



Lingual orthodontics (Treatment approaches and mechanics): A Review

Norhan Anees¹ and Zainab Mousa Kadhom²

¹ Dentist, Ministry of Health, Iraq.

² Department of Orthodontic, College of Dentistry, University of Baghdad, Baghdad, Iraq.

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Corresponding author:

Zainab Mousa Kadhom

Email: schati1981@yahoo.com

Department of Orthodontic

College of Dentistry

University of Baghdad

Baghdad, Iraq

ABSTRACT

Objectives: This review shows the ability of the lingual orthodontic braces in the treatment of most orthodontic problems such as teeth malposition, anteroposterior discrepancies, pre-and -prosthetic surgical cases, and the similarity to some extent in the mechanics that used the labial orthodontic brackets except for some types of treatment techniques.

Conclusion: The lingual orthodontic technique is similar to the labial orthodontic technique; they share in the treatment of many orthodontic problems.

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INTRODUCTION

The high Orthodontic criterion was achieved from the prominent advancement from a mercantile technological point of view and the establishment of different Orthodontic modes.¹

Lingual braces are called "inside" braces because of their position. The treatment with this type of appliance means that its components (brackets, wires, and elastics) which are used to straighten malposed teeth, are fixed on their (tongue side). At the same time, the traditional "outside" braces are placed on the labial side of the teeth that show. The labial and lingual appliances are similar in many properties.²

Most orthodontic problems could be corrected by the lingual braces as well as the labial brackets like; anteroposterior discrepancies, pre-prosthetic surgical cases, and malposition of teeth.³

There are particularly planned brackets included in this system that are appropriate to be put on the tooth lingually.⁴

The number of adult patients was increasing in orthodontic practices,⁵ so the lingual orthodontic treatment becomes the number one treatment option among these patients who always seek the aesthetic.⁶

THE HISTORY OF THE LINGUAL BRACES

A "Lingual removable Arch." was published in 1889 by John Farrar. The design of these early removable lingual appliances

was planned to expand the dental jaws. In 1918, a paper entitled Dr. John Mershon had published the removable lingual arch as these braces were used for the treatment of teeth malocclusion. Also, the advantages of lingual braces have been honored in the dental literature as they move teeth.⁷

In 1976, research was progressed and initiated by Ormco, who collaborated with Dr. Alexander (Jim) Wildman on a non-edgewise lingual appliance in Eugene, Oregon. There are many difficulties involved with a completely lingual fixed appliance that had referred from this program.^{8,9}

Also, in the same year 1976, finally, Dr. Kurz displayed specific purports and designs to the US Patent Office for the patent rights to his single edgewise lingual appliance. Then, an intense program by Dr. Kurz and Ormco started to bring the appliance from a dream to truth and develop it⁸. This group taught many seminars from 1981 to 1983. They had specified goals like: promote the methods of mechanotherapy and help refine bracket design (torques, dimensions, thickness, angulations, etc.).¹⁰

Advantages and disadvantages of lingual orthodontics:

According to Smith *et al.* in 1986,¹¹ the advantages are:

1. Maintain esthetics.
2. Repose to the lips and cheeks.
3. Tongue-exercise effect.
4. Remove the obvious decalcification.

While the disadvantages are:

1. The difficulty in putting and elimination of arch wires.
2. The orthodontist approach and direct viewing
3. Critically putting the brackets in place precisely more than for labial brackets.
4. The lingual appliance is very expensive.

Bracket design in a lingual orthodontic appliance (the initial criteria)

According to (Walter 1981).¹²

1. To display the amount of control that is equivalent to that obtained with labial fixed appliances.
2. To interfere with soft tissue very minimal by developing a smooth low profile appliance for patient comfort.
3. To develop a lingual appliance, if possible, with a straight wire approach,
4. To gain the least deviation from usual well-determined labial edgewise appliances.

