Korean Journal of Lingual Orthodontics

Case Report

Treatment of Skeletal Class II Protrusion with Gummy Smile Using a Antero-Posterior Lingual Retractor

Hobeen Yu, Hyo-Won Ahn

Department of Orthodontics, School of Dentistry, Kyung Hee University, Seoul, Korea

Purpose: In this case report, we present the application of antero-posterior lingual retractor (APLR) for a protrusion and gummy smile case which needs anterior torque control and intrusion of anterior teeth.
Results: After total 24 months of treatment, the superimposition between pretreatment and post-treatment showed slight proclination of the maxillary incisiors (FH-U1 angle, from 111.5° to 117.5°) during 3.0 mm intrusion and 5.0 mm retraction of the incisal edge. The maxillary molars were intruded up to 0.5 mm, which was followed by autorotation of the mandible (mandibular plane to FH angle, from 35.3° to 34.6°) with 1.0 mm advancement of pogonion.
Conclusion: The APLR system produced excellent and efficient retraction with good torque control and significant intrusion of the anterior segment. This system approach would be an effective option for skeletal Class II with the bialveolar protrusion and gummy smile patient.

Key words: Anterior-posterior lingual retractor, Gummy smile, lip protrusion, Torque control, Vertical control

INTRODUCTION

In lingual orthodontic treatment, one of the most difficult problem is to control anterior torque during space closure.[1-3] A C-lingual retractor (CLR) splints the six maxillary anterior teeth and retracts them by using palatal TADs without posterior bonding. Retraction of the anterior teeth as splinted into single unit using palatal TADs has a biomechanical advantage.[4-6] If the length of retraction lever arm is controlled properly, the force vector will pass through the center of resistance of anterior teeth.[7] Unfortunately, retraction using CLR could result in excess overbite of the anterior teeth and a shallow overbite in the canine region. The use of an antero-posterior lingual retractor (APLR) has been proposed to compensate for these limitations of the CLR.[8]

APLR maximizes the benefits of the CLR and allows vertical control of the posteriors, therefore it has been reported that it is advantageous for the correction of Class II hyperdivergent protrusion in a previous study.[9]

This case report describes the application of APLR for a patient who needed anterior torque control and intrusion of anterior teeth.

DIAGNOSIS

A 15-year-old female patient visited our hospital for treatment of lip protrusion and gummy smile. In clinical examination, the patient showed convex profile with lip incompetency at rest, and facial asymmetry to the left. Intraoral photos showed Class I molar relationship, Class II canine relationship, upper anterior spacing, scissors bite on #17 and crossbite on #25. The overjet was 2.5 mm and overbite 0.5 mm. The upper midline deviation was 0.5 mm to the right.

Received M D, 201X; Last Revision M D, 201X; Accepted M D, 201X

Corresponding author: Hyo-Won Ahn.
Department of Orthodontics, School of Dentistry, Kyung Hee University, 23 Kyunghee-daero, Dongdaemun-gu, Seoul 02447, Korea.
Tel +82-2-958-9390, Fax +82-2-966-7160, E-mail hyowon@khu.ac.kr

Korean J Lingual Orthod 2018;7(1):1-7
ISSN 2287-7290

The lateral cephalogram revealed a skeletal Class II relationship (ANB angle, 6.6°), hyperdivergent pattern (Björk SUM, 404.1°; FMA, 35.3°), and slightly linguoversion of upper anterior teeth and labioversion of lower anterior teeth (Interincisal angle, 111.2°; U1 to FH angle, 111.5°; IMPA, 102.0°). The patient had symptoms of TMJ (a clicking sound on right TMJ without pain) and had no CO-CR discrepancy (Table 1, Fig. 1 and 2).

Basis on the above findings, the patient was diagnosed as skeletal Class II hyperdivergent pattern with protrusion and gummy smile.

TREATMENT PLAN

The treatment objectives were as follows (1) correction of lip protrusion and gummy smile; (2) mandibular counter-clockwise autorotation by molar intrusion; (3) establishment of Class I molar and canine relationships.

