

# Anterior Crossbite Correction with a Series of Clear Removable Appliances: A Case Report

JAE HYUN PARK, DMD, MSD, MS, PhD\*

TAE WEON KIM, DDS, MSD, PhD†

## ABSTRACT

The Clear Aligner can be used to correct tooth movement without involving extraction, surgery, and other adjunct orthopedic appliances. The Clear Aligner is a procedure that can be performed by either an orthodontist or a general dentist without computer simulation/calculation. Since the Clear Aligner is fabricated from the stone model for new appliance at each or every other appointment, it is readily available to change the treatment sequence throughout the course of the treatment. The patient can receive any necessary dental procedures with ease during the course of the treatment. The treatment can also be easily resumed even if the patient has not worn the aligners for a period of time. The purpose of this article is to report dental anterior crossbite correction with a series of Clear Aligners. The Clear Aligner could be used as an alternative in appropriate cases for those who are reluctant with conventional appliances.

## CLINICAL SIGNIFICANCE

The Clear Aligner, a clear removable orthodontic device, can perform tooth movement for the following: crowding resolution, space closure, arch expansion or constriction, anterior, or posterior crossbite correction, space maintenance or regaining, and other prosthodontic treatments combined with orthodontic treatment.<sup>1-3</sup> This article illustrates an example of its use.

(*J Esthet Restor Dent* 21:149-160, 2009)

## INTRODUCTION

Anterior crossbites are not aesthetically pleasing. Until recently, the process of straightening the teeth typically has involved appliances involving bands, brackets, and wires that can be difficult to clean. The desire for a cosmetic solution to misaligned teeth has led to an increase in the number of

patients seeking veneers, crowns, and other laboratory-fabricated cosmetic restorations. Dental anterior crossbites are dental malocclusions resulting from abnormal axial inclinations of maxillary anterior teeth, whereas skeletal anterior crossbites are usually part of a skeletal problem such as mandibular prognathism and midface deficiency.<sup>4</sup> The correction of

dental anterior crossbites is a common orthodontic treatment that may be performed with a removable or fixed appliance or a combination of both. This treatment has been recommended to prevent abnormal enamel abrasions, fractures of anterior teeth, periodontal pathosis, and to produce a more esthetic dentofacial complex and a better occlusion.<sup>5-7</sup>

\*Director, Postgraduate Orthodontic Program, Arizona School of Dentistry & Oral Health, Mesa, AZ, USA

†President of Korean Society of Lingual Orthodontics, Private Practice of Orthodontics, Seoul, South Korea

Furthermore, habitual mandibular malpositioning and inappropriate pattern of jaw musculature related to crossbite may adversely affect maxillary and mandibular growth and potentiate temporomandibular joint abnormalities.<sup>8</sup>

For esthetics, clear brackets may be placed, however, they can be irritating to the cheeks and gums because they are large and bulky. Lingual braces are a great option for those who want straight teeth and a beautiful smile without showing any braces.<sup>9,10</sup> While the lingual clinical techniques have been developed, lingual treatment may not be cost effective due to increased chair time. Invisalign (Align Technology, Santa Clara, CA, USA) was developed for the benefit of cleaning of the teeth easily and going about normal life without interruption.<sup>11–14</sup> These appliances are particularly popular among adults who want to straighten their teeth without the unflattering look of traditional metal braces, which are commonly worn by children and adolescents.

The Clear Aligner can move the teeth easily without braces. It is different from Invisalign, which provides serial aligners from one impression.<sup>11–14</sup> Rather than just delivering the aligners, the clinician should be the pilot of the treatment. The main reason for the fabrication of the Clear Aligner every

3 to 6 weeks is that the clinician can control tooth movement more precisely. The Clear Aligner is an efficient orthodontic appliance produced periodically.<sup>12</sup> It can be easily fabricated by either an orthodontist or a general dentist in their own labs. In order to fabricate a Clear Aligner, impressions are taken for the working cast that are used with two or three different plastic sheets (Duran, Scheu-dental, Iserlohn, Germany) and a pressure molding machine (Biostar, Scheu-dental) or a vacuum machine (Dentsply Raintree Essix, Metairie, LA, USA).<sup>1–3</sup> Different plastic sheets are thermoformed on the setup model made for tooth movement using a vacuum former. The tooth movement is very efficient, and the patient feels comfortable.