The impression

The best materials such as high-quality alginate or silicone should be used to take the impression; this is essential to make it precise.¹³

The accurate hygiene of the teeth has to be completed by the orthodontist before impressions are taken, to remove all the biofilm. The technique of silicone impression consists of two phases to achieve an exact one. Generally, all anatomical landmarks should be incorporated to produce a perfect impression. The stability of the impression dimensions stays at least from 7 days to 14 days.¹⁴

Bonding Techniques

The lingual orthodontics could be planned with an indirect bonding manner. The lingual tooth surface is irregular and variable in its shape with the difficulty of arrival; this makes the bracket placement very controlled in the laboratory. The resin under the bracket bases contains the required tip, torque, in-out and rotational corrections, which regard the most substantial part of positioning the lingual orthodontic brackets during bonding¹⁵.

MECHANICS AND TREATMENT APPROACH OF THE LINGUAL ORTHODONTICS

Torque

Bracket torque (BT) can be defined as the measurable relationship between the main crown-root axis of the tooth and the correct facial axis of the clinical crown. It is the key factor in attaining proper tooth inclination.¹⁴

Anchorage

An efficient control for lingual orthodontic treatment is important, with some auxiliary appliances to assist it.¹³ In the upper arch, the maximum anchorage included¹⁶ transpalatal arch and a buccal sectional arch from first to second upper molars for stabilization together with helical loop and T-loop mechanics (.017 x .025 TMA). While in the lower jaw, an elastic power chain is used on the lingual surface of the tooth, with a buccal sectional arch for stabilization (.017 x .025 TMA or .016 X.022 SS) that can maximize the anchorage.

FACIAL PROFILE AND THE LINGUAL APPLIANCE

Romano in 1998¹⁶ referred to the distinction between extraction and none extraction treatment is not obvious. The none extraction approach can result in many completely suitable cosmetic alterations. At the same time, the cosmetic and functional worth of extraction treatment modality should never be ignored. The profiles with slightly more fulfilling one of the contemporary standards of facial esthetics requirements. The treatment approach that made a fuller profile to be a none extraction method, so the willingness for it will increase by prospective orthodontic patients.

There are different none extraction treatment approaches that are available to be used singly or joining together to attain pleasing expansion outcomes:

1. Expansion by crozat
2. Expansion by archwire
3. Dualization of molars
4. Interproximal enamel reduction
5. Surgical approach for rapid palatal expansion (RPE).

Expansion

The expansion of the dental arches is achieved by many

methods, but a more effective one is the use of the Crozat appliance (Figure 1).

Distalization of Molars

Several different treatment methods could do the Distalization of the posterior teeth. Possibilities include one of these modalities, such as coil springs in the fixed appliances or Nitinol wires, and removable appliances such as a modified Cetlin appliance. This kind of appliance (Cetlin appliance) permits adaptation to the lingual appliance during the first phase and maintains good oral hygiene; therefore, it's more favorable in adult patients.

The removable Cetlin appliance (Figure 2) is made from distalizing springs on the second premolars and on the first molars, destabilizing screws between the first and second premolars, two Adams clasps on this appliance is effective molar distalization, rotation, incisor proclination when needed, and better than archwires in expansion.

