SHORT COMMUNICATION

Transverse features of subjects with sucking habits and facial hyperdivergency in the mixed dentition

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Introduction: The aim of this study was to analyze the transverse characteristics of subjects with sucking habits and hyperdivergency in the mixed dentition. **Methods:** The test group consisted of 80 subjects with sucking habits and hyperdivergency in the intermediate mixed dentition, and it was compared with a control group of 185 subjects. The prevalence rate of posterior crossbite was recorded. Maxillary and mandibular intercanine and intermolar widths, and anterior and posterior transverse interarch discrepancies were measured on the dental casts. The statistical comparisons between the test and control groups were performed with independent sample *t* tests and chi-square tests ($P < .05$). **Results:** The prevalence rate of posterior crossbite in the test group was significantly greater (52%) than in the control group (14%) ($P < .001$). The test group had significantly smaller maxillary intermolar and intercanine widths and significantly greater posterior transverse discrepancy ($P < .01$). No significant differences were found for mandibular intermolar and intercanine widths or anterior transverse discrepancy. **Conclusions:** Prolonged sucking habits and hyperdivergency in the mixed dentition were associated with narrow maxillary intermolar and intercanine widths, increased posterior transverse discrepancies, and increased prevalence of posterior crossbites. (Am J Orthod Dentofacial Orthop 2007;132:226-9)

Evidence is available that shows the effects of prolonged dummy or finger sucking on the transverse dentoskeletal relationships in growing subjects. In particular, both thumb and dummy sucking are associated with reduced maxillary arch width and increased palatal depth.[1,2] Katz et al[3] assessed the relationship between nonnutritive sucking habit, facial morphology, and occlusion in 3 planes of space in 330 Brazilian children. A significant association was found between sucking habit and malocclusions, such as posterior crossbite and anterior open bite.

It has been emphasized that vertical facial patterns might play a strong role in the transverse growth of the maxilla and the mandible.[4] In addition, vertical skeletal characteristics of the face (hyperdivergency) are significant risk factors for anterior open bite in subjects with prolonged sucking habits in the mixed dentition.[5] It appeared interesting, therefore, to analyze the relationship between sucking habits and transverse maxillary deficiency in subjects with increased vertical dimensions. In particular, our aim in this study was to compare the transverse occlusal characteristics of subjects with sucking habits and hyperdivergent facial patterns with those of a control group of subjects with normal vertical relationships without sucking habits.

MATERIAL AND METHODS

The test group consisted of 80 subjects (mean age, 8 years 9 months ± 1 year 6 months; 48 girls, 32 boys) from the files of the orthodontic departments of the universities of Florence and of Rome Tor Vergata. The subjects were selected based on the following criteria: (1) intermediate mixed dentition (permanent incisors and first molars fully erupted, deciduous teeth in the buccal region—canine, first molar, and second molar[6]), (2) sucking habit (thumb or dummy sucking) beyond the age of 3 years, (3) Class I occlusal relationship, (4) normal sagittal skeletal relationships (2 <ANB angle <4), and (5) hyperdivergent facial pattern (facial hyperdivergency was diagnosed on the basis of the concurrent FMA >25°).[7]

The control group consisted of 185 subjects in the

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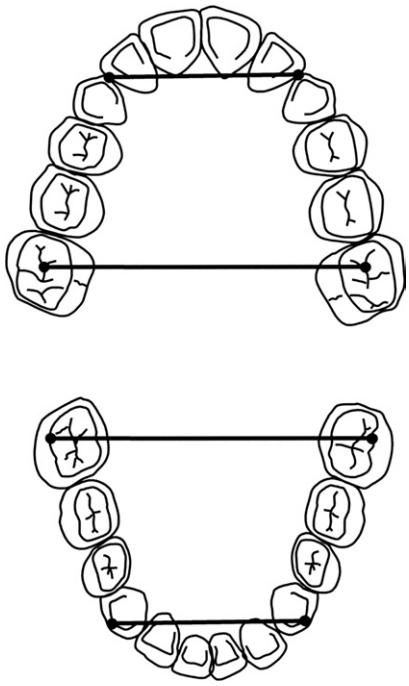

Fig. Transverse measurements on dental casts.

intermediate mixed dentition (mean age, 9 years ± 1 year 8 months; 103 girls, 82 boys) from the same universities with no sucking habit, and with Class I occlusion, and normal sagittal and vertical skeletal relationships.

