Original Article

Class II Malocclusion with Maxillary Protrusion from the Deciduous Through the Mixed Dentition: A Longitudinal Study

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Abstract: The aim of this study was to analyze the skeletal characteristics of Class II malocclusion with maxillary protrusion in the deciduous dentition and to describe the growth features of this type of skeletal imbalance during the transition from the deciduous through the mixed dentition. A group of 17 subjects having skeletal Class II malocclusions in the deciduous dentition due to maxillary protrusion was compared with a control group of 30 untreated subjects with ideal occlusion at the same stage of development. Both groups were observed for the first time in the deciduous dentition (T_1) and followed during the transition from the deciduous to the mixed dentition (T_2). During this time no orthodontic treatment was provided. Lateral cephalograms were taken for all subjects at T_1 and T_2. A cephalometric analysis was performed based on a reference system that consisted of two perpendicular lines traced through stable basicranical structures. The results indicate that a Class II skeletal pattern due to a maxillary protrusion is established early in the deciduous dentition and remains unmodified in the transition to the mixed dentition. The maxilla appeared to be displaced forward in Class II subjects, whereas the mandibles of the Class I and Class II subjects did not show any significant differences at this stage of growth. In the passage from the deciduous through the mixed dentition, Class I and Class II subjects showed growth increments that were not significantly different from each other. Sucking habits appeared to be correlated with the skeletal maxillary protrusion. (*Angle Orthod* 2005;75:980–986.)

Key Words: Class II; Deciduous dentition; Maxillary protrusion

INTRODUCTION

Early traits of a Class II malocclusion are observable in the deciduous dentition.[1–10] Foster and Hamilton[3] studied British children from 2.5 to three years and reported a 38.8% prevalence of distal step of the second deciduous molars and a 59% prevalence of Class II deciduous canine relationships. The respective values in Finnish children were reported to be 43.3% and 68.1%.[4] Bishara et al reported that a full Class II malocclusion in the deciduous dentition is never self-correcting in growing children.[5] Several reports have noted that a distal-step relationship of the second deciduous molars leads to a Class II relationship of the first permanent molars in the transition from the deciduous to the mixed dentition.[5–10]

The early skeletal characteristics of a Class II malocclusion have not been investigated extensively in the literature. In subjects with a deciduous dentition showing a Class II occlusal relationship, Baccetti et al[10] found a significantly retruded and shorter mandible. Varrela[1,2] reported lesser dimensions of the mandibular corpus and a larger gonial angle. In the transition from the deciduous to the mixed dentition, Class II subjects have been reported to show significantly larger increments in maxillary protrusion, whereas total mandibular length and the length of mandibular body show significantly smaller increments in comparison with normal subjects.[10] Smaller decrements of the gonial angle and a more backward and downward incli-

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Accepted: November 2004. Submitted: September 2004.

nation of the condylar axis in relation to the mandibular line have also been reported present in the Class II group.[10]

Interestingly, the skeletal features of Class II malocclusion with maxillary protrusion have never been analyzed as early as in the deciduous dentition in the literature. Therefore, the aim of this study was to analyze the skeletal characteristics of Class II malocclusions with maxillary protrusion in the deciduous dentition and to describe the growth features of this type of skeletal imbalance in the transition from the deciduous through the mixed dentition.

MATERIALS AND METHODS

Two groups of untreated subjects were selected from the archives of the Department of Orthodontics at the University of Florence. The first group consisted of 17 subjects (11 boys and six girls) in the deciduous dentition diagnosed as having a skeletal Class II malocclusion due to maxillary protrusion (maxillary protrusion group, MPG). The identification of the Class II sample was based on the use of floating norms for the deciduous dentition as reported by Tollaro et al.[11] A distal-step relationship of the second deciduous molars, Class II deciduous canine relationships, and excessive overjet were also present, as recorded in the clinical records and the dental casts. The control group (CG) was composed of 30 subjects (13 boys and 17 girls) with normal occlusion in the deciduous dentition as demonstrated by a mesial step relationship of the second deciduous molars, Class I deciduous canine relationships, and a normal overjet.[12]

The mean age of MPG was 5.6 $\pm$ 1.2 years at T_1 for deciduous dentition and 7.9 $\pm$ 1.5 years at T_2 for mixed dentition. The observation interval was a mean of 2.3 $\pm$ 1.2 years.

