

# Two-stage treatment of skeletal Class III malocclusion during the early permanent dentition

Jiuhui Jiang,<sup>a</sup> Jiuxiang Lin,<sup>b</sup> and Changrong Ji<sup>c</sup>

Beijing, China

A patient with skeletal Class III malocclusion was treated in 2 phases during the early permanent dentition. In phase 1, maxillary protraction was combined with rapid palatal expansion; in phase 2, fixed appliances were placed. The results were good posttreatment, and, 1 year later, a favorable growth tendency could be observed. This report shows that treatment for a patient with skeletal Class III malocclusion can be started in the early permanent dentition, with very good final results. (*Am J Orthod Dentofacial Orthop* 2005;128:520-7)

Most patients with developing Class III malocclusion display anteroposterior (A-P) maxillary deficiency with a normal to slightly protruded mandible. Many clinicians successfully treat these patients with maxillary protraction and palatal expansion.<sup>1-5</sup> Generally, treatment starts during the early mixed or late deciduous dentition,<sup>6</sup> and it is recommended that early treatment (phase 1) be started as early as possible for a more favorable result.<sup>5,7</sup> But the long-term stability of phase 1 treatment for Class III patients is still unclear, and relapse can occur. It seems that the earlier we start phase 1 treatment, the more problematic it becomes to maintain long-term stability. We decided to begin treatment for this patient in the early permanent dentition stage, hoping to reduce relapse.

## DIAGNOSIS AND ETIOLOGY

The patient was a girl, aged 11 years 3 months, whose chief complaints were crowding and anterior crossbite (Figs 1-5). Her medical history was unremarkable. Her father had edge-to-edge anterior occlusion. The patient had a concave profile with maxillary deficiency. Her mandible could not move into edge-to-

edge anterior occlusion. Her permanent dentition had erupted up to the mandibular second molars, and she had a persistent mandibular left second deciduous molar. There was 5 mm of crowding in the maxillary arch but almost none in the mandible. Her incisor relationship was Class III with overjet of -2 mm and complete overbite of 4 mm. The maxillary midline was coincident with the face, but the mandibular midline was deviated 1 mm to the right. The molar relationships were full Class III on both sides.

The panoramic film showed all 4 third molars unerupted. The lateral cephalometric radiograph and tracing showed a skeletal Class III relationship with maxillary retrusion and a little mandibular protrusion (Table).

## TREATMENT OBJECTIVES

The following objectives were identified: improve the soft tissue profile, correct the A-P skeletal discrepancy and the anterior crossbite, establish Class I canine and molar relationships, correct the midline, align the teeth, and coordinate the arch forms.

## TREATMENT ALTERNATIVES

A chin-cap appliance could be used during phase 1 treatment, but Sugawara et al<sup>8</sup> showed that Class III patients treated early with chin-caps alone have latent catch-up of mandibular displacement in a forward and downward direction. In addition, this modification treatment might not be suitable for Class III malocclusion patients with maxillary retrusion.

A second option was to wait until growth had ceased and then use dental camouflage treatment or orthognathic surgery. However, some patients and their parents reject orthognathic treatment, and, after growth

<sup>a</sup>Lecturer, Department of Orthodontics, School of Stomatology, Peking University, Beijing, China.

<sup>b</sup>Professor, Department of Orthodontics, School of Stomatology, Peking University, Beijing, China.

<sup>c</sup>Professor, Department of Orthodontics, School of Stomatology, Capital University of Medical Sciences, Beijing, China.

Reprint requests to: Dr Jiuhui Jiang, Department of Orthodontics, Peking University, School of Stomatology, 23 Zhongguancunnandajie, Haidian District, Beijing, 100081, China; e-mail, williamjiang@21cn.com.

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Fig 1. Pretreatment facial photographs.



Fig 2. Pretreatment intraoral photographs.

has ceased, solving the problem with orthodontic treatment alone can be difficult; it seldom achieves the desired results. Most parents hope to begin their child's treatment early to avoid negative psychological effects.

The third treatment option consisted of maxillary protraction combined with rapid palatal expansion to correct (or overcorrect) the anterior crossbite, followed by fixed appliance treatment. This option was selected.

