



LINGUAL ORTHODONTICS – A REVIEW

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ABSTRACT

The addition of lingual appliances to the world of aesthetic orthodontic appliances has provided the ultimate in aesthetics because they are not visible. Patients with high aesthetic demands seem more interested in this approach and enjoy having confidence in their smile before their braces are removed. This article attempts to review the development and current principles and techniques of lingual orthodontics.

INTRODUCTION

The number of adult patients in orthodontic practices is increasing^[1]. The decision taken by adults to commit themselves to orthodontic treatment is a more complex matter than for the younger age groups, as they have the demands of their work and broader social needs to consider. Of those who would accept all other aspects of treatment there is a group that is not prepared to display their orthodontic appliances and lingual orthodontics has become the aesthetic solution for meeting the needs of these patients^[2,3]. When Miura *et al*^[4] presented an acid etch bonding system in 1971, it was possible for the first time that the total orthodontic appliance could be placed on the palatal or the lingual surfaces of the dental arches so that it would not be seen. Fujita^[5,6] began to work on the development of a specific lingual bracket technique and published a few case reports using his method in 1979. The addition of lingual appliances to the world of esthetic orthodontic appliances has provided the ultimate in esthetics^[7]. Kurz and coworkers^[8-15] in cooperation with the Ormco Company developed an edgewise bracket for lingual application and they tested these new brackets in approximately 80 cases in 1980. In 1981,^[6] prominent American orthodontists formed the Lingual Task Force with a mission to promote lingual orthodontics. Since then courses have been given all over the world and many universities have integrated lingual orthodontics into the curriculums of their post-graduate orthodontic programs.^[2] Both Fujita and Kurz with their coworkers^[5,8-15] adapted the edgewise mechanism for use

on the lingual surfaces. However, Paige 16, who preferred the Edgewise appliance labially, recognized that a round archwire technique would be more suitable when applied lingually. The greater variation of lingual surface anatomy meant that a round archwire compared with a rectangular wire was less liable to cause undesirable torque, and therefore the positioning of brackets at precise angulations was less critical. As distinct from labial approach, the ribbon arch bracket was positioned with the vertical slot directed towards the occlusal surface to facilitate archwire placement.

The Lingual Task Force members and others provided many reports on the continuing development of the lingual appliance.^[8, 11, 13-15, 17-25] In many places of the world there have been limited acceptance of lingual technique by orthodontists because of problems encountered in the early evolution of the appliance. Many have considered the lingual technique difficult to employ.^[13,20] and more time consuming^[26] for the patient and for the orthodontist. However, technological advancements in materials and processes are creating renewed interest in lingual protocols^[27]. Patients who have been offered the lingual orthodontic option are very enthusiastic in their acceptance^[28]. Patients with aesthetic demands, especially those with acting, singing, modeling or entertaining goals seem more interested in this approach. They enjoy having confidence in their smile before their braces are removed^[7].

As the patient's profile and lip position are not distorted by the brackets, a true cosmetic evaluation during treatment is possible^[6]. Moreover, contrary to the popular myths about lingual appliances, good results can be achieved equivalent to that of labial appliances with proper patient and case selection, and a sound treatment plan.

The Lingual Edgewise Appliance

Different kinds of lingual bracket systems have been manufactured, for example, Fujita, Ormco, Forestadent and Creekmore Enterprise^[29,30]. The Kurz-Ormco 7th generation lingual brackets are Edgewise brackets specifically designed for the lingual surface of the teeth^[7]. The maxillary anterior brackets have a built-in bite plane which helps minimize accidental debonding from the lower incisors.

The bite plane effect also allows for efficient bite opening in deep bite cases. The mandibular anterior brackets are designed to minimize interference with oral hygiene maintenance. The ball hook extends away from the tissue to allow access during toothbrushing. The wider bicuspid bracket has been designed for better rotation and tip control of the bicuspids. The interbracket width is now more uniform throughout the arch. The ball hook has been shortened and flattened for easy ligation, increased patient comfort and minimal gingival irritation. The twin bracket is recommended for the first molars when both the first and second molars are bonded or banded.

When a transpalatal bar may be required, the twin bracket with an auxiliary tube is used. The hinge cap is an ideal attachment for the terminal tooth. Using a hinge cap opening tool, the cap is easily opened, exposing the archwire slot. The archwire is inserted with the end of the archwire already bent at the appropriate angle. Then the hinge cap is closed, using a utility plier. Finally, the terminal tube is used when the clinical crown height of the terminal teeth is too short to accommodate a hinge cap^[7]. New lingual brackets and bracket systems are continuously being developed. The self ligating brackets solve the problem of ligation in lingual orthodontics and greatly reduce chair time^[31]. With the latest in CAD/CAM technology, Wiechmann described an individualised lingual bracket system in which the processes of bracket production and bracket positioning are combined^[32].