The mean age of the CG at T_1 was 5.7 $\pm$ 0.7 years for deciduous dentition and 8.0 $\pm$ 1.2 years at T_2 for mixed dentition. The observation period was a mean of 2.4 $\pm$ 1.0 years.

Both groups were observed for the first time in the deciduous dentition and followed during development from the deciduous to the mixed dentition. No orthodontic treatment was provided during the observed period. Lateral cephalograms were available for all subjects of both groups at T_1 and T_2.

The anamnestic records of all subjects in both MPG and CG were analyzed. The presence of sucking habits at T_1 was noted.

Cephalometric analysis

A computer-assisted analysis of the serial lateral cephalograms of the two groups was performed using a digitizing tablet (Numonics 2210, Numonics, Londsdale, Pa) and digitizing software (Viewbox, ver. 3.0, D. Halazonetis, Athens, Greece). The magnification factor of all lateral cephalograms of the two groups at T_1 and T_2 were standardized at 10%.

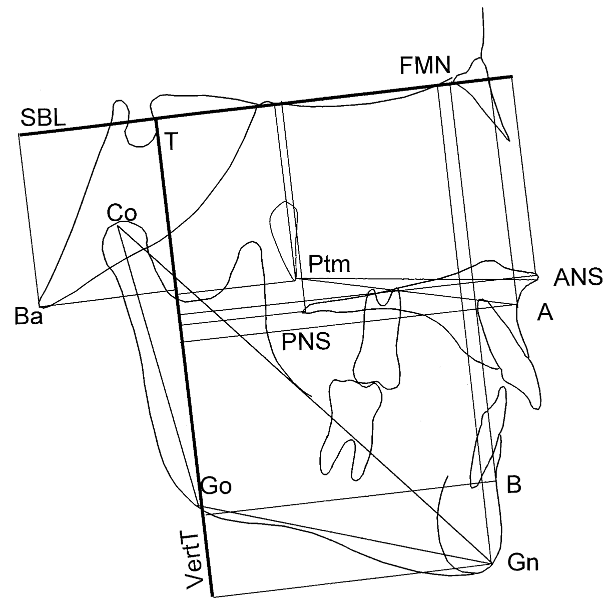

FIGURE 1. Linear measurements—linear cephalometric measurements.

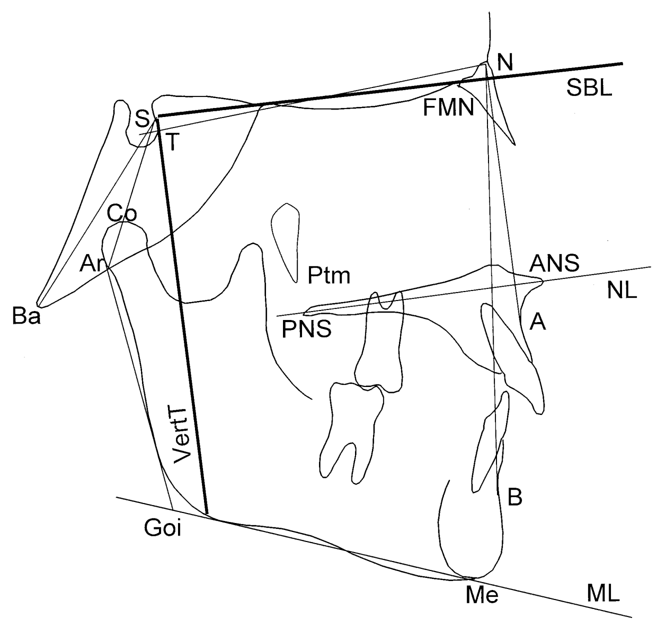

FIGURE 2. Angular measurements.—angular cephalometric measurements.