The orthodontic treatment plan included extraction of the first premolars in maxillary arch and the second premolars in mandibular arch using absolute anchorage in upper arch and maximum anchorage in lower arch. To correct gummy smile, total intrusion and re-

Table 1. Comparison of the initial and final lateral cephalometric analysis

	Pretreatment	Posttreatment	Mean±SD
Sagittal Skeletal Relations			
Maxillary Position (S-N-A) (°)	75	75	82±3.5
Mandibular Position (S-N-B) (°)	72	72	80±3.5
Sagittal Jaw Relation (A-N-B) (°)	3	3	2±2.5
Dento-basal Relations			
Maxillary Incisor Inclination (FH-U1) (°)	108.5	111.5	112±6.0
Mandibular Incisor Inclination (IMPA) (°)	102	90	94±7.0
Dental Relations			
Overjet (mm)	2	2	3.5±2.5
Overbite (mm)	3.5	2.5	2±2.5
Interincisor Angle (°)	123.5	130.5	132±6.0

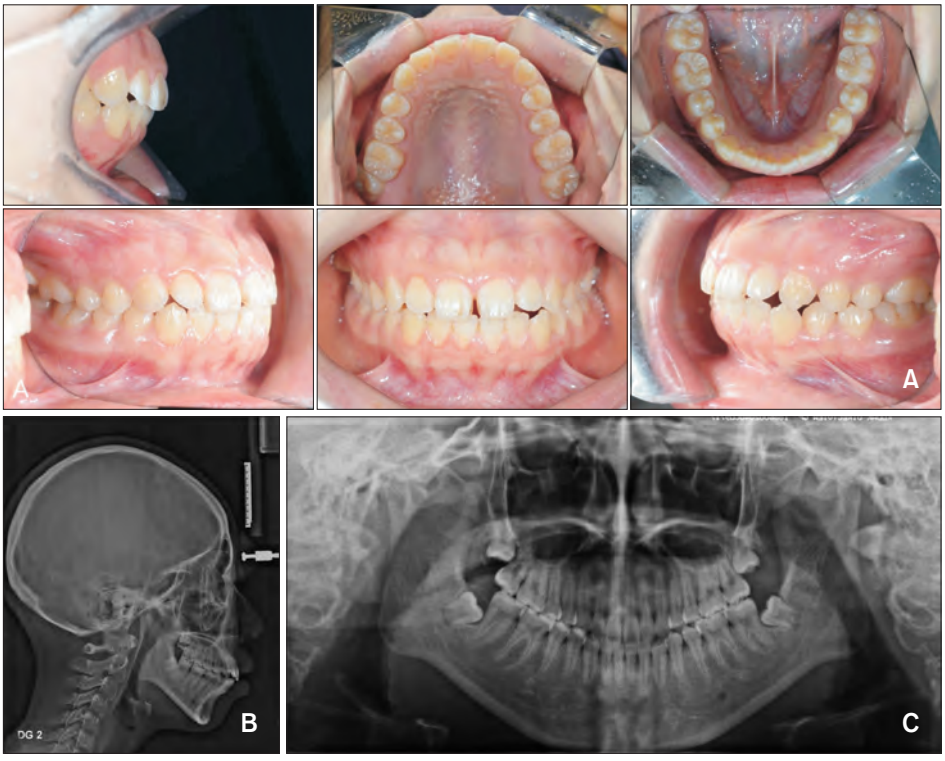

Fig. 1. Initial intraoral photographs (A) lateral cephalogram (B), and panoramic radiograph (C).

traction of the upper incisors was required. The APLR system was chosen on the upper arch to have good torque control on the anteriors and vertical control of whole dentition.

TREATMENT PROGRESS

1. Design of the antero-posterior lingual retractor

1) Anterior segment

The anterior segment made of stainless-steel wire soldered to lingual mesh pads that splints the six anterior teeth into a single unit. Two retraction lever arms are soldered to the anterior segment, designed to direct the vector of the retraction force passes through the center of resistance. A guide wire is soldered to the upper canine mesh pads and extended distally through the tube (Fig. 3).

2) Posterior segment

The posterior segment was splinted together into one unit with a soldered transpalatal arch between the maxillary first molar and including a short tube. A hook was extended from the TPA on the right side to upright the second molar.

2. TADs application

Two TADs, 1.6 mm in diameter and 6 mm in length (Jeil medical co., Seoul, Korea), were applied to paramedian area of the palate.