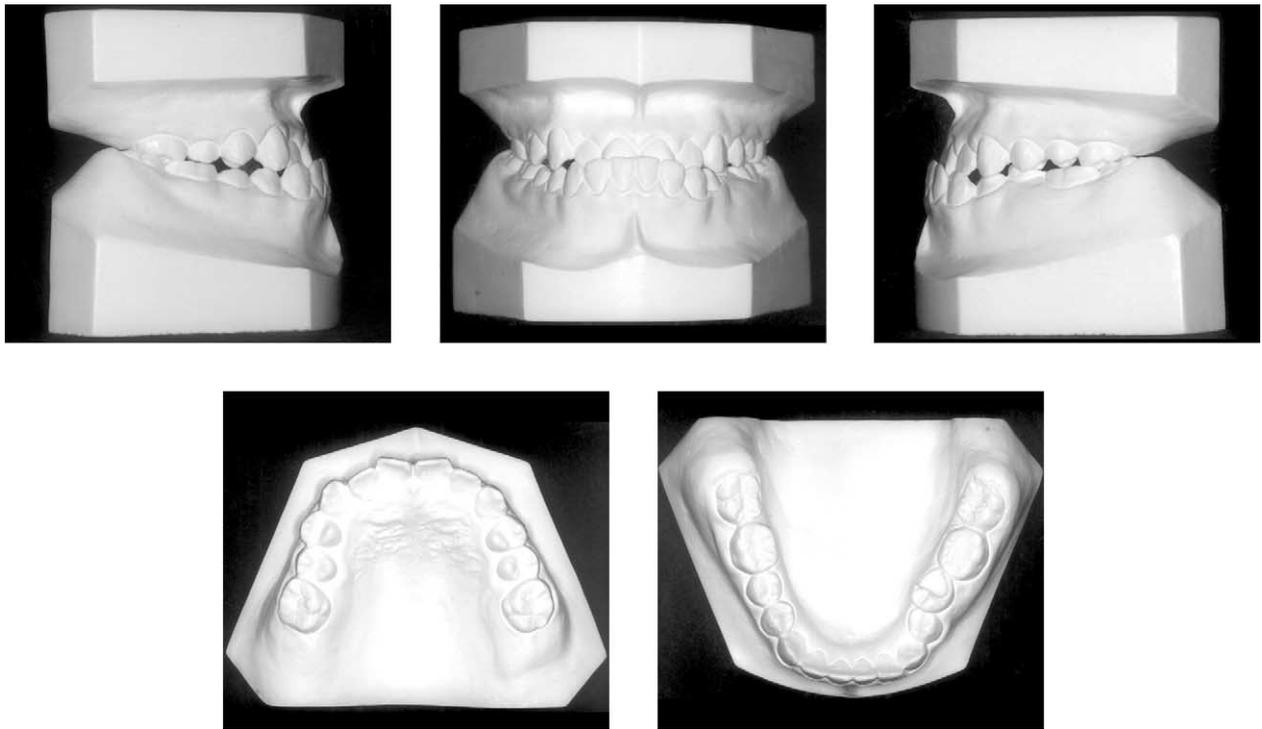
#### TREATMENT PROGRESS

During phase 1, a banded (both first molars and first premolars), jackscrew rapid palatal expansion appliance was activated 90° twice a day for 2 weeks (7 mm total expansion); the screw was then reversed to its original stage over a 1-week period. Hooks were soldered to the bands of the maxillary first premolars, extending to the mesial surface of the canines. Delaire's facemask was used for 12 hours a day, with a force of 500 g on each side directed nearly 30° downward and forward. Six months later, the A-P crossbite had been corrected (Fig 6).

For phase 2, the intraoral appliance was removed, the molars were rebanded, and the remaining teeth were bonded with a 0.022-in edgewise appliance. The first archwire, 0.016-in nickel-titanium, was followed by 0.017 × 0.025-in nickel-titanium, 0.018-in stainless steel, and 0.018 × 0.025-in stainless steel (Fig 7). After 6 months' observation, we removed the fixed appliances and placed removable Hawley retainers in the maxilla and mandible. Total treatment time was 22 months.

#### TREATMENT RESULTS

After active treatment, nearly all skeletal and dental objectives had been achieved (Figs 8-12). The anterior crossbite had been corrected, and Class I molar and canine relationships had been achieved on both sides. These results seemed stable 1 year later (Figs 13-15). The sagittal discrepancy was improved significantly. The maxilla had moved forward, and SNA angle had increased from 79.3° to 82.5° after active treatment, reaching 86.3° 1 year later. The mandible was rotated downward and backward slightly. Superimposition of



**Fig 3.** Pretreatment study models.



**Fig 4.** Pretreatment cephalometric tracing shows skeletal Class III relationship with maxillary retrusion and some mandibular protrusion.



**Fig 5.** Pretreatment panoramic radiograph.

pretreatment and posttreatment tracings showed good skeletal modification of the maxilla.

**DISCUSSION**

Early treatment with maxillary protraction and palatal expansion can correct most A-P discrepancies in Class III patients. Further study is needed to determine the best timing of early treatment for long-term stability.