#### CASE REPORT

A 28-year-old Korean female was referred to the orthodontist for evaluation of anterior crossbite. Her chief complaint was the unesthetic appearance of her upper anterior teeth, which were behind the lower anterior teeth and she wanted esthetic treatment with a comfortable appliance. There were no significant findings in her medical and dental histories. The patient presented a mesofacial, symmetrical face, and a straight profile (Figure 1). She showed moderate crowding on the upper arch with an anterior crossbite and mild spacing on the lower arch with

lingually tilted lower right and left canines. She had a Class I molar relationship on both sides with –1 mm overjet and 50% overbite. On smiling, the patient showed excessive gingiva on the maxillary central incisors. Although the maxillary dental midline was coincident with the facial midline, the mandibular dental midline was deviated 1 mm to the right when the mandible was guided in centric relation, and the maxillary central incisors showed fractures on incisal edges in centric relation (Figure 2). The panoramic radiograph demonstrated no evidence of bone or dental pathology (Figure 3A). Cephalometric analysis indicated a skeletal Class III (ANB = –2) with hypodivergent growth pattern (SN-G<sub>0</sub>G<sub>n</sub>: 27). The maxillary incisors were retroclined (U1 to SN: 95) and the mandibular incisors showed proclination (IMPA: 109) (Figure 3B). The treatment objectives for this patient were to correct the anterior crossbite, to establish normal overbite and overjet, to align the anterior teeth for ideal inclination, to obtain a stable occlusal relationship, and to improve the patient's facial and dental esthetics by resolving an anterior gummy smile. Before orthodontic treatment, she had a consultation with a periodontist and a general dentist for gingivectomy and restoration of upper central incisors. In order to correct anterior crossbite and to align the maxillary anterior teeth, oblique