3. APLR Bonding procedure

Treatment was started with the placement of a APLR in the maxilla. An anterior transfer putty jig that covers the four maxillary incisors. After a fit check, the bonding of six anterior teeth was first achieved with a dual-cure resin adhesive. The posterior segments are slipped onto the guide wires and bonded to posterior teeth.

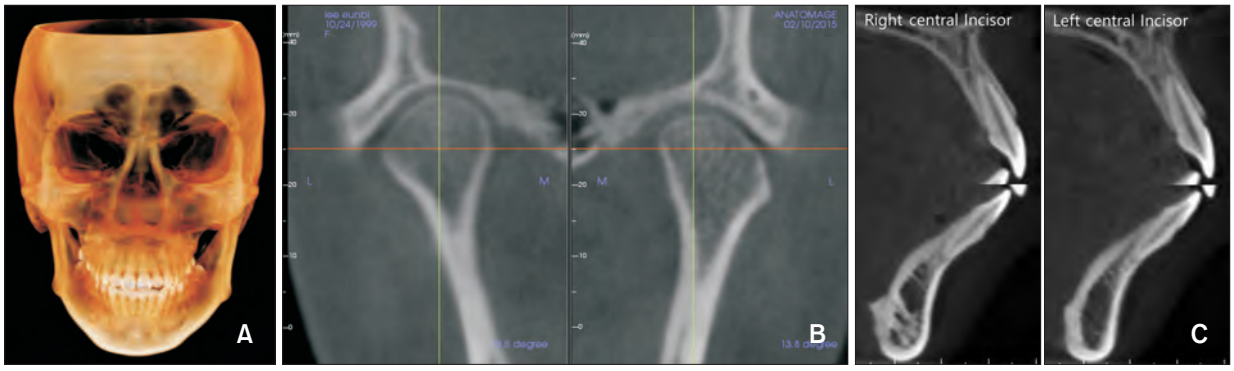

Fig. 2. Initial frontal image of skull (A), coronal image of TMJ (B), sagittal image of incisors using CBCT (C).

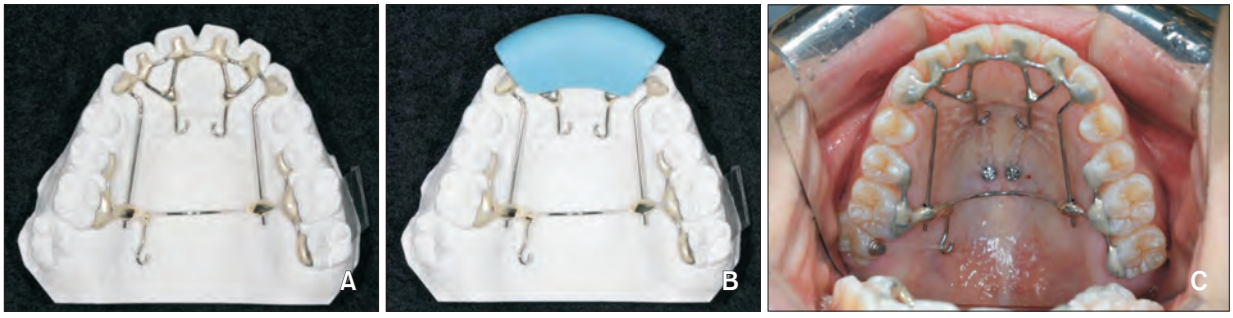

Fig. 3. Design of Antero-posterior lingual retractor (APLR) appliance (A), transfer jig (B), and intraoral photograph immediate after bonding (C).

4. Treatment progress on the upper arch

Immediately after a APLR bonding, extraction of the upper first premolars was done, and lower second premolars was extracted after one month. The mandibular dentition was treated with conventional labial fixed appliances.

The maxillary anterior teeth were retracted with elastomeric chains between the retraction hook and palatal TADs. The total retraction period for the maxillary anterior dentition using the APLR was 9 months. Four months after retraction, the transpalatal arch was removed. The amount of retraction could be monitored by the length of the sliding wire protruding distally to the tube of the first molar. At the removal of the APLR, labial fixed appliances were bonded to complete treatment (Fig. 4).

