

CASE REPORT

Non-Surgical Treatment of an Adult Skeletal Class III Patient with Insufficient Incisor Display

CHEOL-HO PAIK, DDS, PHD
YOUNGJOO JUDIE WOO, DDS
ROBERT BOYD, DDS, MED

Improving an insufficient incisor display is essential in building an attractive smile. It becomes particularly critical in Class III patients who lack upper lip support because of a deficient maxilla. Forward and downward maxillary protraction will usually increase the incisor display in such cases.

This report shows the treatment of an adult skeletal Class III patient, with a rapid palatal expander (RPE), modified lip bumper, and intermaxillary elastics used to extrude the maxillary dentition in a forward and downward direction.

Diagnosis

An 18-year-old female presented with the chief complaints

of midfacial concavity and a protrusive chin (Fig. 1). A minimal upper incisor display made her smile unappealing to her. The patient had undergone nonextraction orthodontic treatment as an adolescent to “straighten her front teeth”. Unfortunately, she experienced a skeletal Class III growth pattern after treatment.

The diagnostic evaluation revealed bilateral Class III canine and molar relationships, a 1.5mm overjet, and a .5mm overbite. The upper incisors were severely proclined, and the lower incisors moderately retroclined, with minor spacing in the lower anterior area. In the frontal full smile view, less than 20% of the maxillary incisor crowns was revealed. Oral hygiene and overall periodontal health were excel-

lent.

Cephalometric measurements indicated a Class III horizontal relationship, with an ANB differential of -5.5° (Table 1). The maxilla was retrusive relative to the cranial base, as reflected in the patient’s mild midfacial concavity. Her lower facial height was short, and she had a brachyfacial vertical pattern.

Treatment Planning

The patient was more concerned about her facial appearance than her occlusion. Reducing the prognathic appearance of the mandible and adding fullness in the midface were her main treatment objectives. Because the lack of incisor display could be expected to worsen with

Drs. Paik and Woo are in the private practice of orthodontics at SAI Orthodontic Center, Sochodong 1690-3, Seoul 137-070, Korea, and Visiting Assistant Professors, Department of Orthodontics, School of Dentistry, University of the Pacific, San Francisco, San Francisco, CA. Dr. Paik is also a Clinical Professor, Department of Orthodontics, Seoul National University and Dankook University, Korea. Dr. Boyd is Professor and Chairperson, Department of Orthodontics, School of Dentistry, University of the Pacific, and is a Contributing Editor of the *Journal of Clinical Orthodontics*. E-mail Dr. Woo at judiewoo@hanmail.net.



Dr. Paik



Dr. Woo



Dr. Boyd

Non-Surgical Treatment of a Class III Patient with Insufficient Incisor Display



Fig. 1 18-year-old female patient with skeletal Class III malocclusion and lack of upper incisor display in smile.



Fig. 2 Heavy intermaxillary elastics worn between transpalatal arch and modified lip bumper for orthopedic forward and downward traction of maxilla.

aging, another important goal was to increase her upper incisor display at rest and in full smiling. Other treatment objectives were to eliminate the lower anterior spacing, increase the overbite, and establish Class I canine and molar relationships.

Three treatment options were considered. The first was to use a maxillary Le Fort I posteri-

or impaction with anterior downward fracture and advancement of the maxilla, combined with a bilateral sagittal split mandibular setback osteotomy, to rotate the occlusal plane and lower face in a clockwise direction. Presurgical nonextraction orthodontics would involve leveling, alignment, and arch coordination. The patient refused the jaw surgery;



Fig. 3 Orthodontic protraction and extrusion of maxillary dentition with Class III and anterior vertical elastics to lip bumper hooks.



Fig. 4 Patient after 28 months of treatment.

moreover, surgical advancement of the maxilla could have widened the alar base and thus made her nose unattractive.

A second alternative was nonextraction orthodontic treatment using conventional Class III mechanics, which would ameliorate the patient's protrusive appearance by rotating the mandible clockwise. In this plan, however, the correction of the Class III relationship would have worked against the goal of improving the incisor display.