Each subject was accurately evaluated clinically. For each subject, anamnestic records were also available for the assessment of sucking habits. Dental casts and lateral cephalograms were analyzed to evaluate dentoskeletal relationships.

Posterior crossbite was recorded when at least the maxillary first permanent molar occluded palatally to the opposing mandibular molar. No discrimination was made between unilateral and bilateral posterior crossbites.

On the lateral cephalograms, sagittal and vertical skeletal relationships were assessed in both groups. As for occlusal measurements, overjet was measured from the incisal margin of the most protruded maxillary incisor to the facial surface of the corresponding mandibular incisor and recorded in millimeters. Overbite was measured as the vertical distance between the incisal edges of the most protrusive maxillary and mandibular central incisors. Anterior open bite was recorded when overbite was less than 0 mm.

Several measurements were made on the dental casts (Fig). Maxillary intercanine width was measured as the distance between the most mesial points on the palatal surface of the deciduous canine at the maxillary arch, and mandibular intercanine width was measured as the distance between the cusp tips of the deciduous canine at the mandibular arch. Anterior transverse interarch discrepancy was calculated as the difference between maxillary and mandibular intercanine widths.

Maxillary intermolar width was measured as the distance between the central fossae of the maxillary right and left first molars. Mandibular intermolar width was measured as the distance between the tips of the distobuccal cusps of the mandibular right and left first molars.

Posterior transverse interarch discrepancy was calculated as the difference between maxillary and mandibular intermolar widths.[8]

The measurements were made with a dial calliper to the nearest 0.01 mm.

Statistical analysis

The statistical comparison between the test and control groups was performed with independent sample *t* tests ($P < .05$). The use of parametric statistics was allowed by the normal distribution of the data and the equality of variances. The chi-square test was performed to compare the prevalence rates of anterior open bite, posterior crossbite, and functional mandibular shift in the 2 groups.

Method error for dental cast and cephalometric measurements was assessed with Dahlberg's formula[9] on 30 repeated measurements randomly selected from the total observations. Method error for the dental casts measurements was 0.16 mm. The errors ranged from 0.43° to 0.88° for angular cephalometric measurements and from 0.77 to 0.87 mm for linear measurements.

RESULTS

Our results (Table) showed that overjet was similar in the test and control groups (3.6 and 3.8 mm, respectively), whereas overbite was significantly smaller ($P < .001$) in the test group than in the control group (−0.1 vs 3.0 mm). The prevalence rate of anterior open bite in the test group was significantly greater (61%) than in the control group (19%, $\chi^2 = 35.0$, $P < .001$). The prevalence rate of posterior crossbite in the test group was significantly greater (52%) than in the control group (14%, $\chi^2 = 30.9$, $P < .001$).

The test group showed significantly smaller maxillary intermolar and intercanine widths (42.2 and 22.7 mm, respectively) when compared with the control group (45.0 and 24.2 mm, respectively) ($P < .01$). No significant differences were found for mandibular intermolar and intercanine widths in the test group (45.7

Table. Descriptive statistics and statistical comparisons for cephalometric and dental cast measurements

	Test group		*Control group*		
Measurement	*Mean*	*SD*	*Mean*	*SD*	P *value*
SNA angle (°)	78.1	3.0	79.5	2.5	NS
SNB angle (°)	75.2	3.3	76.4	2.5	NS
ANB angle (°)	2.9	1.2	3.1	0.9	NS
FMA (°)	31.3	3.6	26.8	2.3	†
Overjet (mm)	3.6	2.1	3.8	2.7	NS
Overbite (mm)	−0.1	2.8	3.0	2.1	†
Maxillary intermolar width (mm)	42.2	2.5	45.0	2.5	*
Mandibular intermolar width (mm)	45.7	2.5	46.4	2.6	NS
Maxillary intercanine width (mm)	22.7	2.2	24.2	2.7	*
Mandibular intercanine width (mm)	25.0	2.2	25.6	2.1	NS
ATID (mm)	−2.3	2.5	−1.5	2.5	NS
PTID (mm)	−3.6	2.6	−1.3	1.3	†

ATID, Anterior transverse interarch discrepancy; *PTID,* posterior transverse interarch discrepancy.
*$P < 0.01$; †$P < 0.001$; *NS,* not significant.

and 25.0 mm, respectively) when compared with the control group (46.4 and 25.6 mm, respectively).

