

Cephalometric Characteristics of Pseudo-Class III and Skeletal Class III Malocclusions

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Class III malocclusion has been divided into two subtypes: skeletal and pseudo-Class III.¹⁻⁶ Characteristics of the skeletal Class III malocclusion have been well documented in comparison with either normal occlusion or Class I malocclusion.⁷⁻¹⁴ However, the pseudo-Class III malocclusion has not often been compared with the skeletal Class III, probably because of the relatively low incidence of Class III malocclusion in non-Asians and the difficulty of distinguishing between pseudo-Class III and mild skeletal Class III.¹⁵⁻¹⁹

The purpose of the current study was to compare the characteristics of pseudo-Class III malocclusions with those of skeletal Class III malocclusions in southern Chinese children in the mixed or early permanent dentition.

Sample

All patients were of southern Chinese eth-



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nic origin and were treated in the Department of Orthodontics, Hong Kong University. All had full records taken in the mixed or early permanent dentition.

Thirty-six patients (15 females, 21 males, mean age 10 years, 7 months) were included in the pseudo-Class III malocclusion group, according to the following criteria:

1. Class III incisor relationship and Class I molar relationship (at least two incisors with reverse overjet and overbite) in centric occlusion.
2. Mandibular displacement.
3. No development of skeletal Class III malocclusion, as verified by follow-up after the growth spurt.
4. No treatment that might affect skeletal growth (reverse headgear, chin cup, maxillary expander, or functional appliance).

Forty patients (21 females, 19 males, mean age 9 years, 7 months) were included in the skeletal Class III malocclusion group. Selection criteria were:

1. Anterior crossbite and Class III molar relationship.
2. Severe skeletal Class III relationship confirmed by cephalometric analysis (ANB less than 0°).

Previous investigations have shown that skeletal Class III malocclusion is due to underdevelopment of the maxilla, overdevelopment of the mandible, or a combination of both.^{11-13,20-22} Therefore, we further divided the skeletal Class III subjects into two subgroups, based on cephalometric analysis and clinical examination:

1. Maxillary retrognathism (14 females, 10 males, mean age 9 years, 2 months).
2. Mandibular prognathism (seven females, nine males, mean age 10 years, 4 months).

Analysis

Dental, skeletal, and soft-tissue assessments were performed for both groups, using pretreatment lateral cephalograms taken in centric occlusion. The same cephalostat was used for all records, and the reference points were marked by a single observer.¹⁹ Analysis was performed with Dentofacial Planner 7.0* using traditional cephalometric analysis and the McNamara analysis.²³ The 15 variables were recorded independently on two separate occasions, two weeks apart.

Statistical analysis was performed using SAS 6.11 for Windows. A non-parametric test was used to determine the significance of age differences between male and female subjects within each group and between the two skeletal Class III subgroups. Since no significance was noted, the data for these groups were pooled. Unpaired t-tests were then used to compare the pseudo-Class III malocclusion group with each skeletal Class III malocclusion group.

Results (Table 1)

Skeletal Measurements

Craniofacial morphology: There were significant differences between the pseudo-Class III group and the maxillary retrognathism group in both anterior cranial length (SN, $p < .01$) and posterior cranial length (SAr, $p < .001$).

Sagittal maxillary position: The maxillary retrognathism group showed a significantly lower mean SNA and a significantly more retrusive A point, in relation to nasion perpendicular, compared to the pseudo-Class III subjects ($p < .05$). There were no significant differences between the pseudo-Class III and mandibular prognathism groups. Likewise, midfacial length (Co-A) was significantly different only between the pseudo-Class III and maxillary retrognathism groups ($p < .001$).

Sagittal mandibular position: SNB varied signifi-

cantly between the pseudo-Class III and mandibular prognathism groups, as did the mean distance from Pg to nasion perpendicular ($p < .01$). The mean Go angle was significantly lower for the pseudo-Class III group than for the maxillary retrognathism group ($p < .01$). There was a significant difference in mandibular length (Co-Gn) between the pseudo-Class III and mandibular prognathism groups ($p < .05$).

Maxillomandibular relationship: ANB and the maxillomandibular differential varied significantly between the pseudo-Class III and mandibular prognathism groups ($p < .01$). No significant difference was found between the pseudo-Class III and maxillary retrognathism groups.

Vertical relationship: Mandibular plane angles of the pseudo-Class III and maxillary retrognathism groups were significantly different ($p < .05$), but no significant difference was found between the pseudo-Class III and mandibular prognathism groups. In lower anterior facial height, there was no significant difference between the pseudo-Class III patients and either of the other categories.

Dental Measurements

Maxillary incisor inclination: When maxillary incisor inclination was evaluated by U1/MxPl, no significant differences were found among the pseudo-Class III, maxillary retrognathism, and mandibular prognathism groups. The mean measurement from the maxillary central incisor to the perpendicular from A point to FH (U1-AV) showed a significant difference between the pseudo-Class III and mandibular prognathism groups ($p < .05$).

Mandibular incisor inclination: There were extremely significant differences ($p < .001$) in the mean values of L1/MnPl between the pseudo-Class III group and both the maxillary retrognathism and mandibular prognathism groups.

Soft-Tissue Measurements

Facial convexity: A significant difference was found between the pseudo-Class III and

*Dentofacial Software Inc., 100 Simcoe St., Suite 303, Toronto, Ontario, M5H 3G2 Canada.

