

The Mushroom Bracket Positioner for Lingual Orthodontics

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Although recent developments in bracket systems and more flexible wires have eliminated many of the problems associated with the early stages of lingual orthodontics,¹⁻⁶ it is still difficult to achieve good results without accurate bracket positioning. Improper bracket placement can create more serious errors than with conventional labial appliances because lingual bonding is more difficult and technique-sensitive.

Indirect bonding is essential for lingual brackets. Even on the plaster cast, however, the morphology of the lingual tooth surfaces is so varied that it is difficult to locate exact bracket positions. For this reason, Kyung developed the Individual Indirect Bonding Technique (IIBT) in 1986.⁷ This method uses a setup model, but still requires the base of each preadjusted lingual bracket to be modified to adapt precisely to the lingual tooth surface. A new tool, the Mushroom Bracket Positioner* (MBP), can determine the exact bracket inclination, height, and angulation simultaneously on the patient's setup model.

The MBP consists of a setup model holder,

horizontal and vertical arms, two mushroom-shaped horizontal plates with long, narrow slots (one for each arch), and lingual bracket holders (Fig. 1). Each plate comes with two curved anterior bracket holders, two single bracket holders, and two posterior bracket holders. Slots on the holders allow the brackets to be easily inserted, tied with elastomeric ligatures, or removed without releasing the nuts and bolts on the mushroom plate. The anterior bracket holders are curved so that the four anterior teeth can be bonded at the same time if there is no great variation in the lingual surfaces. Preadjusted canine and posterior brackets can be placed in the large posterior bracket holders. Single bracket holders are used for canines or abnormally shaped teeth.

Preparation of the Setup Model

The setup model should be built for over-correction in height, angulation, and inclination. For example, it is usually advisable to add 5-10° more torque to the maxillary incisors, depending on the case (Fig. 2A). The bracket holders are used to determine whether all the lingual brackets can be placed in one parallel horizontal plane

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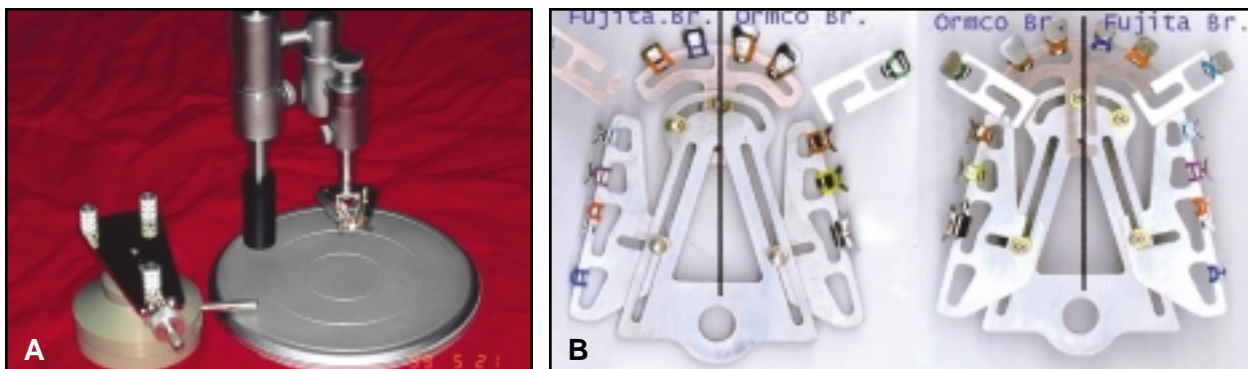


Fig. 1 A. Mushroom Bracket Positioner setup model holder with prototype mushroom plate. **B.** Most recent version of mushroom plates with bracket holders, showing two types of lingual brackets on each arch.

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(Fig. 2C). Once the final bracket positions have been chosen, a separating medium is applied and allowed to dry.