The superimposition between pretreatment and 7 months after treatment showed the torque of the maxillary anterior teeth was well maintained (U1 to FH, 105.5°) while anteriors were retracted 5.0 mm, and intruded 4.0 mm. The upper molars were intruded 1mm during the APLR treatment (Fig. 5).

At finishing stage, four TADs, 1.6 mm in diameter and 6 mm in length (Jeil medical co., Seoul, Korea), were placed in the buccal interradicular space on both arches for posterior vertical control. No additional retaction of anteriors was made in this period.

TREATMENT RESULTS

After total 24 months of treatment, anterior protrusion and gummy smile was resolved. Class I canine and molar relationship, balanced competent lips, adequate overjet and overbite were achieved. The maxillary and mandibular midline were coincided.

The superimposition between pretreatment and post-treatment showed slight proclination of the maxillary incisiors (FH-U1 angle, from 111.5° to 117.5°) during 3.0 mm intrusion and 5.0 mm retraction of the incisal edge. The maxillary molars were intruded up to 0.5 mm, which was followed by autorotation of the mandible (mandibular plane to FH angle, from 35.3° to 34.6°) with 1.0 mm advancement of pogonion (Table 1, Fig. 6 and 7).

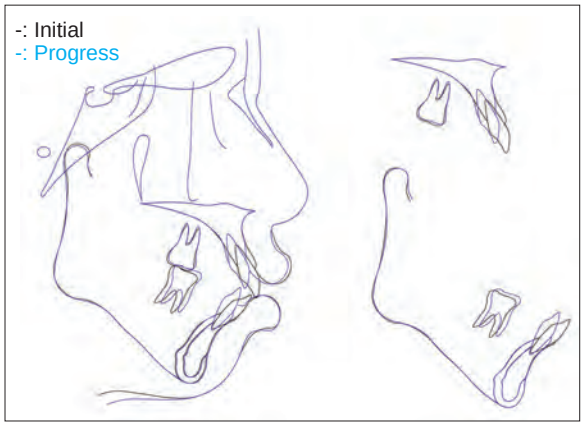

Fig. 5. Superimposition between pretreatment (black) and 7 months after treatment (blue).

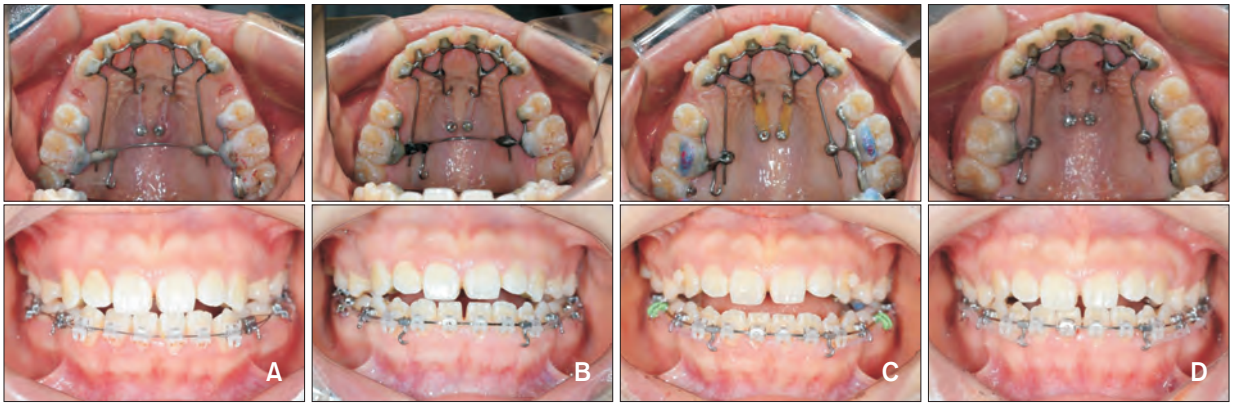

Fig. 4. Treatment progress of occlusal view and front view. After 1 month (A), after 3 months (B), after 5 months (C), and after 7 months (D).