TABLE 1
CEPHALOMETRIC ANALYSIS†

	Pseudo- Class III (N = 36)		Retrognathic Maxilla (N = 24)		Prognathic Mandible (N = 16)		Sig. (Pseudo- Retrog.)	Sig. (Pseudo- Prog.)
	Mean	S.D.	Mean	S.D.	Mean	S.D.		
<i>Craniofacial</i>								
NSAr (°)	121.8	4.35	123.7	3.74	120.6	6.22	N.S.	N.S.
SN	65.4	2.74	62.8	3.84	63.8	3.47	**	N.S.
SAr	33.1	3.37	29.9	2.53	34.0	2.42	***	N.S.
<i>Sagittal Maxillary Relationship</i>								
SNA (°)	81.4	3.38	79.2	3.48	82.7	2.59	*	N.S.
A-N Perpendicular	-1.6	3.34	-3.6	3.46	-0.3	2.77	*	N.S.
Co-A	82.9	3.78	79.0	4.83	82.3	4.30	***	N.S.
<i>Sagittal Mandibular Relationship</i>								
SNB (°)	81.1	3.60	79.7	2.20	84.5	4.42	N.S.	**
Pg-N Perpendicular	-4.5	6.63	-7.0	4.35	2.9	9.25	N.S.	**
Go	122.1	5.72	126.3	6.17	124.8	6.21	**	N.S.
Co-Gn	111.3	5.27	108.3	6.25	117.0	10.20	N.S.	*
<i>Maxillomandibular Relationship</i>								
ANB (°)	0.4	2.28	-0.4	2.36	-1.7	3.33	N.S.	**
Mx-Md Differential	28.4	4.35	29.2	5.52	34.7	7.37	N.S.	**
<i>Vertical Relationship</i>								
MnPI (°)	25.9	6.04	29.5	4.85	29.4	5.75	*	N.S.
LAFH (°)	62.3	4.09	60.4	5.54	64.9	7.24	N.S.	N.S.
<i>Dental</i>								
U1/MxPI (°)	114.6	7.76	114.4	8.25	117.9	8.67	N.S.	N.S.
U1-AV	2.4	3.37	1.8	2.06	4.7	2.98	N.S.	*
L1/MnPI (°)	93.9	6.41	84.9	7.05	84.3	8.02	***	***
<i>Soft Tissue</i>								
Facial Convexity (°)	1.6	5.34	0.2	5.62	-3.8	7.65	N.S.	**
Upper Lip Cant (°)	11.2	2.92	12.1	2.58	12.4	4.10	N.S.	N.S.
Nasolabial Angle (°)	104.8	11.20	107.2	8.40	99.2	9.95	N.S.	N.S.
Upper Lip Protrusion (°)	6.7	1.54	5.0	1.67	6.0	1.58	***	N.S.
Lower Lip Protrusion (°)	7.6	1.64	7.2	1.74	8.3	1.35	N.S.	N.S.
Upper Lip to E Line (°)	0.1	2.17	-1.0	2.18	-1.0	1.91	N.S.	N.S.
Lower Lip to E Line (°)	4.0	1.97	3.7	2.07	4.6	1.77	N.S.	N.S.

†Linear measurements (mm) unless indicated as angular measurements (°).

*p < .05; **p < .01; ***p < .001; N.S.: p > .05.

mandibular prognathism groups ($p < .01$).

Upper lip protrusion: There was a highly significant difference between the pseudo-Class III and maxillary retrognathism groups ($p < .001$). No significant differences were found in any other soft-tissue measurements.

Discussion

Variations in diagnostic criteria between pseudo-Class III and skeletal Class III patients can have important clinical implications for the timing and mode of treatment.¹⁹ We recently reported a simple and effective method of treating pseudo-Class III patients with a 2 x 4 fixed appliance.²⁵ The skeletal Class III patients in the present sample, after their growth has been monitored for several years, will receive surgical-orthodontic treatment to eliminate dental and skeletal discrepancies.

The maxilla tends to be more retrusive in skeletal Class III patients with maxillary deficiency than in pseudo-Class III patients. Skeletal Class III patients with mandibular prognathism tend to have longer mandibles with significantly different sagittal positions, as measured by SNB and Pg-nasion perpendicular, compared to pseudo-Class III patients. The overall similarity in lower anterior facial height could be due to a mandibular functional shift, caused by incisor interference, in the pseudo-Class III patients.

Previous studies based on clinical impressions have concluded that pseudo-Class III patients exhibit retroclined maxillary incisors

and/or proclined mandibular incisors, in contrast with skeletal Class III malocclusions, where proclined maxillary incisors and retroclined mandibular incisors compensate for the underlying skeletal discrepancy.^{3,4,11,15-18,26} In the present investigation, however, only the skeletal Class III patients with mandibular prognathism showed both proclined maxillary incisors and retroclined mandibular incisors. Both the pseudo-Class III group and the maxillary retrognathism group had retroclined maxillary incisors, as measured by U1/MxPl, compared to the Chinese norm²⁷ (118°). Similar results were found when maxillary incisor inclination was assessed by U1-AV. On the other hand, when mandibular incisor angulation (L1/MnPl) was compared with the Chinese norm²⁷ (97°), the pseudo-Class III group had normal values, but both the maxillary retrognathism and mandibular prognathism groups showed dental compensation with extremely retroclined mandibular incisors.

In a skeletal Class III malocclusion, the soft tissues tend to camouflage the underlying discrepancy,¹⁴ and the patient often displays a concave facial profile with a short upper lip.²⁸ Comparison of extraoral photos from this study revealed that the pseudo-Class III profile appears normal in centric relation and slightly concave in centric occlusion.^{15,17,29}

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