The test group showed a significantly greater posterior transverse discrepancy (−3.6 mm) with respect to the controls (−1.3 mm) ($P < .001$), but no significant differences were found between the 2 groups for anterior transverse discrepancy (−2.3 mm in the test group vs −1.5 mm in the control group).

DISCUSSION

In this study, we analyzed the transverse occlusal features of subjects with prolonged sucking habits and increased vertical dimension in the intermediate mixed dentition. The findings confirmed the significant tendency toward anterior open bite in hyperdivergent subjects with prolonged sucking habits.[3,5] The prevalence rate of anterior open bite was 3 times greater in hyperdivergent subjects with prolonged sucking habits than in normal subjects. The average amount of overbite was 3 mm smaller in these subjects compared with the normal controls. Similar results were found in a previous investigation that demonstrated that prolonged sucking habits and increased vertical skeletal relationships are significant risk factors for anterior open bite in the mixed dentition.[5]

As for the transverse features of subjects with sucking habits and hyperdivergency, a significantly narrower maxillary arch was recorded when compared with normal controls. An average difference of about 3 mm was assessed for maxillary intermolar width between the test and control subjects. This difference is statistically significant and clinically relevant. However, no significant difference for mandibular intermolar width was found between the 2 groups (−0.7 mm). As a consequence, subjects with sucking habits and hyperdivergency had significantly greater posterior transverse discrepancy with respect to the controls (about −2.5 mm).

The maxillary intercanine measurement showed a significant difference between the test and control groups, with an average deficiency in maxillary intercanine width of 1.5 mm in subjects with sucking habits. Aznar et al[2] also demonstrated that dummy use causes reduction of maxillary arch width, especially in the canine region. No significant difference for mandibular intercanine width was found between the test and control groups (−0.6 mm). No significant difference was found between the 2 groups for anterior transverse discrepancy (−0.8 mm).

A significantly narrower maxillary arch in the posterior region in subjects with sucking habits and hyperdivergency was reflected in the significant increase in the prevalence rate of posterior crossbites. More than half of these subjects showed crossbite at least at the level of the first permanent molars. The prevalence of posterior crossbite in the test group was almost 4 times that in the control group. In a previous investigation, Katz et al[3] reported a prevalence for posterior crossbite of about 12% in 4-year-old children with sucking habits. The higher prevalence rate of posterior crossbite found in this study must be because we evaluated children from orthodontic populations, whereas Katz et al[3] analyzed children from state school districts.

The transverse occlusal characteristics of subjects with sucking habits and hyperdivergency in the intermediate mixed dentition (narrow maxillary intermolar and intercanine widths associated with increased posterior transverse discrepancy and increased prevalence of posterior crossbites) are indications for treatment protocols aimed to increase the transverse dimensions of the maxillary arch. The use of therapeutic devices such as rapid maxillary expanders (alone or combined with other treatment protocols to control the vertical dimension of the face—eg, the vertical pull chincup[10]) or the quad-helix are therefore indicated for the correction of the transverse disharmony in these subjects.[11] The elimination of persisting sucking habits and the control of the vertical dimension must be additional therapeutical objectives. A recent study reported effective elimination of thumb sucking and correction of anterior open bites in hyperdivergent subjects with

sucking habits treated with the quad-helix combined with the palatal crib.[11] Future investigations should evaluate the effects on the transverse dimensions of the dental arches induced by treatment protocols aimed to stop sucking habits in growing subjects.

CONCLUSIONS

Our findings showed that prolonged sucking habits and hyperdivergency in the mixed dentition are significantly associated with transverse occlusal disharmonies: narrow maxillary intermolar and intercanine widths, increased posterior transverse discrepancy, and increased prevalence of posterior crossbites.

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