The cephalometric analysis (Figures 1 and 2) was based on a reference system that consisted of two perpendicular lines traced through stable basicranical structures:[13]

- Stable basicranial line (SBL). A line through the most

TABLE 1. Descriptive Statistics of Cephalometric Measurements of TG and CG at T_1

Cephalometric Measurements	Class II Deciduous (n = 17)					Class I Deciduous (n = 30)					Mann-Whitney *U* test	
	Mean	Median	SD	Min	Max	Mean	Median	SD	Min	Max	*Z*	Sig.
SNA	84.5	85.0	2.5	79.3	89.3	80.6	80.7	3.3	74.4	86.1	−3.764	***
SNB	76.2	76.3	2.9	71.1	81.8	76.4	76.7	3.1	70.0	81.8	−0.310	NS
ANB	8.3	8.2	2.1	4.9	13.0	4.2	4.2	1.4	1.4	7.4	−5.181	***
Ptm-VertT	11.1	11.0	2.4	6.2	17.7	10.3	10.6	2.7	5.0	16.1	−0.819	NS
Ptm-LBS	26.3	26.5	1.9	22.0	30.1	25.3	25.5	2.3	21.1	31.3	−1.771	NS
PNS-VertT	14.2	13.7	2.5	10.2	21.0	12.7	12.4	3.0	4.9	18.8	−1.661	NS
PNS-LBS	33.3	32.8	2.0	29.2	37.8	32.3	32.2	2.6	27.3	38.5	−1.373	NS
ANS-VertT	53.7	53.7	2.3	50.6	58.5	50.9	51.0	4.3	4.3	62.5	−2.790	**
ANS-LBS	34.1	34.1	3.1	26.7	40.7	34.0	33.8	2.4	28.8	37.8	−0.066	NS
A-VertT	51.0	50.8	2.4	47.2	55.3	48.1	47.8	4.4	37.4	60.0	−3.055	**
A-LBS	37.3	37.3	3.0	30.0	43.5	37.1	37.2	2.5	32.7	41.6	−0.332	NS
B-VertT	40.9	41.3	3.3	34.5	45.8	40.8	40.5	5.6	28.2	55.1	−0.266	NS
B-LBS	64.5	64.9	5.1	53.5	75.9	64.4	64.2	4.5	53.9	75.0	−0.177	NS
Gn-VertT	35.7	36.3	2.7	29.4	39.4	35.8	35.1	6.0	24.1	48.9	−0.465	NS
Gn-LBS	79.3	78.8	5.9	67.2	92.8	77.8	78.1	5.4	63.5	92.1	−0.841	NS
Ba-T-VertT	37.8	38.6	3.9	30.4	43.3	40.2	41.1	5.9	29.1	52.40	−1.727	NS
Ar-T-VertT	32.5	33.6	4.2	22.6	39.1	34.4	34.4	6.4	21.7	47.9	−1.107	NS
Ptm-A	41.4	40.8	2.5	37.8	46.3	39.6	39.3	2.1	35.6	44.8	−2.303	*
Ptm-ANS	43.3	42.7	2.4	38.8	48.4	41.6	41.5	2.3	37.9	46.9	−2.192	*
Co-Gn	79.7	79.2	5.1	68.8	91.4	79.8	79.4	4.8	69.6	93.0	0.000	NS
Co-Go	37.1	36.7	2.0	33.9	42.2	36.4	36.1	2.8	32.0	43.5	−1.240	NS
Go-Gn	51.0	51.2	4.1	41.4	58.2	52.2	51.7	3.9	43.5	60.3	−0.797	NS
ML-SBL	29.7	29.2	4.0	23.0	36.5	30.7	30.1	4.4	18.8	38.1	−0.863	NS
NL-SBL	1.2	1.9	2.4	−3.8	5.0	2.7	3.2	3.5	−5.8	10.2	−1.771	NS
NL-ML	28.5	29.3	4.2	20.3	33.9	28.0	28.2	4.5	17.4	37.2	−0.664	NS
Ar-Goi-Me	129.4	128.6	6.4	117.3	143.1	129.1	129.2	4.7	121.5	137.8	−0.089	NS

* $P < .05$; ** $P < .01$; *** $P < .001$.

superior point of the anterior wall of sella turcica at the junction with tuberculum sellae (Point T) and the fronto-maxillo-nasal suture identified as the most anterior point of the lamina cribrosa of the ethmoidal bone.