The horizontal slot of each bracket is attached to the blade of a bracket holder. A light-cured sealant (Maximum Cure**) is applied to

the bracket bases and cured with a light gun. Next, the resin of a two-paste or light-cured system (Bisfil-Core***) is applied to each bracket base, and the blade is moved to position the bracket on the tooth surface on the setup model (Fig. 3). Excess resin can be removed with a scaler or explorer after the correct bracket positions are achieved. The resin is then cured, customizing each bracket base to adapt properly to

**Reliance Orthodontic Products, P.O. Box 678, Itasca, IL 60143.

***Trademark of Bisco, Inc., 1100 W. Irving Park Road, Schaumburg, IL 60193.

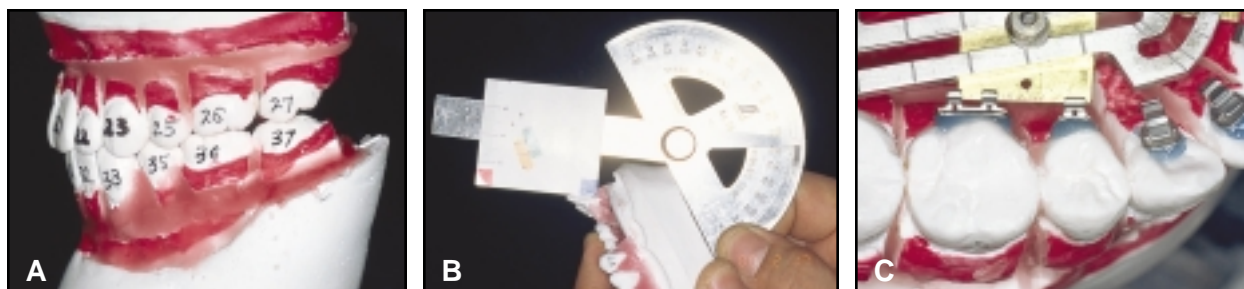


Fig. 2 A. Setup model with built-in overcorrections. B. Tooth angulations measured with modified protractor. C. Setup model checked with lingual brackets attached to bracket holders to determine whether brackets slots can be placed in one parallel horizontal plane.

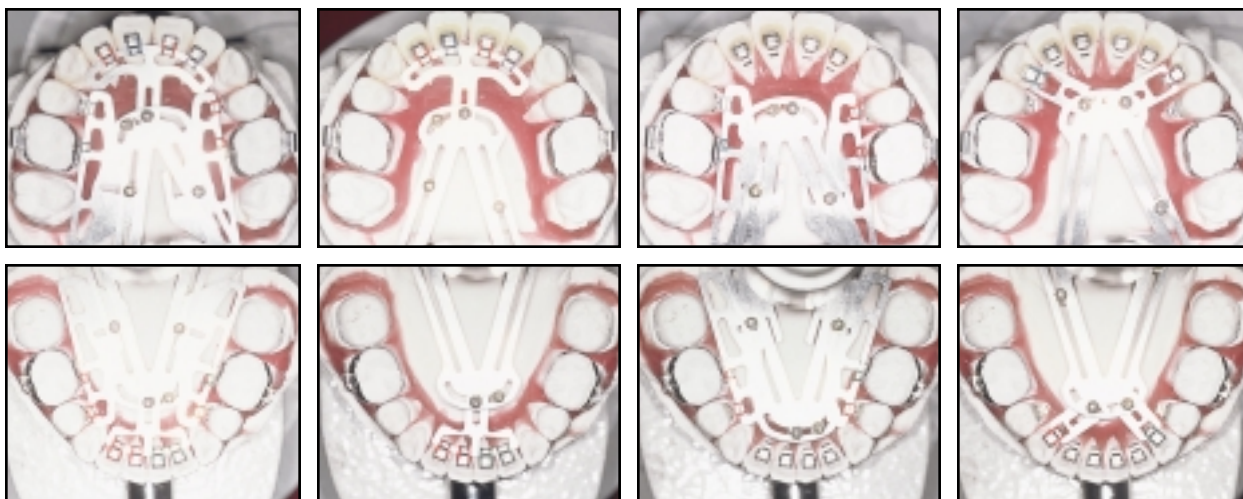


Fig. 3 Bracket holders used for indirect bonding on setup model. Spaces between bracket and tooth are filled with light-cured resin to customize bracket bases.

