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CLEAR ALIGNER: AN EFFICIENT, ESTHETIC, AND COMFORTABLE OPTION FOR AN ADULT PATIENT



The Clear Aligner represents an easy way to treat orthodontic patients when a minor tooth movement is necessary (crowding or spacing less than 4 mm) or when relapse occurs during the retention phase. During the retention phase, the Clear Aligner acts as a passive retainer but it is activated if relapse occurs. The Clear Aligner is an esthetic, efficient, comfortable, and low-cost appliance. In this article, the authors explain the indications and limitations of the Clear Aligner, as well as the laboratory and clinical protocol. World J Orthod 2007;8:13-18.

Many authors have made different proposals for orthodontic treatment with positioners or aligners. There are 2 categories of positioners: ready-made positioners in a variety of sizes and those constructed on the basis of the set-up cast of each patient.¹⁻⁶ Most of these positioners are bimaxillary and do not allow the patient to speak; they are also unesthetic. Therefore, adult patients cannot use these positioners for a sufficient number of hours each day.

There are several different categories of aligners: aligners made on the basis of the initial cast, which are activated with thermopliers^{7,8}; aligners made on the basis of virtual set-up with computer-aided software and hardware⁹; and the Clear Aligner (Seoul, Korea), made on the basis of a new cast taken for each step.¹⁰⁻¹⁵ The aligners are more esthetic and comfortable compared to the positioners (Figs 1a and 1b).

CHARACTERISTICS OF THE CLEAR ALIGNER

The Clear Aligner has several positive qualities. It is esthetic, comfortable, has simple mechanics, requires less chair-time and treatment time, and is not expensive.

INDICATIONS AND LIMITATIONS

The Clear Aligner is especially indicated for treatment requiring minor tooth movement and in cases of relapse. The main indications are: (1) minor crowding (less than 4 mm, especially from canine to canine); (2) rotation control, especially for rotated incisors; (3) expansion; (4) intrusion; (5) space closure, less than 4 mm; (6) passive/active retainer.

The Clear Aligner is not as effective for extraction cases, tip control, open-bite cases, or intercuspation cases.

FABRICATION OF THE CLEAR ALIGNER

Clear Aligner treatment requires high-quality impressions. A set-up cast is made, reproducing the treatment goals. The amount of movement necessary to achieve the treatment goals can be measured by superimposing the initial cast and the set-up cast. A movement of 0.5 mm can be made with the initial Clear Aligner appliance, and the teeth can be moved 1 mm with each of the following appliances. Therefore, it is possible to calculate how many Clear Aligner appliances will be necessary.

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Fig 1 (a) The Clear Aligner appliance. (b) The Clear Aligner in the mouth of a patient. Note the excellent esthetics.



Fig 2 Reference lines.

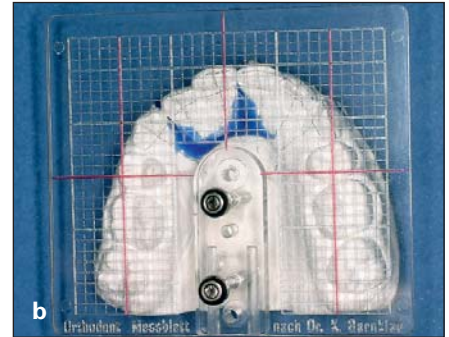
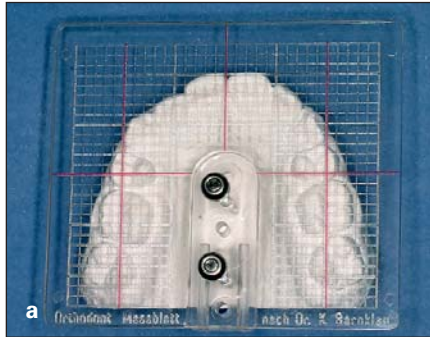


Fig 3 (a) Bernklau plate over the cast before the correction. (b) Bernklau plate over the cast after the correction.

The patient will use each appliance for 1 month, so in this way the clinician can know the treatment time. For superimposition of the images, Clear Aligner software, called Aligner Aid Program (IV Tech; Invisible Technology, Seoul, Korea), can be used.

To make the first Clear Aligner appliance, it is necessary to saw and remove the malpositioned teeth from the initial cast and move them in the direction of the correction by 0.5 mm. To check the movement of the teeth, use the reference lines (Fig 2), the Bernklau plate (Invisible Technology) (Figs 3a and 3b), the Model-Checker (Invisible Technology) (Figs 4a and 4b), or the Aligner Aid Program (Fig 5). Once the cast teeth are fixed in the new position, 2 thermoplastic plates will be adapted to the cast with a vacuum former. The first plate is 0.020-inch thick, and the second one is 0.030-inch thick. The patient will use the first plate for 1 week (at least 17 hours a day), and the second plate is used over the following 2 weeks. After this, the patient has to return to the office for new

impressions, and then the new Clear Aligner appliances will be made.