- Vertical T (VertT). A line perpendicular to SBL and passing through Point T.
- A cephalometric analysis based on this reference system comprised the following measurements:
- Angular measurements for the assessment of sagittal relationship: SNA, SNB, and ANB
- Linear measurements for the assessment of sagittal relationships: A-VertT, B-VertT, Ptm-VertT, PNS-VertT, ANS-VertT, B-VertT, and Gn-VertT
- Linear measurements for the assessment of vertical relationships: A-SBL, B-SBL, Ptm-SBL, PNS-SBL, ANS-SBL, B-SBL, and Gn-SBL
- Linear measurements for the assessment of maxillary dimensions: Ptm-A and Ptm-ANS
- Linear measurements for the assessment of mandibular dimensions: Co-Gn, Co-Go, and Go-Gn
- Angular measurements for the assessment of cranial base angulation: Ba-T-VertT and Ar-T-VertT
- Angular measurements for the assessment of vertical relationships: mandibular line (ML-SBL), nasal line (NL-SBL), nasal line–mandibular line (NL-ML), and gonial angle (Ar-Goi-Me).

Data analysis

The data from cephalometric analysis of the two groups were compared by a nonparametric test (Mann-Whitney *U*-test) for independent samples ($P < .05$) at T_1 and T_2.

The homogeneity between the Class II and the Class I samples regarding age and observation period at T_1 and T_2 allowed a comparison of growth changes (T_2-T_1) between the two groups (Mann-Whitney *U*-test). All statistical computations were performed with a Social Science Statistical Package Software (SPSS, Version 12.0, SPSS, Inc, Chicago, Ill).

Method error

Fifteen randomly selected cephalograms were retraced to calculate method errors for all the variables as described by Dahlberg.[14] Any systematic error was determined by calculating the coefficients of reliability for all the variables as suggested by Houston.[15] Method errors ranged from 0.1 to 0.9 mm for the linear measurements and from 0.4° to 1° for the angular

TABLE 2. Descriptive Statistics of Cephalometric Measurements of TG and CG at T_2

Cephalometric Measurements	Class II mixed (n = 17)					Class I mixed (n = 30)					Mann-Whitney *U* test	
	Mean	Median	SD	Min	Max	Mean	Median	SD	Min	Max	*Z*	Sig.
SNA	83.4	83.9	3.2	77.8	90.2	79.9	80.0	3.0	74.3	85.4	−3.343	***
SNB	76.0	76.1	2.6	70.8	79.5	76.7	76.5	3.2	68.5	81.3	−0.930	NS
ANB	7.4	7.4	1.7	4.2	10.7	3.2	3.5	1.8	0.2	6.6	−5.269	***
Ptm-VertT	11.5	11.3	2.2	7.3	16.2	10.5	11.0	2.9	4.6	15.5	−0.952	NS
Ptm-LBS	28.1	27.7	1.9	24.7	30.9	27.4	26.9	3.1	23.5	36.1	−1.572	NS
PNS-VertT	14.2	13.6	2.3	10.8	19.2	12.3	11.8	3.2	5.3	18.2	−2.214	*
PNS-LBS	35.1	35.1	2.2	30.1	39.3	34.9	35.0	2.9	28.8	42.8	−0.399	NS
ANS-VertT	54.9	54.4	2.4	51.1	60.6	52.2	51.9	5.1	39.6	68.3	−2.524	*
ANS-LBS	36.7	35.8	3.3	31.1	43.4	37.1	36.8	3.1	32.4	46.5	−0.487	NS
A-VertT	52.3	51.9	2.3	48.5	56.9	49.3	49.3	4.9	38.0	64.7	−2.989	**
A-LBS	39.5	38.2	3.1	34.6	46.5	40.1	40.3	3.4	34.2	51.1	−0.642	NS
B-VertT	42.1	42.3	3.2	36.1	46.3	42.4	41.8	6.1	28.9	60.2	−0.199	NS
B-LBS	69.7	67.7	4.8	64.9	82.0	69.8	69.0	6.1	53.8	90.3	−0.332	NS
Gn-VertT	38.0	39.5	3.8	30.4	42.8	38.3	37.8	6.6	23.1	56.5	−0.310	NS
Gn-LBS	84.1	82.3	5.3	77.7	95.9	83.8	82.3	7.1	63.7	106.3	−0.221	NS
Ba-T-VertT	38.0	38.3	4.2	31.0	45.0	40.2	40.9	5.6	28.8	50.6	−1.395	NS
Ar-T-VertT	33.2	33.6	4.4	24.9	43.3	34.8	34.6	6.2	22.0	47.5	−1.063	NS
Ptm-A	42.5	42.2	2.8	38.8	47.7	41.0	40.6	2.9	36.2	51.4	−1.816	NS
Ptm-ANS	44.4	44.1	3.1	40.2	50.9	42.9	43.1	3.2	36.7	53.7	−1.461	NS
Co-Gn	85.4	84.8	5.1	77.1	95.5	85.9	85.9	6.3	73.7	111.0	−0.288	NS
Co-Go	40.0	39.2	2.6	35.4	45.2	40.0	40.3	3.4	34.4	50.5	−0.244	NS
Go-Gn	55.4	55.6	3.9	48.1	63.7	56.5	56.1	4.7	46.5	72.4	−0.753	NS
ML-SBL	28.9	28.8	4.2	20.3	37.0	29.3	30.6	4.7	15.9	37.0	−0.598	NS
NL-SBL	2.3	2.9	3.0	−3.6	6.8	3.1	3.2	3.3	−2.3	10.2	−0.731	NS
NL-ML	26.6	27.5	4.8	15.0	32.9	26.2	26.9	5.2	9.1	34.7	−0.288	NS
Ar-Goi-Me	126.4	124.2	6.2	116.1	139.1	125.6	124.3	5.2	116.4	134.4	−0.310	NS