The third possible treatment plan involved protraction and extrusion of the entire maxillary dentition after rapid palatal expansion. Based on similar cases, we felt that protraction of the entire maxilla and extrusion of the upper incisors could be achieved by using a modified lip bumper with anterior hooks for intermaxillary elastics. This plan, which was selected in consultation with the patient, would reduce her midfacial concavity through forward and downward protraction of the maxilla. Extrusion of the maxillary anterior teeth would rotate the occlusal plane clockwise and thus improve the incisor display. The profile would also be favorably affected by extrusion of the posterior teeth, since clockwise rotation of the mandible tends to increase lower facial height and decrease mandibular projection.

Treatment Progress

The RPE was a Hyrax* design with a midline screw and bands on the first premolars and

molars. Hooks were added to the first premolar bands to facilitate maxillary protraction. After the RPE was cemented, the jack-screw was opened two quarter-turns a day, once in the morning and once in the evening. Concurrently, the patient wore a facial mask, with a heavy downward and forward protraction force of 600-700g per side applied from the premolar hooks to extrude the posterior segment. Once space was opened between the central incisors and adjacent to the lower first molars, the RPE was replaced with a passive transpalatal arch.

Molar tubes were banded for passive insertion of an .045" stainless steel lip bumper, modified slightly to incorporate two anterior hooks. The anterior bow was adjusted vertically to the level of the gingival margin and held 5mm away from the mandibular incisors. Intermaxillary elastics with a force of 350-400g per side were worn full-time between the transpalatal arch and the lip bumper hooks (Fig. 2).

Five months into treatment, both arches were bonded with .022" × .028" Spirit MB** pre-adjusted appliances, and initial archwires were placed. The force of the elastics was reduced to 150-200g per side, and the configuration was changed to an inverted triangle, so that the elastics would exert a downward and forward pulling force on the maxillary teeth to improve the incisor display (Fig. 3).

Three months later, the patient experienced discomfort in the lower right third molar area,

and the lower third molars were extracted. A reverse curve of Spee was added to the lower archwires, which were progressively increased to .019" × .025" stainless steel.

After 15 months of fixed appliance treatment, a progress cephalogram showed 3mm of incisor display in repose. The lower archwire was then flattened, and vertical anterior elastics were continued for the remainder of treatment.

After 28 months of treatment, the fixed appliances were removed, and upper and lower lingual 3-3 fixed retainers and wraparound removable plates were delivered.

Treatment Results

The patient's profile improved with the increase in maxillary projection and lower facial height (Fig. 4). Class I canine and molar relationships were established, with ideal overjet and overbite. A more feminine and attractive smile was attained as the incisor display gradually increased to 90% (Fig. 5).

The entire maxillary dentition was extruded through orthopedic forward and downward traction, as seen in the overall superimposition. Consequently, the mandibular plane rotated downward and backward, reducing the skeletal Class III tenden-

*Registered trademark of Dentaaurum, Turnstrasse 31, 75228 Ispringen, Germany.

**Registered trademark of Ormco/"A" Company, 1717 W. Collins Ave., Orange, CA 92867.



Fig. 5 Progressive increase in upper incisor display seen in full smile views. A. Before treatment. B. Progress. C. After treatment.