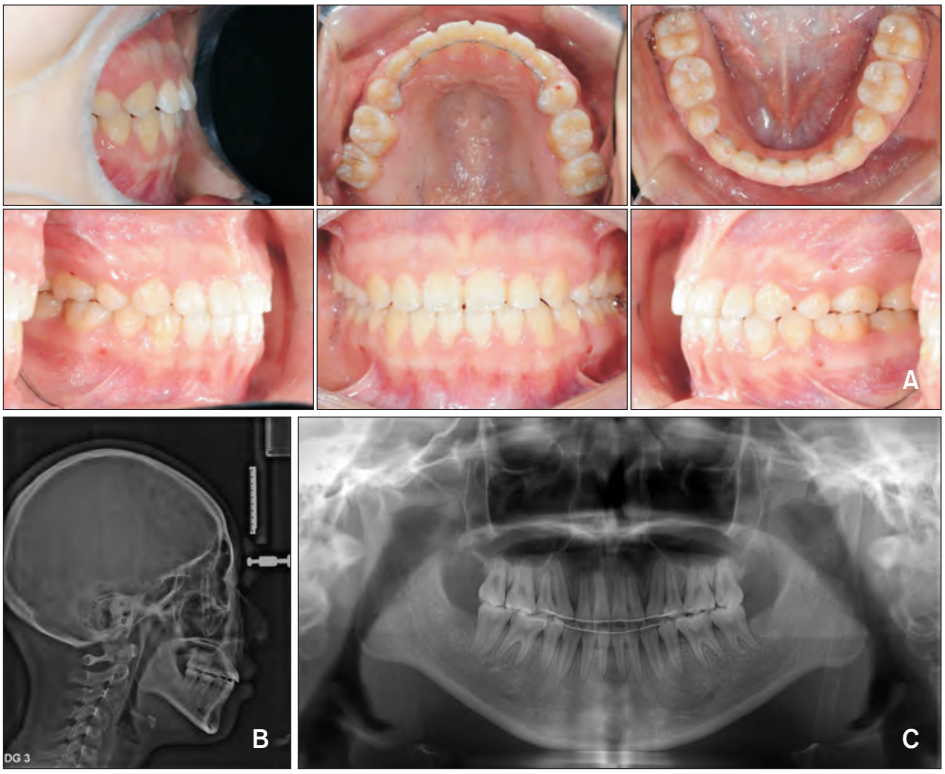

Fig. 6. Final intraoral photographs (A) lateral cephalogram (B), and panoramic radiograph (C).

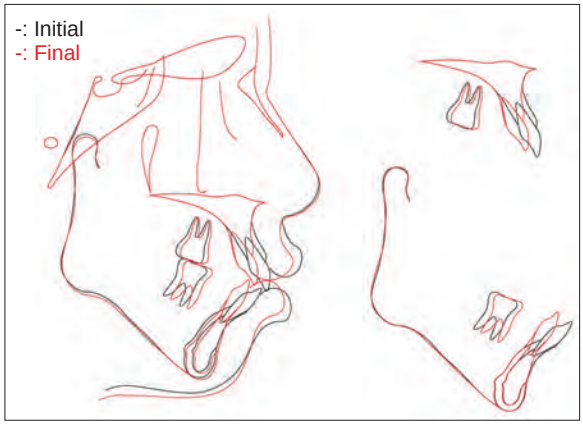

Fig. 7. Superimposition between pretreatment (black) and posttreatment (red).

The retention was provided by lingual fixed retainers and circumferential retainers on both arches. At 16 months after debonding, the treatment results were well maintained (Fig. 8).

DISCUSSION

The hyperdivergent skeletal Class II malocclusion demonstrated a steep occlusal plane, which was possibly contributed to by an excessive elongation of the maxillary incisors. In addition, lingual tipping of the maxillary incisors might have contributed to the clockwise rotation of the mandible.[10,11] If the torque is not properly controlled during the anterior teeth retraction, the anterior teeth rotate in a clockwise direction, which increases the vertical dimension. The lack of vertical control of the posteriors also increases the vertical dimension.[12,13]

The APLR induced more bodily movement of the anterior teeth because it had biomechanical properties similar to a continuous arch with a posterior segment. The guide bar controlled and directed retraction vectors to achieve bodily retraction of the anterior segments.[8] With respect to vertical movement, the APLR resulted in intrusion of the full maxillary arch and flattened the occlusal plane. When the intrusive retraction force is applied, the kinetic energy from the guide bar would cause intrusion force on the upper molars.[14]

At 7 months after treatment, intrusion of the maxillary posteriors occurred, but the autorotation of the mandible did not occur. The reason for this is thought to be that the lower posteriors were simultaneously

Fig. 8. Intraoral photographs after 16 months of retention.

extruded while upper posteriors were intruded. In other words, vertical control of the lower posteriors is also important part to induce counter-clockwise rotation of the mandible. In this case, the mandibular dentition was distalized using TADs after mandibular extraction spaces were closure, which resulted in intrusion of the mandibular posteriors, and autorotation of the mandible.