* $P < .05$; ** $P < .01$; *** $P < .001$.

measurements. Corresponding coefficients of reliability ranged from 0.96 to 1.00 for the linear measurements and from 0.94 to 1.00 for the angular measurements.

RESULTS

Descriptive data and statistical comparisons for the skeletal features in Class II and Class I samples in the deciduous and mixed dentitions are reported in Tables 1 and 2. Descriptive statistics and statistical comparisons for the growth changes in the transition from the deciduous through the mixed dentition in Class II and Class I subjects are described in Table 3.

Class II and Class I groups showed significant differences at T_1 for the SNA and ANB angles. Point A and anterior nasal spine appeared to be displaced forward in Class II subjects (ANS-VertT and A-VertT linear measurements were greater in MPG). Maxillary dimensions were found to be greater in subjects with maxillary protrusion as well (Ptm-A and Ptm-ANS linear measurements were greater in MPG).

At T_2, the Class II subjects maintained the skeletal Class II and forward position of the maxilla with respect to the Class I subjects (significant differences were found for the SNA and ANB angles and for PNS-VertT, ANS-VertT, and A-VertT linear measurements that were significantly greater in MPG as compared with CG). No significant differences were found for growth increments from T_1 to T_2 between the two groups. At T_1, sucking habits were present in 58% of the subjects with Class II malocclusion and 31% of the subjects with Class I occlusion.

DISCUSSION

Skeletal maxillary protrusion was described by Riesmeijer et al[16] as a main component of Class II malocclusion in the mixed and permanent dentitions. On the other hand, Lundstrom and Woodside,[17] Carter,[18] Buschang et al,[19] Ngan et al,[20] and others[21,22] found a lack of mandibular growth as the most prevalent skeletal aspect of distal occlusion. Using stable basicranial structures, Baccetti et al[10] observed that during the transition from the deciduous to the mixed dentition the upper jaw becomes significantly more protruded.