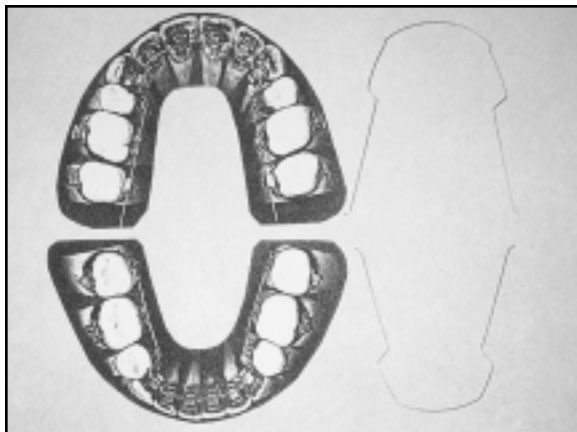


Fig. 4 Individual ideal lingual archform made by photocopying setup model with .014" round archwire in bracket slots.

the lingual surface.

After the brackets have been attached to the setup model, an .014" round archwire can be inserted into the bracket slots. A photocopy of the occlusal surface of the setup model can then be used as an individual ideal lingual archform (Fig. 4).

Indirect Bonding Procedure

Although silicone is easy to handle and inexpensive as a material for making individual bonding trays, it is sometimes a little too soft to provide an accurate fit for a tooth with a small clinical crown, such as a lower incisor. We now use a flexible light-cured resin (Fermit†) to pro-

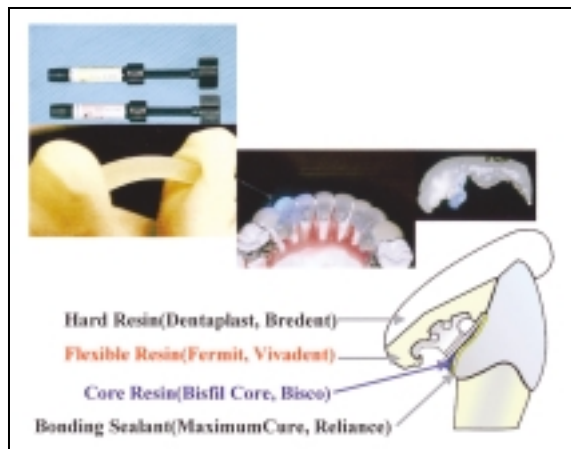


Fig. 5 Flexible Core Trays consist of flexible inner tray made of light-cured resin and hard outer tray made of pattern resin.

duce what we call Flexible Core Trays (FCT). This material is hard enough, but less bulky than silicone and soft enough to reuse when bond failures occur. A clear, hard pattern resin (Bredent‡) is applied over the flexible resin and over the incisal edge and labial surface of each tooth to improve stability and provide an accurate fit (Fig. 5). After the resin has set, the tray is removed from the model and cut into individual transfer trays for each tooth.

The bracket bases should be cleaned with acetone before bonding. The brackets are then

†Ivoclar Vivadent, Inc., 175 Pineview Drive, Amherst, NY 14228.

‡Bredent USA, 12145 S.W. 131st Ave., Miami, FL 33186.

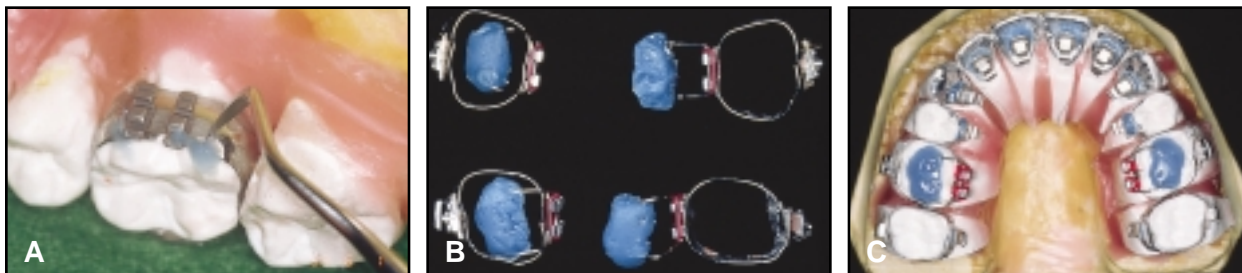


Fig. 6 Individual indirect banding. A. Bracket position marked with sharp scaler on band surface. B. Molar bracket temporarily affixed to molar band with light-cured resin; bracket slot connected with wire segment to occlusal seating stop made of light-cured resin. C. Molar bands on setup model.



Fig. 7 26-year-old female with lip protrusion before treatment.

bonded one by one, from posterior to anterior, using the individual FCTs. After bonding, the trays should be stored until the end of treatment in case they need to be reused.