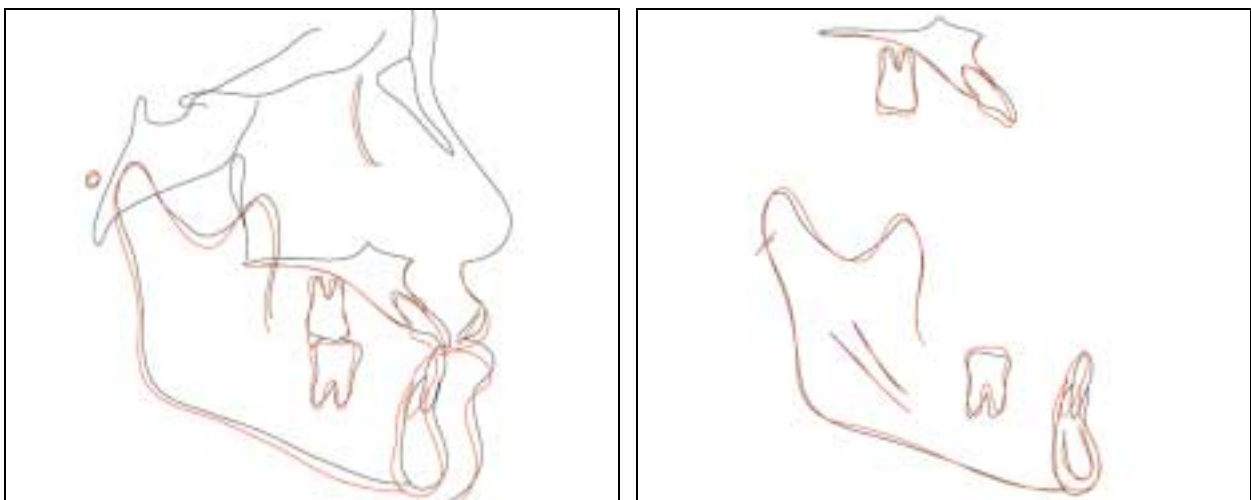


Fig. 6 Superimposition of pre- and post-treatment cephalometric tracings, showing increased distance from inferior border of upper lip to upper incisal edge, increase in anterior facial height, and extrusion of upper and lower molars.

cy and prognathic appearance. SNB improved by 2° , and the ANB differential decreased to -3.7° (Fig. 6, Table 1). The retroclination of the maxillary anterior teeth and lengthening of the maxillary incisors relative to the upper lip improved the smile by increasing the incisor display. Superimposition on the palatal plane showed 1.2mm of maxillary molar extrusion. The mandibular superimposition demonstrated a slight retraction and anterior tipping of the mandibular incisors and distal tipping and extrusion of the molars. L1-

GoMe increased by 7.2° .

After one year of retention, the patient has shown little change in her incisor display and overall facial appearance.

Discussion

Sarver has emphasized the importance of incisor display in today's dynamic, three-dimensional patient evaluation.^{3,4} Lack of upper incisor display can make a person look older, because a steady decrease in upper incisor display and a corresponding increase in lower incisor dis-

play are associated with aging.⁵ Increasing a patient's maxillary incisor exposure can thus provide a more youthful appearance.^{3,6}

Unfortunately, many orthodontists have unintentionally reduced the amount of incisal-gingival display by using utility arches with an accentuated curve to intrude the upper or lower incisors. Long-term usage of these intrusion mechanics has often produced undesirable flattening of the smile arc, as observed by Zachrisson⁶ and by Ackerman and colleagues.⁷

In a previous article, we raised the possibility of intruding the entire maxillary dentition in a skeletal Class II patient with vertical excess.⁸ Here, the opposite approach was employed: the entire maxillary dentition was extruded using heavy elastic forces transmitted by a modified lip bumper and facilitated by rapid palatal expansion. Although the patient began with an acceptable occlusion, a relatively long period of orthodontic treatment was required to produce a significant facial improvement. Flaring of the upper incisors, a common dental compensation seen in skeletal Class III patients, contributes to insufficient incisor exposure. Conventional Class III orthodontic treatment may further flatten the occlusal plane, reducing the upper incisor display and compromising the esthetic result. In this case, by using Class III elastics with an inverted triangular configuration and adding a reverse curve of Spee to the lower archwire, the Class III malocclusion was corrected and the incisor display was improved.

Lip bumpers are normally used for preservation of molar anchorage⁹ and to gain space in the mandibular arch.^{10,11} The modified lip bumper used here allows a heavy protraction force to be delivered to the maxillary dentition, producing an orthopedic change in a downward and forward direction. The elastic force was distributed to the lower molars, moving them distally and preventing the lower incisors from further uprighing

