

REVIEW

Lingual Orthodontics

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Abstract:

At the early stages of the 80's, most of the practitioners and the patients have been seduced by lingual. But the difficulties of the technique have rapidly given a disappointment. Today ten years later the authors present the progress which have been realized: the evolution of the brackets, the accuracy of their placement in the lab procedures, the making of the wire, the increase in patient's comfort. So this article attempts to review some of the advantages, disadvantages, bracket systems and laboratory procedures of lingual orthodontics

Key words: *Lingual bracket, Indirect bonding, Torque angulations*

INTRODUCTION ¹:

The development of numerous Orthodontic techniques together with notable progress from a commercial technological point of view have led to the achievement of exceptionally high Orthodontic standards. In fact, there are no limits to the solution of any kind of malocclusion, whether dental or skeletal, with a high percentage of success.

A pleasant esthetic look increases people's self-confidence and provides reassurance when making personal contacts. To be good looking is always an advantage, especially in relationship between adults. The better looking a person, the more positive the assessment by others. The esthetic aspect has great importance and is the most frequent motive encouraging patients to undergo Orthodontic treatment.

Today, the main goal is to achieve facial balance, and the development of Orthodontic treatment is the balance between esthetic treatment, functionality and patient's aspirations. Keeping rigorously to skeletal Orthodontic treatment plan is considered an

error in modern Orthodontic philosophy. So the esthetic aspect has great importance and is the most frequent motive encouraging patient's to undergo Orthodontic treatment. Many patients if given choice, despite of being costly would still opt for an appliance that is invisible, and at the same time which provides good quality of treatment. Lingual Orthodontics thus represents the best solution for meeting the needs of patient's without the risk of damaging biomechanical efficiency.

ADVANTAGES:^{2, 3}

1. Facial surfaces of the teeth are not damaged from bonding, debonding, adhesive removal.
2. Facial gingival tissues are not adversely affected.
3. Facial contours are truly visualized since the contour and drape of the lips are not distorted by protruding labial appliances.
4. Inter bracket width is greatly reduced on most teeth because of the smaller lingual arch radius. This becomes less of a problem when more resilient archwires are used.

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5. Most adult and many young patients would prefer "invisible" lingual appliances if costs, treatment times, and results were comparable to those of labial appliance treatment because of esthetic consideration.
6. The bite plane like effect in brackets will allow the intrusion of the incisors and a limited extrusion of the molars.

DISADVANTAGES: ^{2,3}

1. Tissue irritation and speech difficulties.
2. Gingival impingement.
3. Difficulty in rotation correction.
4. Difficulty in oral hygiene.
5. Non economic.
6. Technique sensitive.

FAVORABLE CASES:⁴

Non extraction cases:

1. Deep bite, class I with mild crowding, good facial pattern.
2. Deep bite, class I with spacing or diastema, good facial pattern.
3. Deep bite, mild class II, good facial pattern.
4. Class II div 2 with retruded mandible.
5. Low angle deep bite.

EXTRACTION CASES:

1. Class II upper 1st premolar and lower 2nd premolar.
2. Class II upper 1st premolar extraction.
3. Mild bimaxillary protrusion with 4 premolar extraction.
4. Class III tendency with deep bite.

UNFAVOURABLE CASES :

1. Surgical cases.
2. Open bite cases

3. Periodontal involvement with reduced bone level
4. Class III high angle cases
5. Class II high angle cases
6. Severe class II discrepancies
7. Short clinical crown
8. Poor oral hygiene.
9. Acute TMJ dysfunction.

BRACKET SYSTEMS

During the past 20 years, various lingual brackets have been designed and modified for patient control, mechanical efficiency and precise tooth positioning.

1. CONCEAL

Thomas Creekmore.

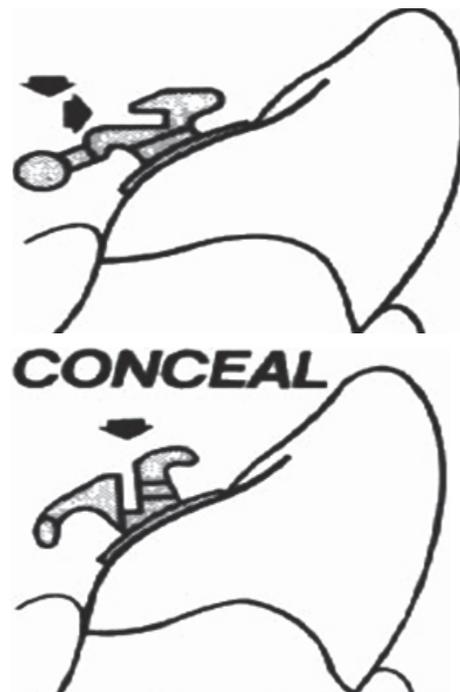


Figure. 1 Lingual insertion, occlusal insertion

The opening of the arch wire slots is occlusal rather than to the lingual aspect. This occlusal approach makes arch wire insertion, seating, and removal easier than arch wire insertion with lingually opening slots.⁵