When the molars are banded, brackets or tubes can be soldered or welded to the bands for use in the MBP system. After the edge of the weldable molar bracket base has been marked with a sharp scaler, the bracket is temporarily attached by applying a small amount of light-cured resin or cyanoacrylate glue to the occlusal

bracket wing and the occlusal surface of the molar. The slot of the tube or bracket is then connected with a wire segment to an occlusal seating stop made of light-cured resin (Fig. 6). This stop acts as an index to provide a precise bracket position, even on a cemented band.

Case Report

A 26-year-old female presented with the chief complaint of both lips protruding (Fig. 7).

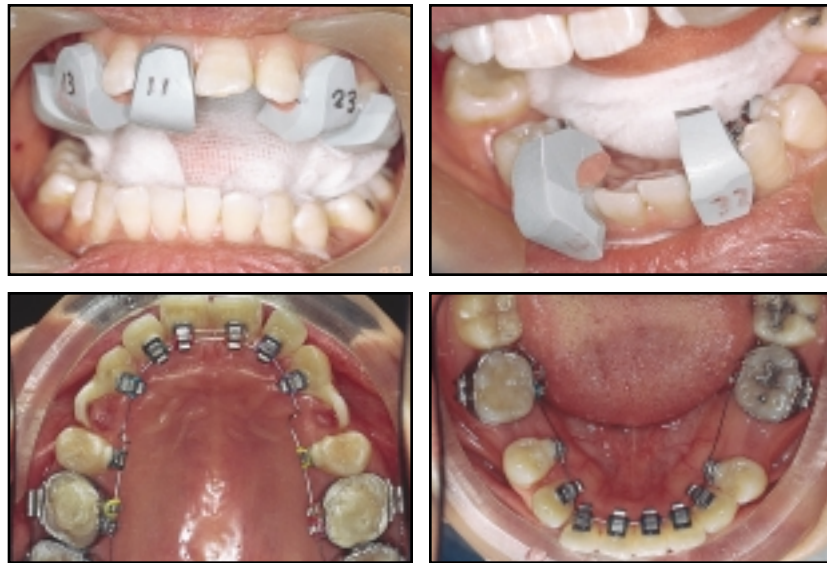


Fig. 8 Indirect bonding from posterior to anterior using individual silicone transfer trays, with upper second molars banded directly. Light-cured resin added on occlusal surfaces of upper first molars to prevent contact of lower anterior teeth with upper anterior lingual brackets.

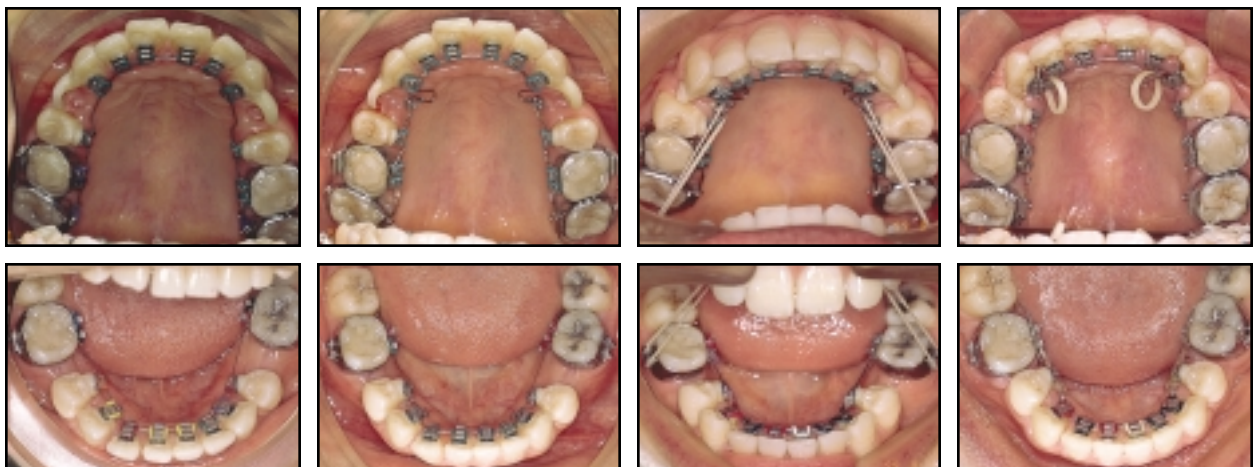


Fig. 9 Treatment progress.