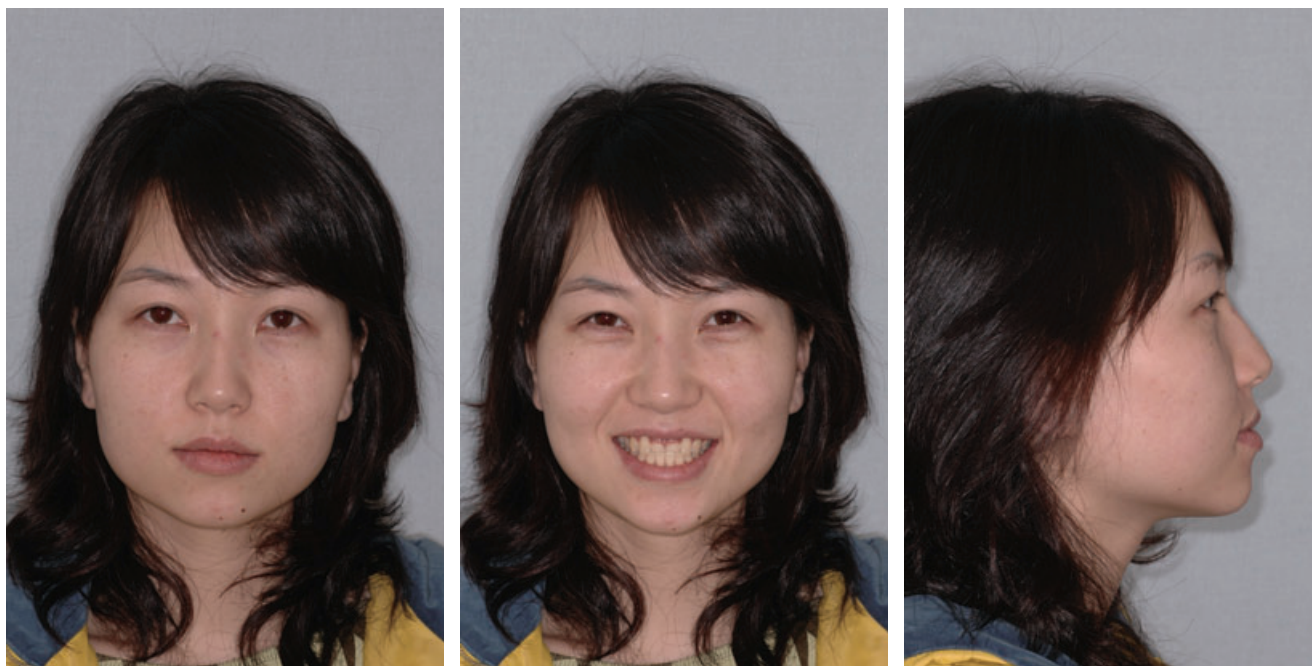


Figure 1. Initial facial photographs.

lateral and anterior-posterior (A-P) expansion was performed using three aligners (Figures 4–6). Two aligners were used to align the lower arch (Figure 7). Because the patient had only mild spacing on the lower arch in order to upright the lower incisors, approximately 3 mm of interproximal reduction (IPR) was achieved in the lower anterior dentition.

When fabricating the setup model for a Clear Aligner, the information of tooth angulations (e.g., upper incisor to SN and IMPA) can be converted to the setup model using the Clear Aligner model checker (IV-Tech, Seoul, South Korea). Consequently, it is

possible to determine ideal torque and angulation of anterior dentition during setup model fabrication (Figure 8A).<sup>1–3</sup> The Clear Aligner also uses an aligner aid program (AAP) (IV-Tech) to fabricate a setup model. The AAP combined with a 2D digital camera could be used to accurately measure the movement. Before fabricating the setup model, the initial working cast photo is taken using a digital camera. After the target tooth is moved to the desired position, it is fixed by the baseplate wax or Blue Blokker (Scheu-dental) and a digital photo is retaken. Setup changes can be exactly measured and verified by overlaying digital photos. It can control tooth

movements every 0.1 mm. This computer-compatible program measures distance and angles of teeth movements on setup models (Figure 8B).<sup>1–3</sup>

After jumping the bite, the patient was referred to a periodontist for a gingivectomy procedure to level the gingival heights on the maxillary central incisors (Figure 9). The anterior crossbite was corrected after orthodontic treatment. The patient was referred to the general dentist for veneer restorations on the maxillary central incisors. Acceptable overjet and overbite were established after esthetic restorations were finished (Figure 10). The patient completed treatment



Figure 2. Initial intraoral photographs.

with the same facial profile as pretreatment (Figure 11). The panoramic radiograph showed excellent root parallelism (Figure 12A). Cephalometric analysis revealed a skeletal Class I (ANB = 0) with hypodivergent growth pattern (SN-G<sub>o</sub>G<sub>n</sub>: 27). The maxillary incisors (U1 to SN: 110) showed decent inclination and the mandibular incisors (IMPA: 100)

showed close to normal inclination considering her flat mandibular plane (Figure 12B). Clinical examination of the mandibular position did not show that the mandible shifted backwards, and there was no evidence of a centric relation-centric occlusion shift. The total treatment time was approximately 6 months; 5 months for orthodontic treatment time including

gingivectomy and 1 month for porcelain veneers on the maxillary central incisors. After the orthodontic treatment and esthetic work was done, the patient was given a new Clear Aligner as a retainer.

#### DISCUSSION

Anterior crossbite is defined as a malocclusion resulting from the lingual position of the maxillary



Figure 3. Initial radiographic views: A, Panoramic view. B, Lateral cephalometric view.

