bite.

Many of the studies that focus on the analysis of anterior open bite report a high prevalence of the hyperdivergent phenotype.[10] There is no univocal appraisal of facial hyperdivergency in the development of dental open bite. Through the use of cephalometric parameters, it has been shown that most anterior open bite subjects do have traits of both dentoalveolar and skeletal increased vertical dimensions.[11-13] Vice versa, skeletal open bite subjects do not necessarily have negative overbite.[14,15] The influence of skeletal characteristics on overbite has been calculated to be less than 25% in the mixed dentition.[16]

The aim of this investigation was to test the hypothesis, by means of a prevalence study of a large orthodontic population in the mixed dentition, that sucking habits and a hyperdivergent facial pattern predispose a child to anterior open bite.

MATERIAL AND METHODS

The parent sample for this study consisted of 1827 subjects in the mixed dentition (intertransitional and second transitional periods of the mixed dentition)[17] who had been observed from 1990 to 2005 at the orthodontic departments of the University of Florence and the University of Rome "Tor Vergata," as part of an ongoing multicentric clinical investigation on the prevalence of dentoskeletal open bite. The exclusionary

[a]Professor and head, Department of Orthodontics, University of Rome, Rome, Italy.
[b]Assistant professor, Department of Orthodontics, University of Florence, Florence, Italy; Thomas M. Graber visiting scholar, Department of Orthodontics and Pediatric Dentistry, School of Dentistry, University of Michigan, Ann Arbor.
[c]Research associate, Department of Orthodontics, University of Florence, Florence, Italy; Thomas M. Graber visiting scholar, Department of Orthodontics and Pediatric Dentistry, School of Dentistry, University of Michigan, Ann Arbor.
[d]Fellow, Department of Orthodontics, University of Rome, Rome, Italy.
[e]Professor and head, Department of Pediatric Dentistry, University of Rome, Rome, Italy.
Reprint requests to: Dr Lorenzo Franchi, Università degli Studi di Firenze, Via del Ponte di Mezzo 46-48, 50127 Florence, Italy; e-mail, l.franchi@odonto.unifi.it
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criteria (craniofacial anomalies, cleft lip and palate, supernumerary teeth, tooth agenesis, sequelae of traumatic injuries of the permanent incisors) reduced the parent sample to the final sample of 1710 subjects (mean age, 9 years 3 months ± 1 year 5 months; 923 girls and 787 boys).

For each subject, anamnestic records were available for the assessment of sucking habits, and pretreatment lateral cephalograms for the diagnosis of dental open bite and facial hyperdivergency. The following parameters were recorded for each subject in the form of binary (yes or no) data, as to the absence or presence of: (1) anterior dental open bite (overbite < 0 mm), (2) sucking habits (thumb or dummy sucking) beyond age 3, and (3) facial hyperdivergency based on the concurrent presence of:

- FMA $> 25°$
- Total posterior facial height (S-Go)/total anterior facial height (N-Me) ratio < 0.62
- Lower anterior facial height (ANS-Me)/total anterior facial height (N-Me) ratio > 0.55

Statistical analysis

The use of multiple logistic regression enabled us to evaluate statistically the influence of sucking habits and facial hyperdivergency as factors in the development of anterior open bite. Statistical computations were carried out by means of statistical software (SPSS, Version 12.0; SPSS, Chicago, Ill).

RESULTS

The prevalence of anterior open bite in the mixed dentition was 17.7% (303 of 1710 subjects in the initial total sample). In subjects with anterior open bite, prevalence was 63.4% for sucking habits and 61% for facial hyperdivergency. The prevalence of sucking habits and facial hyperdivergency in patients with anterior open bite was 36.3%. In subjects without anterior open bite, prevalence was 28% for sucking habits and 34.5% for facial hyperdivergency. The prevalence of sucking habits and facial hyperdivergency in patients without anterior open bite was 9.1%. Multiple logistic regression (Table) showed that both sucking habits and facial hyperdivergency were significantly associated with increased risk of anterior open bite.

DISCUSSION

This study analyzed the role of prolonged sucking habits and vertical skeletal characteristics of the face as risk factors in anterior dentoalveolar open bite in a large, mixed-dentition, orthodontic population. Relationships between sucking habits and anterior open bite,[1-9] and between hyperdivergency and anterior open bite[11-16] have been evaluated in the literature, but only separately. Findings by different authors on different samples do not agree on the role of sucking habits and hyperdivergency in the development of a negative overbite.

In our investigation, the prevalence of anterior open bite in the mixed dentition was about 18%. This means that almost 1 of 5 new orthodontic patients in the mixed dentition might have a negative overbite. Diagnosis of anterior open bite was made when all permanent incisors where fully erupted. Patients with pseudo open bite due to incomplete eruption of the incisors were not considered.

In agreement with previous data by Bowden,[6] approximately one third of the subjects having prolonged sucking habits in our sample exhibited anterior open bite. On the other hand, about 1 of 4 subjects with hyperdivergent facial pattern develops anterior open bite, a prevalence almost the same as that reported by Baccetti et al.[16] Multivariate statistics have determined that both prolonged sucking habits and hyperdivergent vertical relationships significantly increase the probability of developing an anterior dentoalveolar open bite. These findings were shown both by multiple logistic regression and when expressed in terms of odds ratios for the 2 factors. The prevalence of sucking habits and facial hyperdivergency in patients with anterior open bites was 36.3%, which was 4 times as great as the prevalence of these features in subjects without anterior open bite (9.1%).

Our results seem to point out the importance of both mechanical, external factors (such as digit or dummy sucking) and structural features of the craniofacial skeleton as risk factors for dentoalveolar malocclusions such as anterior open bite. It has been observed that, in the presence of a definite risk factor (eg, a prolonged sucking habit), facial skeletal characteristics might modulate the appearance and severity of a developing malocclusion.[18] Clinically, a rational diagnosis should include the identification of patients with prolonged sucking habits associated with excessive vertical dimension of the face as candidates for developing an anterior, dentoalveolar open bite. Some therapeutic protocols have been proposed to eliminate sucking habits in growing subjects by using removable or fixed appliances incorporating a grid.[19-21] Therapies proved to be effective in most instances in terms of discontinuing the sucking habit and reducing the anterior open bite. In the light of our findings, it appears advisable to recommend the use of those protocols, to eliminate the sucking habit and to improve, or at least control, the increased vertical dimension.[22]

Table. Multiple logistic regression with presence or absence of anterior open bite as dependent variable

					95.0% CI for Exp (B)	
Variables in model	*B*	*SE*	*Significance*	*Exp (B)*	*Lower*	*Upper*
Hyperdivergency	1.161	0.137	0.000	3.193	2.439	4.179
Sucking habits	1.545	0.137	0.000	4.690	3.582	6.140
Constant	2.789	0.132	0.000	0.062		

B, Regression coefficient; *SE*, standard error; *Exp (B)*, estimated odds ratio.

CONCLUSIONS

The findings of this study showed that both prolonged sucking habits and hyperdivergent facial characteristics are significant risk factors for the development of anterior open bite in the mixed dentition.

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