She had a Class I molar and Class II canine relationship with a skeletal Class II pattern. The patient had a 4mm mandibular arch-length discrepancy, a 3mm curve of Spee, an overjet of 7mm, an overbite of 50%, an ANB angle of 4.5°, an FMA of 21°, an FH-1 angle of 128°, an occlusal plane angle of 5.5°, and a Z angle of 59.5°.

The overall treatment objective was to reduce the lip protrusion by correcting the severe overjet with lingual orthodontic appliances, after

extraction of the upper first premolars and lower second premolars. The setup model was constructed with Fujita triple-slot lingual brackets using the MBP as described above (Fig. 3).

The brackets were bonded using individual silicone trays (an earlier version of the FCT). Maxillary lingual brackets were bonded from second premolar to second premolar (Fig. 8). The first molars were indirect-banded, and the second molars were banded directly at chairside,

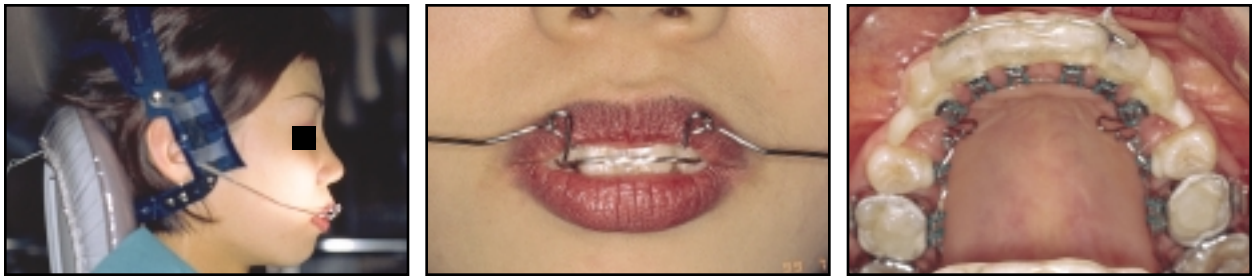


Fig. 10 Application of removable Anterior Root Torquing jig with J-hook headgear.



Fig. 11 Class II molar correction.

with buccal tubes attached on both sides. In the mandibular arch, lingual brackets were bonded from first premolar to first premolar; the first molars were indirect-banded, and the second molars were banded directly during treatment, with welded buccal attachments. Light-cured resin was added to the occlusal surfaces of the upper first molars to prevent contact of the lower anterior teeth with the upper anterior lingual brackets. Cosmetic pontics were bonded to the distal sides of the upper canines.

Initial maxillary .014" Elgiloy^{††} and mandibular .016" nickel titanium archwires were inserted into the horizontal bracket slots for leveling. An .016" × .022" TMA^{‡‡} archwire was then used to control the torque of the six maxil-

lary anterior teeth, while an .016" Elgiloy mandibular archwire was used for re-leveling. En masse retraction was carried out using an .016" × .022" stainless steel archwire with vertical loops in the maxilla and an .016" × .016" stainless steel wire in the mandible. Class I elastomeric threads were placed to retract the lower eight anterior teeth simultaneously with sliding mechanics (Fig. 9). A headgear with a removable Anterior Root Torquing jig was prescribed to reinforce upper anchorage and to help control the torque of the maxillary incisors (Fig. 10). Class II elastics were applied from the maxillary lingual vertical loops to the lower first molar buccal attachments.

When a Class II molar relationship remained after space closure, sectional .016" × .022" nickel titanium omega-loop archwires were placed between the lingual attachments on the upper first and second molars to distalize the second molars (Fig. 11). The maxillary archwire

^{††}Registered trademark of RMO, Inc., P.O. Box 17085, Denver, CO 80217.

^{‡‡}Registered trademark of Ormco/"A" Company, 1717 W. Collins Ave., Orange, CA 92867.