1. FUJITA LINGUAL BRACKET (update)

Ryoon Ki Hong & Hee Wook Sohn

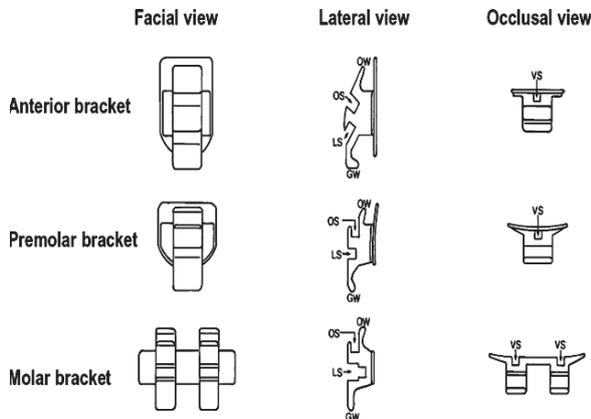


Figure 2:

Fujita's lingual bracket, introduced in 1979, featured a slot that opened towards the occlusal. A lockpin was inserted mesiodistally into a groove in the slot to secure the arch wire in conjunction with elastomers and ligatures. Later many modifications were made to this brackets but the opening is still occlusal.⁶

3. STb (SCUZZO- TAKEMOTO bracket)

Designed by Dr. Scuzzo and Dr. Takemoto (sold by ORMCO)

These brackets (1.5 mm thickness) improve greatly the comfort of orthodontic treatment for the patient, giving minimum discomfort in terms of perception of the appliance and creating any speech disturbance.⁷

4. FORESTADENT

Forestadent lingual brackets are available as 2D-brackets for treating less complex and 3D-brackets for complex cases. They have an extremely low profile and are barely noticeable for the patient. The 2D and 3D lingual-brackets are easy to use self ligating-brackets with a vertical slot for fast and easy archwire insertion.

5. STEALTH BRACKETS (second generation American Orthodontics)

The American orthodontics simple system bracket:

It is the old generation lingual brackets made by American orthodontics. It is a simple bracket, has poor rotation control without the use of auxiliary. It also has a vertical slot to insert an uprighting spring to compensate for the inadequate control caused by a slot that is too short.

6. PHILIPPE SELF LIGATING LINGUAL BRACKETS

It can be directly bonded to the lingual tooth surface because they do not have slots, only 1st and 2nd order movements are possible. Four types are available: a standard medium twin (regular use), a narrow single wing bracket for lower incisors, a large twin and a three wing bracket for attachment of intermaxillary elastics and application of 3rd order movements.⁷

7. KELLY BRACKET (UNITEK): Horizontal insertion bracket

The best in controlling rotations since it is twin with two actual contact points between the bracket and wire. It is a labial Unitek bracket adapted as a lingual one and not related to any special technique.

8. KURZ LINGUAL BRACKETS

They are available in .018 and .022 slot width. The characteristics of this bracket are rounded facial contours, to avoid lingual irritation; large hooks which enable attachment of springs and power chains, increased tie wing area to enable double over tie, bracket base is large to improve bonding and horizontal slot allows easier torque control.

9. ADENTA BRACKETS

In 1999, after using the self-ligating TIME Bracket for several years, Dr. Hatto Loidl approached Adenta GmbH with the idea to use the same self-ligating clip mechanism for a lingual bracket.

10. IN- OVATION- L BRACKET FROM GAC

The small dimension provides better patient comfort and provides greater interbracket distance. It can be placed in the deepest portion

of the lingual fossa, better adapting to the anatomical contours. In particular the forked design built in to the base allows the base pad to be easily bent to fit the complicated lingual shape of the cuspid securely. It has a self ligating clip that remains interactive and in stage of constant activation, this eliminates the need to change ligature ties during office visits.⁸

11. IBRACES (INCOGNITO)

Advantages with system are they have lower profile, patient discomfort is less and exact finishing.⁹ This bracket system differs fundamentally both in designing and in manufacturing methods for existing appliance. Using the state of the art CAD/CAM technology, the two normally separate processes of bracket production and bracket positioning are fused in to one unit.