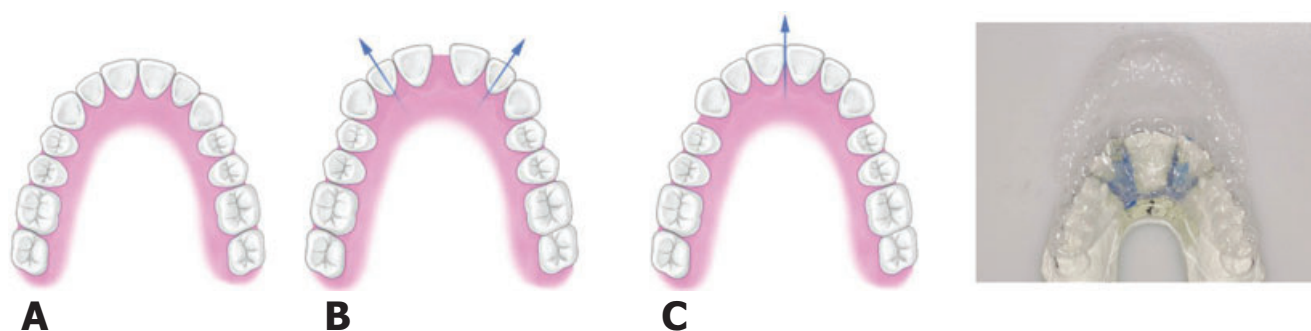


Figure 4. Diagrammatic representation of oblique lateral expansion (A) and A-P expansion (B). Two different plastic Clear Aligners fabricated from the setup model (C).

anterior teeth in relationship with the mandibular anterior teeth. The correction of dental anterior crossbite may involve lingual movement of a mandibular tooth, labial movement of the maxillary tooth, or both. Differential diagnosis of dental versus skeletal anterior crossbite is essential in the selection of cases that can be treated. Skeletal correction requires complicated appliances, and the continuous abnormal jaw growth can lead to relapse. To differentiate dental crossbite from skeletal crossbite,

one should attempt to guide the mandible in centric relation and evaluate the molar and incisor relationship. Furthermore, the relative size of the mandible should be compared with the maxilla using model analysis along with cephalometric assessment.

In the absence of a family history of Class III malocclusion, and upon manipulation of the mandible, if the incisors obtain an end-to-end relationship, it may indicate the presence of a dental problem. If the

molars are in a Class I relationship and the incisors at an end-to-end relationship, a dental correction can be undertaken. The Clear Aligner was chosen for her treatment because her crossbite was a dental origin and she wanted a clear removable appliance. The patient showed an improved overbite relationship after the appliance was removed (Figure 9). Once positive overbite is achieved, relapse is rare in dental anterior crossbite; however, adequate overbite depth to “hold” the correction is necessary.