Delaire has shown that forward positioning of the skeletal maxilla can be achieved with reverse head-

**Table.** Cephalometric analysis from lateral radiographs

A-P variables	Pretreatment	After phase 1	After phase 2	1 year posttreatment
<b>Skeletal variables</b>				
SNA	79.27	82.22	83.51	86.28
SNB	82.24	80.85	81.96	83.38
SNPg	81.54	80.77	81.84	82.95
ANB	-2.97	1.37	1.55	2.90
Wits	-9.07	-3.18	-3.21	-1.98
ANFH*	-3.34	.51	.73	3.25
MP/SN	34.73	38.43	36.93	37.60
MP/PP	23.29	27.89	29.58	29.90
MP/FH	27.14	31.14	30.13	30.66
SGo/NMe	.65	.60	.62	.60
<b>Dental variables</b>				
U1/PP	121.27	127.52	127.66	122.33
U1/SN	111.14	118.08	120.80	116.94
U1-AP	4.07	8.84	10.80	9.80
L1/MP	87.70	83.16	89.10	88.55
L1/FH	61.27	54.63	52.40	56.11
L1-AP	7.95	4.11	6.59	5.83
SN/OP1	13.55	16.66	14.74	16.34
U1/L1	126.43	120.33	113.17	116.90
<b>Soft tissue variables</b>				
NLA(Cm-Sn-UL)	93.69	93.07	89.24	88.10
LL-EP	6.41	4.76	4.73	4.36
UL-EP	-.91	1.06	2.11	.90
Z angle	62.24	62.26	62.68	62.55

\*Point A to nasion perpendicular.<sup>16</sup>

gear if treatment is started at an early age.<sup>9</sup> He suggested that, to be successful, forward positioning of the maxilla should be accomplished before 8 years of age, because after that, orthodontic tooth movement usually overwhelms skeletal movement. According to McNamara,<sup>10</sup> the best time to begin early Class III treatment is in the early mixed dentition, coincident with eruption of the maxillary permanent central incisors. Proffit and Fields<sup>11</sup> recommended that a child with maxillary deficiency have a complete evaluation as early as possible. Baccetti et al<sup>2</sup> studied 46 patients with mixed dentition and found more significant maxillary modification in the early phases of mixed dentition than in later phases. But Merwin et al,<sup>12</sup> in a study of 30 patients, noted strikingly similar skeletal responses in younger (5-8 years old) and older (9-12) groups. Baik<sup>1</sup> examined 47 Korean children and found no statistically significant differences among the 3 groups (<10, 10-12, and >12 years), although he stated that the samples were insufficient. Sung and Baik<sup>13</sup> later evaluated the effect of maxillary protraction in 129 subjects aged 7 to 12 with Class III malocclusions divided into 6 groups according to age; they found no statistically significant differences.

The earlier phase 1 treatment is started, the better



**Fig 6.** Cephalometric tracing just after phase 1 treatment. Anterior crossbite has been corrected.



Fig 7. Intraoral photographs during phase 2 treatment.



Fig 8. Extraoral photographs after phase 2 treatment.