An accurate differential diagnosis in Class II malocclusions has to evaluate specifically the involvement of the maxilla and mandible in the sagittal and vertical planes from the early developmental phases to estab-

TABLE 3. Descriptive Statistics of Growth Increments of Cephalometric Measurements Between T_1 and T_2

Cephalometric Measurements	Class II Increment (n = 17)					Class I Increment (n = 30)					Mann-Whitney *U* test	
	Mean	Median	SD	Min	Max	Mean	Median	SD	Min	Max	*Z*	Sig.
SNA	−1.1	−1.2	1.5	−3.5	1.1	−0.7	−0.7	1.6	−4.2	3.1	−0.797	NS
SNB	−0.2	−0.2	1.7	−3.2	3.2	0.3	0.4	1.3	−1.9	3.2	−1.173	NS
ANB	−0.9	−1.1	1.3	−3.2	1.6	−1.0	−0.9	1.3	−3.7	1.9	−0.133	NS
Ptm-VertT	0.4	0.9	1.3	−2.3	1.8	0.2	0.2	1.0	−1.6	3.5	−1.306	NS
Ptm-LBS	1.8	1.6	1.4	−0.1	5.6	2.0	1.8	2.3	−2.3	10.0	−0.598	NS
PNS-VertT	0.0	0.0	1.7	−3.2	2.9	−0.4	−0.3	2.1	−4.9	3.5	−0.576	NS
PNS-LBS	1.8	1.8	1.4	−0.7	4.1	2.7	2.3	1.8	−0.2	9.8	−1.483	NS
ANS-VertT	1.2	1.4	1.7	−2.2	3.8	1.3	1.1	3.2	−3.3	12.1	−0.376	NS
ANS-LBS	2.6	2.1	2.6	−0.5	9.0	3.1	2.7	2.2	1.0	12.5	−1.018	NS
A-VertT	1.3	1.4	1.6	−1.3	4.3	1.2	1.2	2.7	−3.2	10.6	−0.399	NS
A-LBS	2.2	1.5	2.2	−1.0	8.2	3.0	3.2	2.6	−0.4	13.8	−1.284	NS
B-VertT	1.2	1.6	2.4	−3.1	6.1	1.5	1.9	2.9	−4.4	10.1	−0.465	NS
B-LBS	5.2	4.9	3.6	0.6	13.7	5.4	4.8	4.1	−0.1	21.3	−0.111	NS
Gn-VertT	2.3	3.3	2.5	−2.0	6.1	2.5	2.8	3.0	−3.3	10.1	−0.288	NS
Gn-LBS	4.8	4.4	3.0	0.0	12.1	5.9	5.4	4.3	−0.3	24.5	−1.616	NS
Ba-T-VertT	0.3	−0.3	2.4	−3.8	5.6	0.0	0.0	2.1	−4.1	3.5	−0.022	NS
Ar-T-VertT	0.7	0.4	2.8	−3.7	7.2	0.4	0.6	2.6	−6.9	5.7	−0.089	NS
Ptm-A	1.1	1.3	1.5	−1.1	3.8	1.3	1.6	2.4	−3.4	10.0	−0.598	NS
Ptm-ANS	1.1	0.8	1.8	−2.3	5.2	1.3	1.1	2.7	−4.0	11.0	−0.266	NS
Co-Gn	5.7	5.2	3.2	1.4	13.0	6.1	5.4	4.1	0.3	23.9	−0.487	NS
Co-Go	2.8	3.2	1.6	−0.3	6.0	3.6	3.3	2.2	−0.2	11.1	−1.085	NS
Go-Gn	4.4	4.0	2.7	0.6	10.3	4.3	3.5	3.3	−0.9	17.4	−0.244	NS
ML-SBL	−0.8	−0.6	1.6	−3.9	2.2	−1.3	−0.8	2.4	−7.9	2.4	−0.664	NS
NL-SBL	1.1	0.7	2.6	−3.3	7.5	0.4	0.3	1.7	−3.3	3.5	−1.041	NS
NL-ML	−1.9	−1.0	2.7	−7.7	2.0	−1.8	−1.5	2.3	−8.3	2.9	−0.199	NS
Ar-Goi-Me	−3.0	−2.2	2.0	−7.2	−1.0	−3.5	−2.7	3.0	−10.2	1.6	−0.487	NS

* $P < .05$; ** $P < .01$; *** $P < .001$.