The Clear Aligner is always well adapted and esthetic because the appliances are frequently updated. New impressions are taken almost every month; therefore, the Clear Aligner can be used in mixed dentition and the patient can be treated by a general dentist. (Fillings, extractions, etc, that can change the shape of the teeth can be carried out without any problem during Clear Aligner treatment.)

If the patient fails to wear the Clear Aligner for the necessary number of hours each day, or breaks or loses it, it is possible to duplicate the Clear Aligner using the same set-up cast that was used to fabricate the initial one. The doctor can adjust the tooth movement range through the set-up cast. If the Clear Aligner was not worn for a long enough time period, the clinician should return to the cast used in the previous step. For this reason, casts for each step should be stored until the end of treatment.



Fig 4 (a) Torque measurement with the Model-Checker. (b) Tip measurement with the Model-Checker.



Fig 5 Tooth movement is measured by superimposing the photographs of the casts before and after the correction with the Aligner Aid Program.



Fig 6 Cast with reference lines.

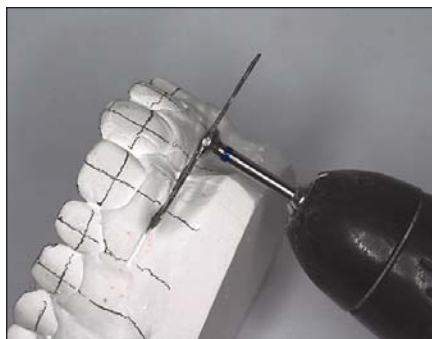


Fig 7 Cutting of the cast with a disk.



Fig 8 After expansion movement of the incisors, they are fixed with Utility Wax.

LABORATORY PROCEDURE

1. *Impression taking and cast trimming.* The impression procedure is done using the normal method. The working cast is made in hard stone; after trimming the cast, edges and bubbles are removed.
2. *Drawing the reference lines.* The reference lines are drawn on the labial and lingual sides of the teeth needing positional correction (Fig 6). One or two horizontal lines are necessary to control the vertical movement of the teeth; one or two vertical lines across the teeth are used to control horizontal and rotational movements.
3. *Sawing and trimming.* A horizontal cut with a disk (Fig 7) is done 5 to 6 mm from the gingival margin. For vertical cuts, saw thickness is 0.3 mm; however, the average amount of sawing space in a stone cast is 0.5 mm. Clini-

cians should take these measurements into account in case stripping has been done before. For cases without stripping, the cut between the teeth should be done first with a fissure bur from the horizontal cut to the edge of the papilla; then, the cast should be fractured to preserve the interdental contact point.

4. *Advancing.* Advancing means the acceptable range of orthodontic tooth movement toward the corrected position. The 3 stages in Clear Aligner treatment are: (1) initial stage, with 0.5 mm movement in the first step; (2) active stage, with 1.0 mm movement in each succeeding step; and (3) retention stage, without movement. The Clear Aligner is passive but it is activated if relapse occurs. In the first 3 weeks of Clear Aligner treatment, the tooth movement range should be less than 0.5 mm. During the active stage, the tooth movement range

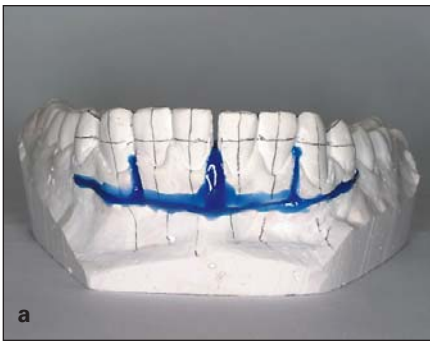


Fig 9 Blocking with LC Block-out Resin. **(a)** Labial view. **(b)** Lingual view.

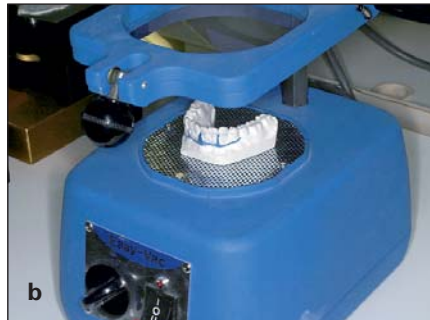


Fig 10 Vacuum former is used to make **(a)** the 0.020-inch-thick Clear Aligner and **(b)** the 0.030-inch-thick Clear Aligner.



Fig 11 Cast with the 2 Clear Aligner appliances.

should not exceed 1 mm per aligner change. Once the teeth are advanced, they are fixed with Utility Wax (Coltene Whaledent Dentalvertriebs, Konstanz, Germany) (Fig 8). It is necessary to check the movement of these teeth with the appropriate instruments (Bernklau Plate, Model-Checker, and Clear Aligner software). Then, the cuts are blocked with LC Block-out Resin (Ultradent, South Jordan, UT, USA) (Fig 9).