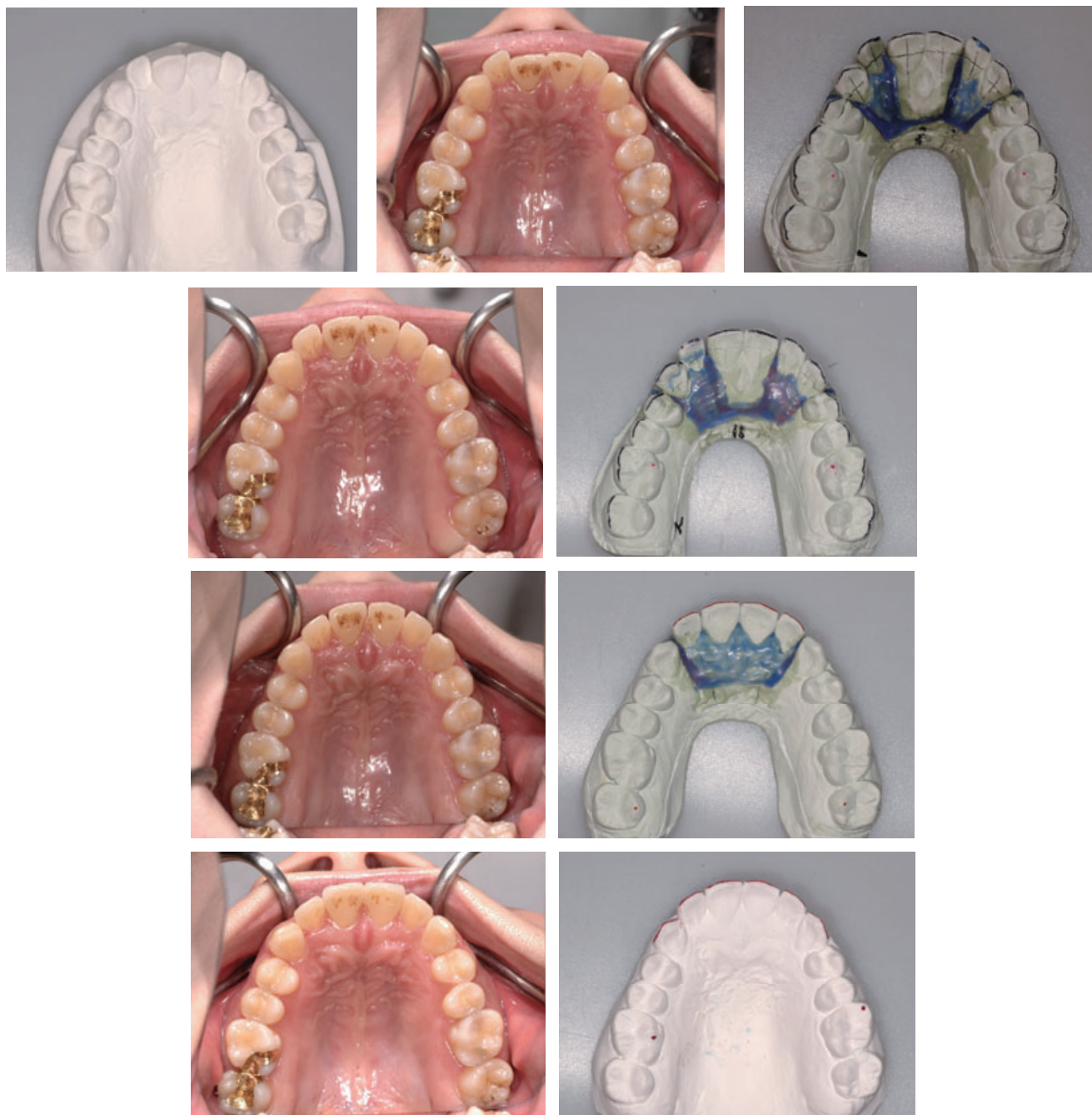


Figure 5. Oblique lateral and A-P expansion was performed on upper arch using Clear Aligners.

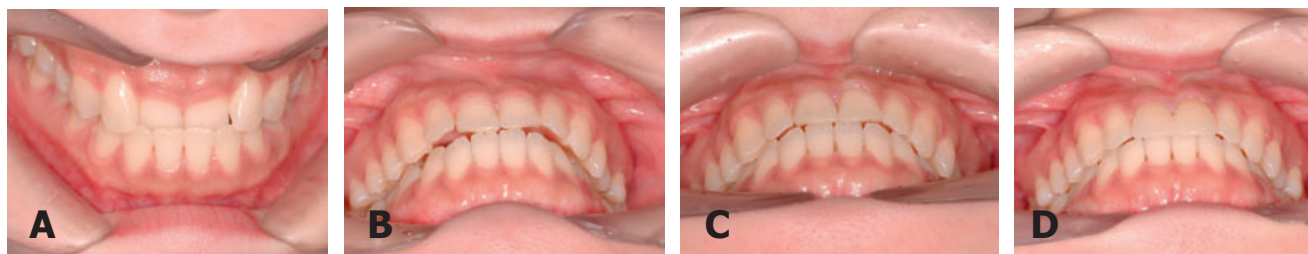


Figure 6. Intraoral photographs showing overjet and overbite changes before (A), during (B), after orthodontic treatment with gingivectomy (C), and veneer restorations (D) on maxillary central incisors.



Figure 7. Intraoral photographs showing alignment of lower arch before (A) and after (C) treatment using Clear Aligners (B).