BONDING IN LINGUAL ORTHODONTICS ¹⁰

In order to fully exploit the potential of the device used in lingual orthodontics, it is imperative that the brackets be positioned with 100 % accuracy. A key factor for successful correction of a malocclusion with lingual orthodontics is precise and accurate bracket positioning.

1. CUSTOMIZED LINGUAL APPLIANCE SET - UP SERVICE SYSTEM (CLASS)

The CLASS technique offers a method of lingual bracket placement that takes in account the anatomic discrepancies in the lingual surfaces of the teeth. This is accomplished by first constructing an ideal diagnostic set - up from a duplicate set - up model of the patient's ideal malocclusion. This ideal set - up or template is then used as a physical guide to place the lingual brackets in an ideal configuration. The brackets are placed on the diagnostic set - up using composite adhesive, which acts as spacer between the metal mesh pad and the individual dental surfaces. After the brackets are placed on the ideal diagnostic set- up, they are next transferred back to the malocclusion cast. At this point, transfer trays are fabricated so the brackets

can be delivered clinically via the indirect bonding method.

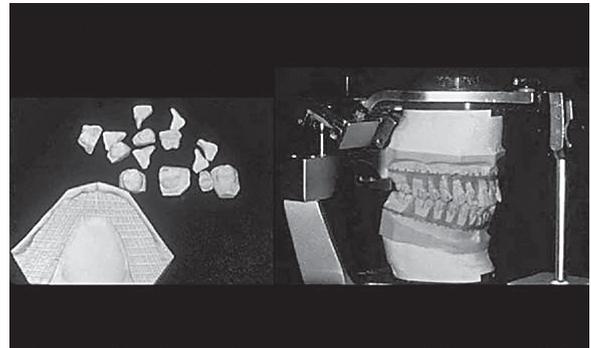


Figure 3 - Set-up models are used in many of the laboratory techniques

Torque Angulation Reference Guide (TARG) System

The TARG machine was launched by the Ormco Society in 1984 as an important aid to the laboratory technique. It allows the accurate placement of the brackets at a precise distance from the incisal and occlusal surfaces of the teeth, as well as making it possible to prescribe the torque and angulation for each tooth individually. This creates a "virtual" set-up, and the brackets can be bonded on the malocclusion model, with each bracket having a specific resin-modified base.

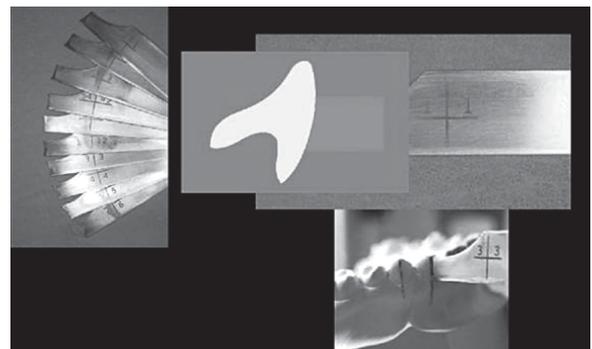


Figure4:

Bonding with Equal Specific Thickness (BEST) System

In 1986, Fillion developed a new system. He realized that there was an important feature missing from the original TARG machine—a device to measure the distance in the horizontal

plane from the labial surface of the tooth to the slot of the lingual bracket. He added a precise measuring device to the original TARG machine to allow compensation for the different thickness between the teeth.

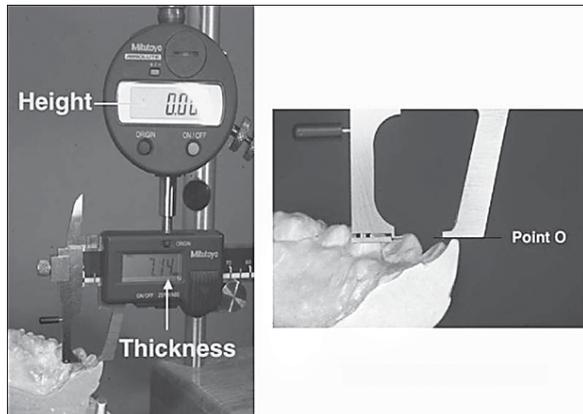


Figure 5: The Electronic TARG has a precise measuring device that measures the distance (thickness) between the labial surface of the tooth and the slot of the bracket.