5. *Clear Aligner manufacture.* Using the vacuum former, 2 Clear Aligners of different thickness (0.020 inch and 0.030 inch) are carefully made (Fig 10). The authors use 0.020-inch and 0.030-inch Easy Gac Vasket plates (3A MEDES, Gyeongsido, Korea). The Clear Aligner appliances are then trimmed and polished (Fig 11). Ultrasonic clean-sing with 75% ethanol is necessary.

6. *Patient application.* After UV sterilization, the Clear Aligner is applied to the patient. Marginal trimming is done to eliminate overpressure on the gingival tissues.

CLINICAL CASES

To demonstrate the effectiveness of the Clear Aligner appliances, the authors present the before and after treatment photographs of 3 typical cases: case 1, with minor crowding in the maxillary arch, treated with Clear Aligner (Fig 12); case 2, with diastemas in the maxillary arch (Fig 13); and case 3, with relapse at the extraction site after orthodontic treatment, then treated with Clear Aligner (Fig 14).

Fig 12 Case 1. **(a)** Crowding in the maxillary arch (before treatment). **(b)** The maxillary arch after treatment.



Fig 13 Case 2. **(a)** Spacing in maxillary arch (before treatment). **(b)** The maxillary arch after treatment.

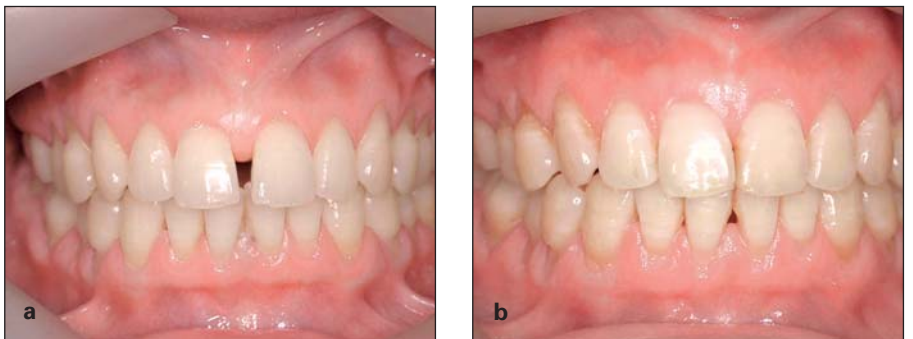


Fig 14 Case 3. **(a)** Relapse on the extraction site (before treatment). **(b)** The extraction site after treatment.



REFERENCES

1. Kessling HD. The philosophy of the tooth positioning appliance. *Am J Orthod Oral Surg* 1945;31:297-304.
2. Kessling JD. Coordinating the predetermined pattern and tooth positioner with conventional treatment. *Am J Orthod Oral Surg* 1946;32:285-293.
3. Yoshii O. New orthodontic device—dynamic positioner (D.P.) I. Approach to the proposal of D.P. and transparent silicone rubber. *Nippon Dent Rev* 1980;452:61-74.
4. Yoshii O. New orthodontic device—dynamic positioner (D.P.) II. Practical application and construction of D.P. *Nippon Dent Rev* 1980;454:107-130.
5. Yoshii O. New orthodontic device—dynamic positioner (D.P.) III. Case reports of reversed occlusion. *Nippon Dent Rev* 1980;457:146-164.
6. Yoshii O. New orthodontic device—dynamic positioner (D.P.) III. Case reports of reversed occlusion (Part II). *Nippon Dent Rev* 1980;458:112-129.
7. Sheridan JJ, Hilliard K, Armbruster P. *Essix Appliance Technology: Applications, Fabrication and Rationale*. Bohemia, NY: GAC International, 2003.
8. Hilliard K. *The Hilliard Smile Aligner Manual*. Metairie, LA: Raintree Essix, 2004.
9. Boyd RL, Miller RJ, Vlaskalic V. The Invisalign system in adult orthodontics: Mild crowding and space closure cases. *Dental Asia* 2000;1:12-19.
10. Kim TW, Echarri P. Clear aligner—El alineador realizado en la consulta (Parte I). *Rev Esp Ortod* 2004;34:71-76.
11. Kim TW, Echarri P. Clear aligner—El alineador realizado en la consulta (Parte II). *Rev Esp Ortod* 2004;34:157-165.
12. Kim TW, Echarri P. Posibilidades terapéuticas del Clear Aligner. *Kor J Clin Orthod* 2004;10:54-65.
13. Kim TW, Echarri P. Tratamiento de la mordida profunda anterior con Clear Aligner. *Ortodoncia Clínica* 2005;8:17-20.
14. Kim TW, Echarri P. *Manual of Clear Aligner. Course Syllabus*. Barcelona, February 26-27, 2005.
15. Kim TW. *Principles and Clinical Application of Clear Aligner. Clinical Cases of Clear Aligner*. Seoul: Myung-Moon Publishing, 2005.