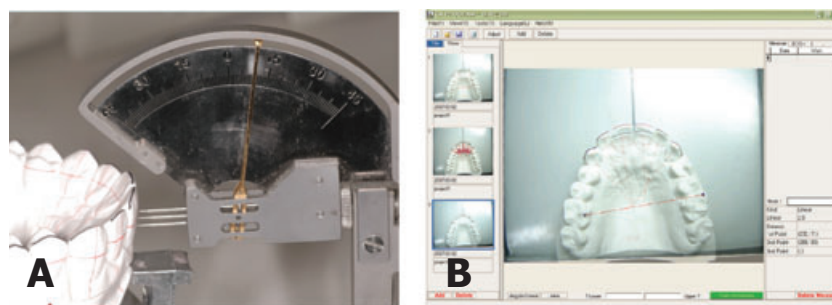


Figure 8. A, The setup model is fabricated with torque on the upper arch using the Clear Aligner model checker. B, Aligner aid program (AAP) presenting the information of tooth movement. Pretreatment model is represented by the black lines and final setup model is represented by the red lines.

An important factor to consider in orthodontic treatment is whether to use a removable or a fixed appliance. Not only for oral

hygiene<sup>15,16</sup> but also for esthetic reasons,<sup>11-14</sup> removable Clear Aligner appliances have advantages. They reduce chair time

during treatment because they are fabricated in the laboratory. In addition, in orthodontic treatment combined with prosthodontic



Figure 9. Intraoral photographs after orthodontic treatment with gingivectomy on maxillary central incisors.

treatment, after orthodontic treatment is completed, the last aligner could be used as a retainer until prosthodontic restorations are completed. General dentists can also perform restorative work with ease since the patient does not have braces. Teeth can be moved after temporary or final restorations are finished as well.

A potential disadvantage of this type of appliance is that it is highly dependent on patient compliance.<sup>14</sup> The aligner should be worn at least 17 hours per day including sleeping time,<sup>1-3</sup> yet, current data suggest that this rarely is an issue.<sup>13,14</sup> There were no compliance issues with this patient and treatment time appeared to be

consistent with what might be expected with fixed appliances. The other significant weakness is the aligner's inability to move the root apex, such as in torquing or translational movements. Tipping of teeth into the extraction space is nearly impossible to avoid, even with fixed appliances, and tipping is exaggerated in an adult patient.





Figure 10. Intraoral frontal and smiling views before (A,C) and after (B,D) orthodontic treatment including esthetic work, gingivectomy and porcelain veneers on maxillary central incisors.



Figure 11. Final facial photographs.



Figure 12. Radiographic views after orthodontic treatment: A, Panoramic view. B, Lateral cephalometric view.

Complex attachment designs for teeth adjacent to the extraction site help reduce tipping, but sectional fixed appliances are necessary in almost all such cases. During orthodontic treatment with Clear Aligner, the attachments are sometimes utilized, however, in this particular case, the attachments were not used. The Clear Aligner does not use attachments as often as Invisalign.<sup>1-3</sup>

Invisalign also uses the CT images of PVS impressions, which are transferred to special software called "Treat" software. It has a number of components that perform different functions. Nevertheless, it is not as accurate as the Clear Aligner especially in finishing stages because it is provided by serial aligners.

This case demonstrates how the Clear Aligners were used to treat anterior crossbite. The patient's gingival health was maintained throughout the treatment period

and decalcification of the surface of the teeth was avoided. The patient did not notice any discomfort during the course of the treatment. The patient's chief concern was addressed and treated to her satisfaction. An esthetic smile was established, and the malocclusion was treated to a stable result.

#### CONCLUSION

Because the Clear Aligner is used for minor tooth movement, the treatment plan is based on patient's chief complaints. If a patient wears the aligner for a recommended period of time, the tooth movement is efficient because the aligner contacts the whole tooth surface. Esthetics is excellent with aligners because of the fact that they are hardly visible. This can be a definite psychological advantage to teenagers and adults alike. The Clear Aligner could be used as an effective alternative in appropriate cases for

those who are reluctant to use conventional fixed appliances.

#### DISCLOSURE

The authors have no financial interest in any of the companies whose products are included in this article.

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*Reprint requests: Jae Hyun Park, DMD, MSD, MS, PhD, Postgraduate Orthodontic Program, Arizona School of Dentistry & Oral Health, 5855 East Still Circle, Mesa, AZ, USA 85206; Tel: 480-286-0455; fax: 480-668-3081; email: JPark@atsu.edu, jhp249@nyu.edu*

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