lish an appropriate treatment plan. For this reason, the present study focused exclusively on subjects with skeletal Class II malocclusion due to maxillary protrusion in the deciduous dentition to describe the skeletal features of this specific craniofacial disharmony in the deciduous dentition and the growth changes during the transition to the mixed dentition. The selection was based on an accurate diagnosis using the floating norms for the deciduous dentition described by Tollaro et al.[11] The degree of the ANB angle, which is probably the most widely used measurement, is affected by numerous limitations.[23] The ANB angle is influenced not only by sagittal jaw relationships but by vertical variables too. Floating norms provide a method of analysis that uses the variability of the associations among suitable cephalometric measures, on the basis of a regression model, combining both sagittal and vertical skeletal parameters. This method allows removal of many distorting factors associated with the unadjusted ANB angle and allows us to perform a correct differential diagnosis.[11,24–26]

Digit and dummy sucking have been described as important etiological factors for malocclusion, particularly for Class II due to maxillary protrusion. Larsson[25] in 1972 and Moore and McDonald[26] in 1997 investigated dentofacial characteristics of children with persistent sucking habits, and they both report an increase in the ANB and SNA angles and a significantly greater anteroposterior maxillary skeletal base in these subjects.

Moore and McDonald[26] did not find significant differences in the SNB angle and in mandibular length as well. Willmot[27] reported the case of 14-year-old homozygous twins, one of whom had a digit-sucking habit, and found that the only different cephalometric variable that appeared different was that the SNA angle was greater in the digit sucker. The analysis of anamnestic and clinical records of the subjects examined in the present study revealed that in the Class II group the prevalence of sucking habits was 58.8%, a high percentage significantly associated with the presence of a skeletal maxillary protrusion. The prevalence of persisting sucking habits in subjects with normal occlusion in the deciduous dentition is about 30%, and half of that is found in the maxillary protrusion group. In our sample, a direct correlation between the sucking habit and the severity of maxillary protrusion was not observable: severe maxillary protrusion was observable in children with and without sucking habits. An unfavorable skeletal facial pattern could be responsible for the maxillary imbalance even in the absence of sucking habits, eg, two subjects showed ANB angle $>11°$ without having an history of digit sucking.

Comparisons of cephalometric measurements at T_1 showed that all the points situated on the maxilla (A, ANS, and PNS) showed a significant forward position in Class II subjects as compared with Class I subjects at T_1 and at T_2 (Tables 1 and 2). The use of PNS and ANS allowed a more complete description of the skeletal features of the maxilla because the use of point A alone could be inaccurate. Point A does undergo an important remodeling during the early stages of growth.[28] In both groups, the maxilla showed similar growth features. PNS did not show a sagittal dislocation, whereas point A showed a forward displacement. The mandibular position, dimensions, and growth features in the Class II group were very similar to those in the Class I group, both in the deciduous and in the mixed dentition. In other words, the Class II skeletal pattern due to maxillary protrusion that had been established in the deciduous dentition was maintained in the transition to the mixed dentition, and the maxilla and the mandible both showed growth increments comparable with those shown by the Class I subjects.

Although the findings of this research indicate that early correction of Class II with maxillary protrusion is not obligatory and one-phase treatment starting in the late mixed dentition is possible, starting treatment in the early mixed dentition could be advisable when lip or tongue function are markedly altered. Psychological conditions related to esthetic problems and prevention of fractures of the upper incisors after traumas can also influence the decision of an earlier intervention. Further investigations based on stable basicranial structures in the successive phases of growth and, in particular, on the changes occurring during the pubertal spurt are advisable. An example of these kinds of studies might be studies on the early treatment of this kind of malocclusion.

CONCLUSIONS

- A Class II skeletal pattern due to maxillary protrusion is established early in the deciduous dentition and remains unmodified in the transition to the mixed dentition.
- The maxilla appears to be displaced forward in Class II subjects, whereas the mandible does not show a significant difference between Class II and Class I subjects at this stage of the growth.
- In the passage from the deciduous through the mixed dentition, Class II subjects show growth increments that are not significantly different from Class I subjects.
- Sucking habits appear to be correlated with the skeletal maxillary protrusion.

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