In the case of gummy smile with shallow overbite, the intrusion of the maxillary incisors for correction of gummy smile would cause excessive extrusion of the mandibular incisors to maintain ideal overbite. Therefore, molar intrusion and autorotation of the mandible should be accompanied not to aggravate periodontal health on lower anteriors. For treatment of a hyperdivergent patient with a gummy smile, the APLR would be an effective treatment option.

CONCLUSIONS

The antero-posterior lingual retractor (APLR) system produced excellent and efficient retraction with good torque control and significant intrusion of the anterior segment. This system approach would be an effective option for skeletal Class II with the bialveolar protrusion and gummy smile patient.

REFERENCES

1. Smith JR, Gorman JC, Kurz C, Dunn RM. Keys to success in lingual therapy. Part 1. J Clin Orthod 1986, 20:252-261.
2. Liang W, Rong Q, Lin J, Xu B. Torque control of the maxillary incisors in lingual and labial orthodontics: a 3-dimensional finite element analysis. Am J Orthod Dentofacial Orthop 2009, 135:316-322.
3. Hong RK, Heo JM, Ha YK. Lever-arm and mini-implant system for anterior torque control during retraction in lingual orthodontic treatment. Angle Orthod. 2005;75:129-41.
4. Mo SS, Kim SH, Sung SJ, Chung KR, Chun YS, Kook YA, Nelson G. Torque control during lingual anterior retraction without posterior appliances. Korean J Orthod 2013, 43:3-14.
5. Kim JS, Kim SH, Kook YA, Chung KR, Nelson G. Analysis of lingual en masse retraction combining a C-lingual retractor and a palatal plate. Angle Orthod. 2011 Jul;81:662-9.
6. Kim SH, Park YG, Chung K. Severe Class II anterior deep bite malocclusion treated with a C-lingual retractor. Angle Orthod. 2004 Apr;74:280-5.
7. Seo KW, Kwon SY, Kim KA, Park KH, Kim SH, Ahn HW, Nelson G. Displacement pattern of the anterior segment using antero-posterior lingual retractor combined with a palatal plate. Korean J Orthod. 2015;45:289-98.
8. Hwang M, Ahn HW, Kwon SY, Choi JH, Kim SH, Nelson G. Control of anterior segment using an antero-posterior lingual sliding retraction system: a preliminary cone-beam CT study. Prog Orthod. 2018 Jan 15;19:2.
9. Kwon SY, Ahn HW, Kim SH, Park YG, Chung KR, Paik CH, Nelson G. Antero-posterior lingual sliding retraction system for orthodontic correction of hyperdivergent Class II protrusion. Head Face Med. 2014 Jun 5;10:22
10. Fushima K, Kitamura Y, Mita H, Sato S, Suzuki Y, Kim YH.

Significance of the cant of the posterior occlusal plane in Class II Division 1 malocclusions. Eur J Orthod. 1996;18:27-40.
11. Ye R, Li Y, Li X, Li J, Wang J, Zhao S, Zhao Z. Occlusal plane canting reduction accompanies mandibular counterclockwise rotation in camouflaging treatment of hyperdivergent skeletal Class II malocclusion. Angle Orthod. 2013;83:758-65.
12. Lamarque S. The importance of occlusal plane control during orthodontic mechanotherapy. Am J Orthod Dentofacial Orthop. 1995;107:548-558.
13. Chung KR, Kook YA, Kim SH, Mo SS, Jung JA. Class II malocclusion treated by combining a lingual retractor and a palatal plate. Am J Orthod Dentofacial Orthop. 2008;133:112-23.
14. Lee EH, HS Y, Lee KJ, Park YC. Three dimensional finite element analysis of continuous and segmented arches with use of orthodontic miniscrews. Korean J Orthod. 2011;41:237-254.