TABLE 1
CEPHALOMETRIC DATA

	Pretreatment	Post-Treatment
<i>Facial</i>		
UL-E line	-3.8mm	-2.5mm
LL-E line	-0.3mm	0.2mm
U1-ULI*	1.6mm	3.8mm
<i>Anteroposterior Skeletal</i>		
SNA	76.5°	76.2°
SNB	82.0°	80.0°
ANB	-5.5°	-3.7°
SNP	83.5°	82.1°
Facial angle	93.7°	93.2°
Convexity	-14.6°	-12.7°
<i>Vertical Skeletal</i>		
GoMeSN	29.0°	30.9°
MPA	20.2°	21.2°
OP-MP	6.0°	5.9°
ANS-Me	64.3mm	66.5mm
<i>Dental-Dentoalveolar</i>		
Overjet	1.5mm	2.2mm
Overbite	0.5mm	1.5mm
U1-SN	124.6°	117.1°
L1-GoMe	86.2°	93.4°
U1-NF**	24.7mm	27.0mm
U6-NF***	21.8mm	23.0mm
L6-MP†	32.0mm	33.5mm

*Maxillary incisal edge to inferior border of upper lip.¹

**Upper anterior dentoalveolar height.²

***Upper posterior dentoalveolar height.²

†Lower posterior dentoalveolar height.²

and extruding as the upper incisors were extruded. Some anterior tipping of the lower incisors was observed, as has been described elsewhere in connection with lip bumper treatment.^{9,12}

It is widely accepted that the older the patient, the poorer the prognosis of maxillary sutural opening. There have been reports of successful rapid palatal expansion without adjunctive

surgery in young adults,^{13,14} however, as occurred in the present patient. Opening of the suture was evidenced by the creation of a diastema between the central incisors, with no pain reported. Because the patient had a deficient buccal overjet, palatal expansion not only stabilized the occlusion, but also facilitated the orthopedic maxillary protraction.¹⁵

REFERENCES

1. Arnett, G.W. and Bergman, R.T.: Facial keys to orthodontic diagnosis and treatment planning, Part II, *Am. J. Orthod.* 103:395-411, 1993.
2. Burstone, C.J.; James, R.B.; Legan, H.; Murphy, G.A.; and Norton, L.A.: Cephalometrics for orthognathic surgery, *J. Oral Surg.* 36:269-277, 1978.
3. Sarver, D.M.: The importance of incisor positioning in the esthetic smile: The smile arc, *Am. J. Orthod.* 120:98-111, 2001.
4. Sarver, D.M. and Ackerman, J.L.: Orthodontics about face: The re-emergence of the esthetic paradigm, *Am. J. Orthod.* 117:575-576, 2000.
5. Vig, R.G. and Brundo, G.C.: The kinetics of anterior tooth display, *J. Prosthet. Dent.* 39:502-504, 1978.
6. Zachrisson, B.U.: Esthetic factors involved in anterior tooth display and the smile: Vertical dimension, *J. Clin. Orthod.* 32:432-445, 1998.
7. Ackerman, J.; Ackerman, M.B.; Brensinger, C.M.; and Landis, J.R.: A morphometric analysis of the posed smile, *Clin. Orthod. Res.* 1:2-11, 1998.
8. Paik, C.H.; Woo, Y.J.; and Boyd, R.L.: Treatment of an adult patient with vertical excess using miniscrew fixation, *J. Clin. Orthod.* 37:423-428, 2003.
9. Bergersen, E.O.: A cephalometric study of the clinical use of the mandibular labial bumper, *Am. J. Orthod.* 61:578-602, 1972.
10. Cetlin, N.M. and Ten Hove, A.: Nonextraction treatment, *J. Clin. Orthod.* 17:396-413, 1983.
11. Ten Hove, A.: Palatal bar and lip bumper in nonextraction treatment, *J. Clin. Orthod.* 19:272-291, 1985.
12. Osborn, W.S.; Nanda, R.S.; and Currier, G.F.: Mandibular arch perimeter changes with lip bumper treatment, *Am. J. Orthod.* 99:527-532, 1991.
13. Alpern, M.C. and Yurosko, J.J.: Rapid palatal expansion in adults with and without surgery, *Angle Orthod.* 57:245-263, 1987.
14. Capelozza, L.; Neto, J.C.; Silva, O.G.; and Ursi, W.: Non-surgically assisted rapid maxillary expansion in adults, *Int. J. Adult Orthod. Orthog. Surg.* 11:57-66, 1996.
15. Baik, H.S.: Clinical results of the maxillary protraction in Korean children, *Am. J. Orthod.* 108:583-592, 1995.