Fig. 12 Final detailing with .014" Elgiloy wires in occlusal slots.

was changed to .014" Elgiloy with flush stop loops just in front of the second molar attachments (Fig. 12), and the first molars and second premolars were retracted sequentially with elastometric threads and Class II elastics. The six upper anterior teeth were then retracted again using an .016" \times .022" stainless steel archwire with sliding mechanics. For final detailing, .014" Elgiloy archwires were inserted into the occlusal slots of the upper and lower lingual brackets. The posterior occlusal bite blocks were ground away gradually as the bite opened during treatment. Total treatment time was 30 months (Fig. 13).

The post-treatment cephalogram showed no substantial changes in skeletal measurements. ANB decreased from 4.5° to 3.5°, and the Z-angle increased from 59.5° to 74.5°, indicating a marked improvement in the profile. The FH-1 angle decreased from 128° to 107°. The patient was completely satisfied with the treatment result.

Discussion

The main concept of IIBT is to use a setup model to determine the precise bracket positions for each patient. Bonding the brackets one by one

makes it easier to control moisture than in conventional indirect bonding techniques, where several brackets are bonded at a time. When crowding makes it impossible to place some lingual brackets in correct positions at first, IIBT allows them to be bonded indirectly whenever enough space is gained. In addition, IIBT does not require extractions to be delayed until after bonding.

In lingual orthodontic treatment, the six anterior teeth are usually retracted together for esthetic reasons. It is difficult to place torque in the four incisors with individual wire bends, however, because of the short interbracket distance and small archwire radius. Therefore, it is advisable to control the torque of the upper incisors with straight wires before en masse retraction. Unfortunately, considering the variable lingual crown morphology and the slope of the maxillary anterior teeth,⁸ any small variation in bracket height can affect the torque delivered to the tooth much more than with labial appliances (Fig. 14).

Although Paige has used auxiliary root-torquing springs to control the torque of anterior teeth,³ adding light-cured resin to the bracket base in the laboratory is a more reliable ap-