Keys to Success in Lingual Therapy

Smith and coworkers^[20,21] reported 12 keys to success in lingual therapy. They were patient selection; bracket placement accuracy; indirect bonding; vertical and transverse control of segments; double-overties on anterior teeth; buccal and lingual molar attachments; correcting rotations; arch form and archwire sequence; archwire stiffness and torque control; en masse retraction; light, resilient wire for detailing and

gnathologic positioner and retention. Other authors also published different keys to success^[7,33].

PATIENT SELECTION

Lingual therapy is demanding on both the patient and the dentist. So the patient must be made aware that it will require greater effort and chair time. The most important factors in selecting patients for lingual treatment seem to be their personalities and reasons for seeking treatment. The patient should be informed of the rationale and the effects of lingual appliance, speech, soreness, bite opening] and told that their attitude should be one of understanding and a desire to do whatever is necessary to accomplish the optimum results.^[3,5,6]

BRACKET DESIGN^[14,22]

To compensate for the tooth form and shape seen on the lingual, some considerations in bracket design need to be followed:

- 1 Since inter bracket distance is reduced on the lingual, the bracket must be designed to be as narrow as possible.
- 2 Because of decreased bracket width, mesio-distal root control becomes difficult which can be taken care of using vertical slots for auxiliaries.
- 3) Since the lingual contours of teeth vary a lot, the amount of torque supplied by the bracket will be very sensitive to its occluso-gingival placement. This can be solved by indirect bonding procedures with Pre-angulated pre-torqued brackets.
- 4) Consideration should be given to the ease of insertion, ligation and removal of the arch wires.

Eventually the method selected for the determination of lingual bracket torques and thickness was to relate the lingual determinants to labial tooth anatomy. Tracings of the labial and lingual profiles were made and a line was drawn through the LA point (now FA point), representing the plane to the arch wire, to define labial torque. Lingual equivalent torque values were then calculated studied statistically and reduced to set of average lingual torque values.

Similar studies were conducted to define lingual pad profile and contours, lingual molar bracket torques, rotations, base curvatures and in-out relationships.

BRACKET PLACEMENT^[30,32,33]

The many variations in tooth size, lingual contour, cingulum and marginal ridge anatomy, inconsistencies in tooth form, shape and inclination of the lingual surface make the use of predetermined bracket placement of no much utility. Smith et al suggested the use of indirect bonding by TARG (torque and angulation reference guide). The TARG instrumentation is designed to transfer bracket prescriptions from the more reliable labial surfaces of each tooth to the lingual at a given bracket height. This allows to set customized torque and angulation for each tooth.

ARCH WIRES^[4,7,19,34]

There is a dramatic difference in the arch form with lingual treatment. Fujita described the “Mushroom Arch” as necessary in lingual treatment because of the difference in facial – lingual thickness of anterior and posterior teeth; also there is a large constriction in arch width as one proceeds distally from the lingual surface of canine to the bicuspid. Since the brackets are designed to minimize bracket profiles, it is necessary to place compensating 1st order bends interproximally at cuspid-bicuspid and bicuspid-molar regions.

BONDING^[35]

For bonding of lingual brackets, the preferred mode of placement is indirect because

1. The variation in lingual tooth morphology creates the need for custom measurement for selection of appropriate bracket base thickness and torque.
2. The clinician's lack of familiarity with lingual tooth morphology makes it difficult to visualize angulations and bracket heights.
3. It is difficult to obtain a direct line of sight for bonding.
4. Increased accuracy in bracket placement is required because compensating lingual arch wire bends are more difficult and time consuming to form.

A modified dental surveyor and TARG (torque and angulation reference guide) are used to align the lingual surfaces relative to the labial crown inclinations. Once the bracket slot height and angulation are marked, indirect bonding of the brackets on the lingual is done.

TREATMENT SEQUENCE^[37-39]

Four phases are normally seen:

1. Leveling, aligning, rotational control and bite opening.
2. Torque control.
3. Consolidation and retraction.
4. Detailing and finishing.

CONCLUSION

Many patients would like to have the benefits offered by high quality orthodontic treatment but do not want to have braces that are visible to their friends and colleagues, a situation considered to be a social stigma by some. Lingual orthodontics is a way out for such patients.

The lingual appliance is no panacea, but if patients are carefully selected, lingual braces can be a valuable addition to the orthodontist's armamentarium.

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