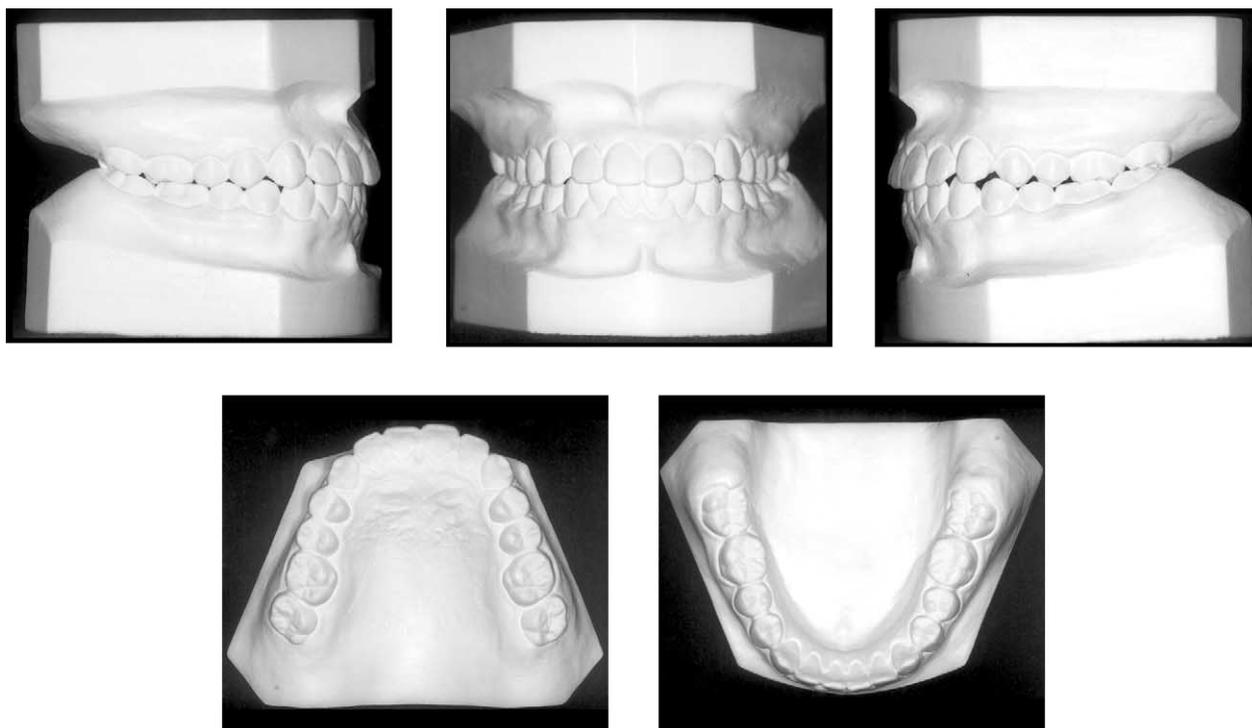


Fig 9. Intraoral photographs after phase 2 treatment.

the chance of achieving the desired skeletal and dental modifications. However, good results are still possible in older patients. Kapust et al<sup>5</sup> examined 63 patients in 3 groups (4-7, 7-10, and 10-14 years) and suggested that early treatment produced a more favorable result, but older children also had significant treatment effects. Saadia and Torres<sup>7</sup> reported similar results. By noting the subjects' ages in these studies, we can tell that some patients might have been in the early permanent dentition, but this was not specifically addressed.

When we talk about the treatment of patients with

skeletal Class III malocclusions, long-term stability should not be ignored; severe relapse can occur. Relapse can cause feelings of failure and frustration for the child, the parents, and even the doctor. Therefore, we try to initiate treatment a little later, near the end of growth, because the result will tend to be more stable. We began phase 1 treatment for this patient during the early permanent dentition. By this time, a patient is often more ready to cooperate, and phase 2 (fixed-appliance) treatment can be started immediately, eliminating the need to maintain the



**Fig 10.** Study models after phase 2 treatment.



**Fig 11.** Cephalometric tracing after phase 2 treatment.



**Fig 12.** Panoramic radiograph after phase 2 treatment.

phase 1 result. The total treatment time is therefore shortened. For patients in the early permanent dentition, judging the growth tendency and prognosis should be somewhat easier than during the deciduous or mixed dentition.

We obtained good results for this patient from both phase 1 and phase 2 treatments. The 2 weeks of rapid palatal expansion contributed considerably to the phase 1 treatment effect. Even though the patient had no transverse maxillary deficiency, expansion promoted



Fig 13. Intraoral photographs 1 year posttreatment.



Fig 14. Cephalometric tracing 1 year posttreatment.

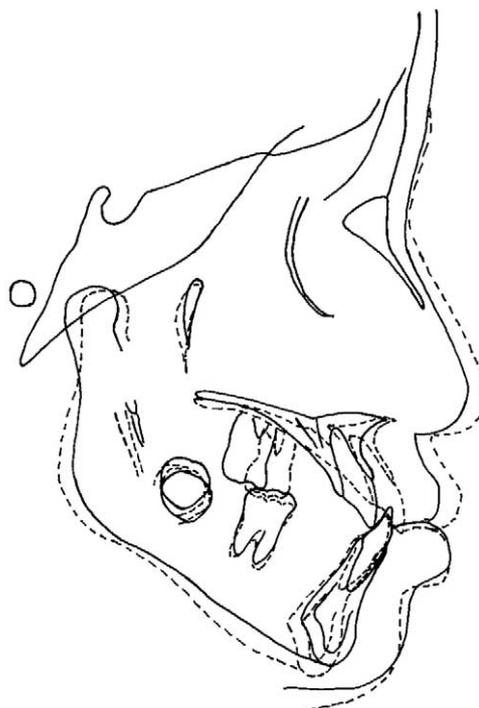


Fig 15. Superimposed tracings (—, pretreatment; - - - -, 1 year posttreatment).

maxillary protraction by disrupting the maxillary sutural system.<sup>14</sup> Maxillary protraction combined with rapid palatal expansion can achieve good orthopedic results for skeletal Class III patients, even those in the permanent dentition. One year after phase 2 treatment, the maxilla seems to have moved forward even more than during the 1-year phase 2 treatment; this is contrary to the report of MacDonald et al,<sup>15</sup> who said that, after facemask therapy, the maxilla grew the same as in untreated Class III patients but less than in Class I patients. In our case, the maxilla showed greater growth 1 year after active treatment; SNA angle increased  $2.8^\circ$  during retention, in contrast to a  $1.3^\circ$  increase during phase 2; U1/SN decreased  $2.7^\circ$ , in contrast to a  $3.8^\circ$  increase during phase 2. Further studies should be done with a larger sample and longer observation time (until

eruption of the third molars, if possible), to explore the long-term stability of treatment in the early permanent dentition.

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