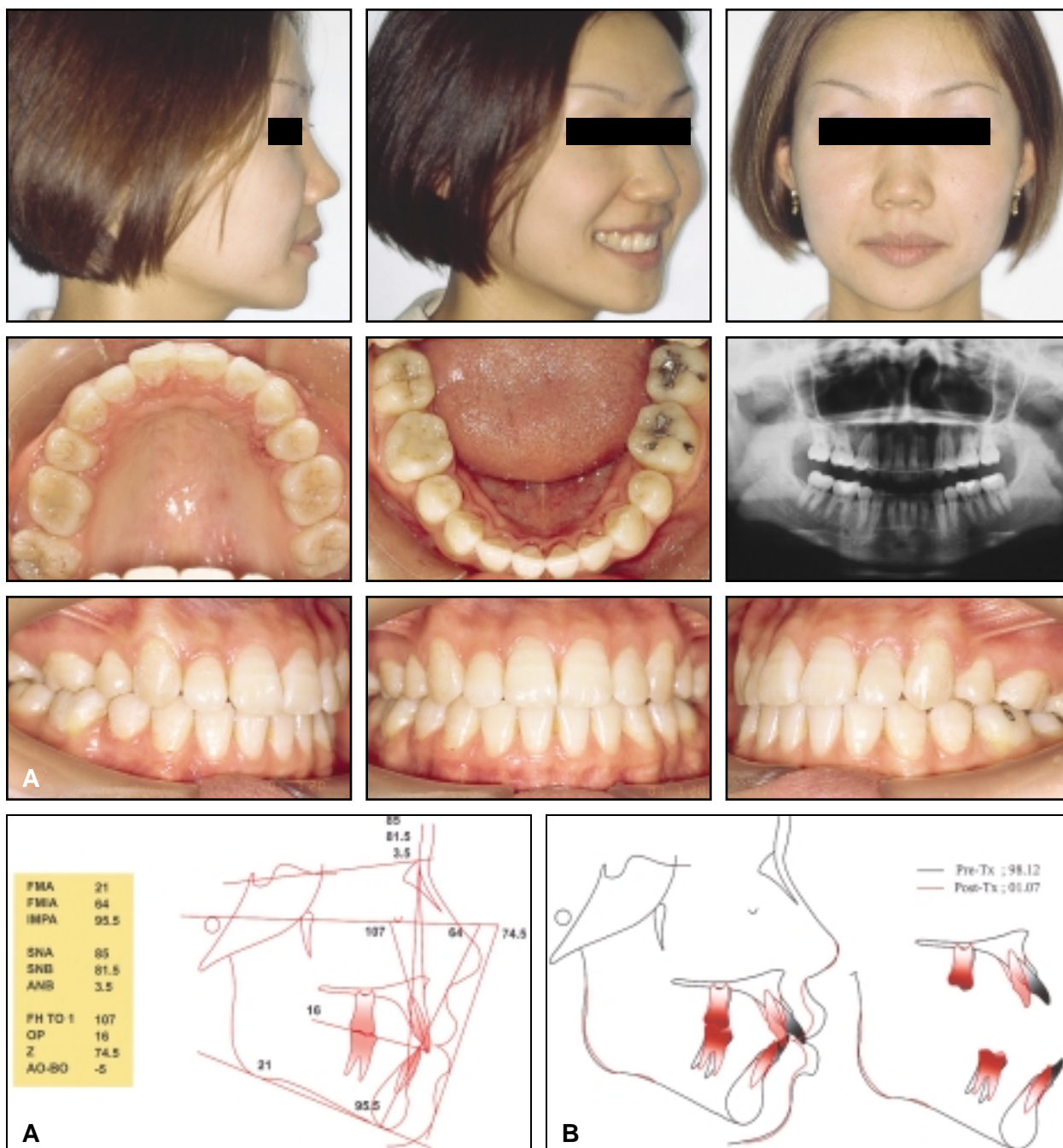


Fig. 13 A. Patient after 30 months of treatment. B. Superimposition of pre- and post-treatment cephalometric tracings.

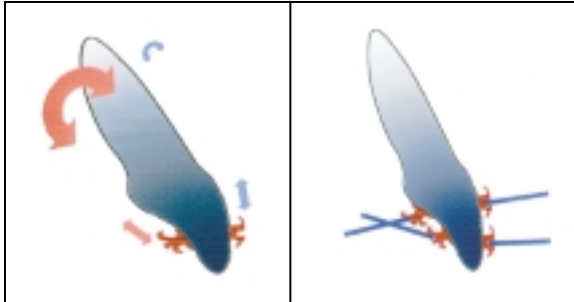


Fig. 14 Comparison of torque changes on labial and lingual sides of upper incisor with identical change in bracket height.

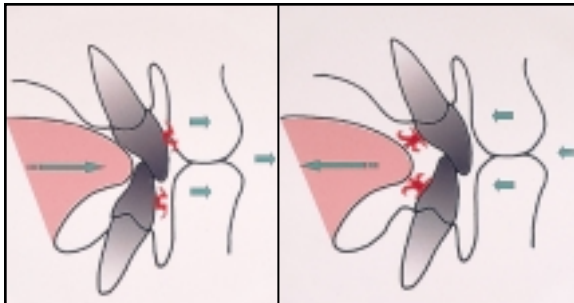


Fig. 15 Lingual brackets act as tongue spur while avoiding lip contact with labial appliances.

proach. The MBP levels all the brackets on one horizontal plane on the setup model, making it possible to determine torque at the same time as bracket height and angulation. It is important to place 5-10° more torque than normally used in the upper incisor brackets, depending on the amount of en masse retraction required and the initial upper incisor inclination, when the setup model is fabricated.

Because lingual brackets act as a tongue crib or spur, the tongue usually avoids the anterior brackets, thus reducing the anchorage loss normally associated with retraction of the anterior teeth (Fig. 15). Lip posture is better with lingual appliances because of the absence of brackets and archwires on the labial surfaces. The buccinator muscle presses the lips continuously against the teeth during lingual treatment, further reinforcing anterior anchorage. When more

anchorage is needed, however, a transpalatal bar and/or a facebow can be utilized, as in labial treatment. J-hooks are difficult to apply to the main archwire, but can be attached to a removable acrylic jig on the maxillary anterior teeth after their alignment (Fig. 10).

Conclusion

Excellent results have been reported with multibracket lingual orthodontic treatment,⁹⁻¹¹ which is often the best option for patients with esthetic concerns.¹² Although many factors can make fixed lingual treatment difficult, problems can be reduced through accurate bracket positioning. The MBP for indirect bonding with a setup model, as presented in this article, is a useful tool for determining the exact bracket inclination, height, and angulation for each tooth. Research is continuing into bracket placement using ideal lingual archforms without offset bends—in other words, for a lingual straight-wire appliance.

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