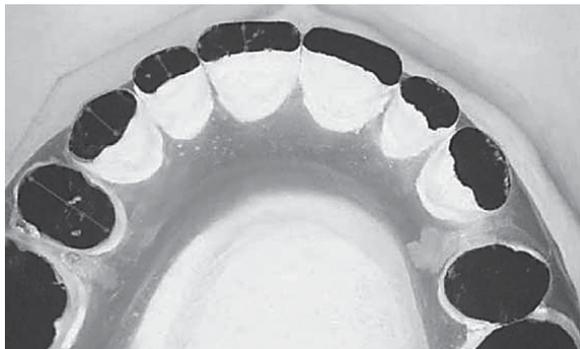


Figure 6: Thickness difference between different teeth need to be compensated for during bracket positioning to allow working with a straighter arch wire.

Slot Machine

The slot machine was designed by Thomas Creekmore for the placement of both conventional and lingual brackets directly onto the malocclusion model. The procedure consists of positioning each tooth to a prescribed torque and angulation; the machine orientates the bracket slot with the Andrews labial archwire plane (LA plane). The slot machine can be used for the placement of brackets having either horizontal or vertical access archwire slots. The fact that no model tooth set-up is required is a major advantage, but the difficulty in managing

the many pieces of the slot machine might be seen as a disadvantage.

Lingual Bracket Jig (LBJ)

The LBJ developed by Geron is the only system that allows direct as well as indirect positioning of brackets. It consists of a set of six jigs for the anterior maxillary teeth, one universal jig for the posterior teeth, and a special ruler. The jigs transfer the Andrews labial bracket prescription to the lingual surface. An occlusal stop measures the height of the bracket from the incisal edge.

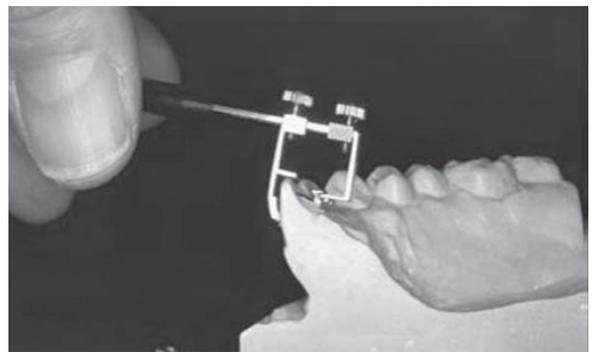


Figure 7: Lingual bracket jig; can be used indirectly on the malocclusion model or for direct bonding in the mouth.

Transfer Optimized Positioning (TOP/INCOGNITO I BRACES system)

The TOP system uses a set-up technique similar to that used for the BEST system, allowing the brackets to be placed directly on the malocclusion model. The technique uses the TARG Professional, which has a bracket holder for twin brackets and tubes in addition to the horizontal and vertical measuring systems first described by Fillion. The target set-up is used to find the optimal height for the brackets.

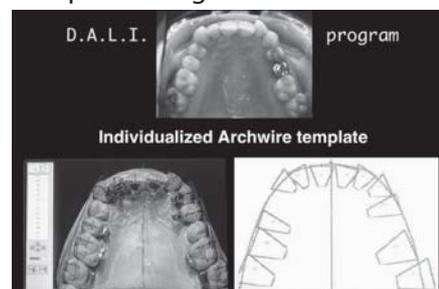


Figure 8: The DALI software coordinates upper and lower arch designs, making it possible to have the wires constructed in advance, thus reducing chair side time.

Korean Indirect Bonding Set-up (KIS)

System

The KIS system was developed by members of the Korean Society of Lingual Orthodontics (KSLO) and uses a bracket-positioning machine that allows the positioning of all brackets at once. Once again it is necessary to create a set-up model; however, the set-up is created with the help of a special set-up model gauge for increased precision.

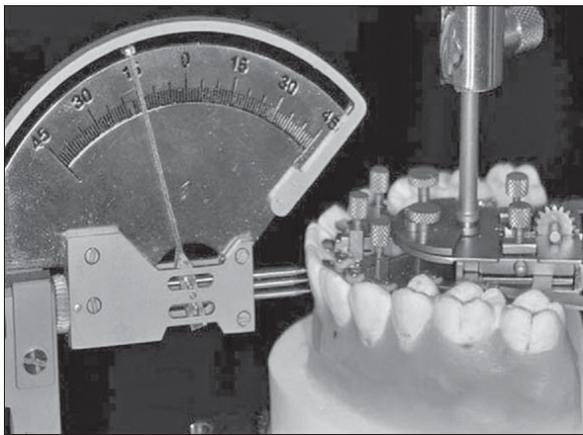


Figure 9: KIS system; all brackets are positioned at the same time.