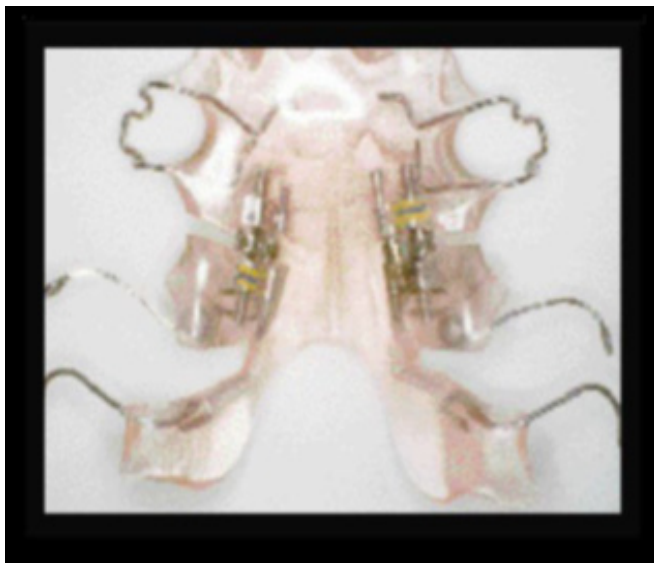


Figure 1: Crozat appliance¹⁶



Figure 2: Modified Cetlin appliance¹⁶

Clinicians should also be aware of what Crozat would wear full-time, except while eating, but it interferes slightly with the speech.¹⁶

Interproximal Enamel Reduction in Lingual Orthodontics

Jadhav et al. in 2011¹⁷ had defined the technique of interproximal enamel reduction (IER) as a way of space obtaining which represents one of the comprehensive orthodontic treatment aspects. The intraoral x-ray should be taken before enamel reduction to locate the root position concerning the inter-radicular bone and the enamel thickness. Only 0.25–0.50 mm in total is the amount of enamel that should be stripped from each side of the tooth, while the dentin will not be exposed. Then the daily fluoride rinses the first premolars and an anterior bite plane.¹⁶

Sliding and Loop Mechanics

The sliding mechanics or loop mechanics accomplish an en masse retraction in the upper jaw. Several types of loops are usually used: L-loop closed helical loop and T-loop. The technique of sliding mechanics is very effective for preventing transverse bowing effects without using a transpalatal arch. At the same time, wire friction and uncontrolled retraction are the main disadvantages of sliding mechanics. However, the wire friction is absent in the loop mechanics during space closing.¹⁶

A 0.016 x 0.022 stainless steel (SS) wire is used in the lower jaw, which means the en masse retraction is commonly done with sliding mechanics, which is accomplished in the mandibular arch in a resemble mode maxillary arch using circular elastics.¹

Orthognathic Surgery in Lingual Orthodontics:

The presurgical orthodontic treatment aims to make the dental arches ready before manipulating the skeletal bases, which is the same in both labial and lingual techniques. Therefore, it is very useful in leaving only the malformed skeletal components to be corrected by the maxillofacial surgery after removing as many of the dental-alveolar components of the malocclusion as possible.¹⁸

There are two treatment options:¹⁶

1. Using a quad-helix (QH) or a rapid palatal expansion (RPE) if the transverse expansion is accomplished in the presurgical orthodontic phase.
2. In LeFort I osteotomy technique, the surgical expansion can be done together to reposition maxillary portions with an intermaxillary disjunction.

Treatment of Teeth Malposition: Combined Orthodontics Prosthetic

The mouth preparation for prosthesis involves reform and subsequent special pretreatment referred to that. Most modern dental practices have applied a combined orthodontic-prosthetic treatment. The space closure by the anterior teeth retraction and closure of the overjet was now eliminated because of removing the bracket anteriorly.¹⁹

The place will be created for the missing teeth restoration; the teeth axis will be straightened in this approach which permits for a long term aesthetic and functional prosthetic treatment to be in a good situation.²⁰

Segmental lingual orthodontics:

Romano (1998),¹⁶ pointed out that there are many benefits of lingual braces for prosthetic adult patients, especially since these patients prefer aesthetics and do not like apparent labial appliances. While many of the problems that faced the prosthodontics can be managed orthodontically with the segmental lingual appliance, some of these problems are:

1. Lingual or buccal crossbites.
2. Teeth rotations.
3. Space closure or space opening by uprighting of the molars.

While the keys for a successful segmental lingual pre-prosthetic:

1. Indirect bonding of brackets to the teeth.
2. Use of clear vacuform retainer for immediate retention.
3. Simple tooth movements are required only.

CONCLUSIONS

The lingual orthodontic appliance has the same ability as the labial orthodontic appliance to treat different types of malocclusion, although the presence of some difficulties can be controlled.

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