Hiro System

Two laboratory techniques that do not require special equipment are the Hiro system and the Convertible Resin Core system. The Hiro system was created by Toshiaki Hiro and improved by Kyoto Takemoto and Giuseppe Scuzzo. It still relies on the preparation of a set-up model where the teeth are sectioned and correctly aligned. The brackets are positioned and placed on the set-up model with the help of a full-sized rigid rectangular archwire.

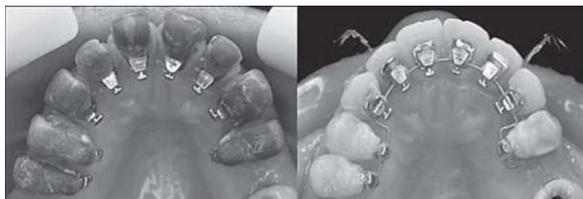


Figure 10: HIRO system; the transfer trays are made individually and transferred directly from the set-up model to the mouth.

Convertible Resin Core System

The Convertible Resin Core system uses hard resin to prepare the individual transfer trays and an elastomeric ligature to hold the tray and bracket together.

This allows accurate repositioning of the bracket within the resin core and the trays can be reused in cases of bracket failure. The use of unitary trays makes the initial bonding session longer and the technique still relies on a set-up model to position the brackets.

Hybrid Core System.

This is not so much a bracket-positioning system but rather a bracket-transfer system. The Hybrid Core system developed by Matsuno combines the favorable properties of silicone and composite resin in the construction of its indirect transfer tray. Silicone covers the bracket and this in turn is covered by composite resin. This combination allows for stable positioning of the transfer tray within the mouth, followed by easy removal of the silicone component from the bonded bracket.

Simplified Technique

The Simplified Technique is associated with the development of the new STb brackets. The brackets are positioned directly on the malocclusion model by using a bracket placement plier or simple tweezers.

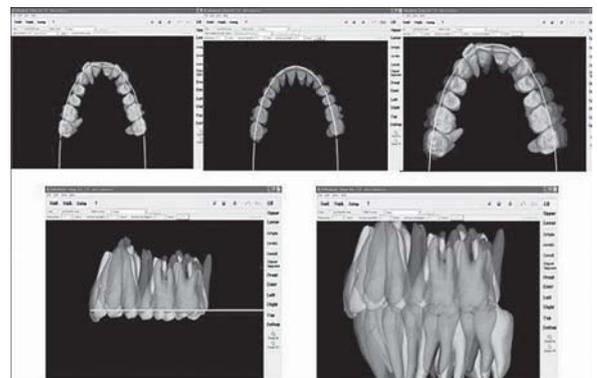


Figure 11: STb brackets can be positioned directly onto the malocclusion model at 1.5 to 2.0 mm from the incisal edge of the anterior teeth.

Orapix System

The newest lingual orthodontic laboratory technique is the Orapix system, which is still in its final phase of refinement. A scanner will scan a patient's model and create a three dimensional (3D) data file. The orthodontist will receive the 3D data file of the patient and a 3-Txer software package via the Internet. With the 3-Txer software the orthodontist will visualize a 3D model and will be able to create his own virtual set-up on his computer for that particular patient.

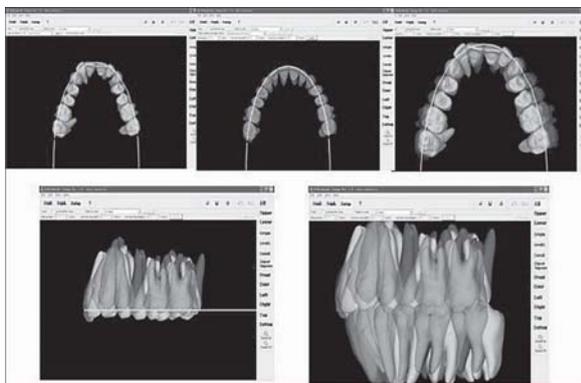


Figure 12 : Orapix system; the clinician will receive the patient's data via the Internet and decide on the adequate angulation, torque, arch curve, and occlusion details on the clinician's computer screen. The information is sent back to the laboratory via the Internet.

RETENTION IN LINGUAL ORTHODONTICS

Clear retainer

Begg-Type retainer

Spring Retainer

Passive lingual retainer

Active lingual retainer (bonded)

CONCLUSION:

During the last few years the work of few specialists has led to the codification of the main steps of the lingual technique, as well as of the labial technique, allowing an easier approach for less experienced Orthodontists. Lingual Orthodontics needs wider diffusion, it should become part of every Orthodontists cultural baggage. Many universities and Orthodontic societies around the world are now beginning to offer lingual Orthodontic courses.

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