



*Comparative Study*

## **LINGUAL PASSIVE SELF-LIGATING STRAIGHT WIRE WITH SQUARE SLOT BRACKETS AND ACTIVE RETAINERS: COMPARISON BETWEEN LINGUAL ORTHODONTIC TECHNIQUES FOR THE RESOLUTION OF ANTERIOR DENTAL CROWDING**

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### **ABSTRACT**

Anterior crowding is one of the main reasons for orthodontic treatment in adults. The aim of this study is to evaluate the differences between two orthodontic alignment techniques of the anterior groups. The first technique involves the use of an active retainer that uses Copper Nickel-Titanium (Cu Ni-Ti) orthodontic wires with a round section which are free to slide in the composite modeled on the palatal surfaces of the dental elements. The second technique involves the use of lingual passive self-ligating system straight wire with square slot brackets. The passive self-ligating straight wire with square slot brackets technique is more reliable than the active retainers with round section Cu Ni-Ti arches for the alignment of anterior sectors.

**KEYWORDS:** *lingual orthodontics, active retainers, self-ligating, straight wire, anterior crowding*

### **INTRODUCTION**

Anterior crowding is one of the main reasons for orthodontic treatment in adults (1). With the increase of orthodontic treatments in adulthood, there has been an increase in the demand for aesthetic and comfortable techniques (2). An alternative to traditional vestibular appliances is lingual orthodontic treatment, especially for those patients who want to keep a smile free for the entire duration of treatment (3). Lingual orthodontic treatments were introduced over 30 years ago, (4,5) and in recent decades the demand for lingual orthodontic treatments has increased among patients seeking

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aesthetic improvement (5-7). There are other aesthetic options such as labial ceramic brackets and clear aligners. Although the aligners are widely used by clinicians, they are not recommended as a first choice, in particularly complex cases. Lingual orthodontics techniques have also given positive results in these cases (7). At the same time, lingual biomechanics differs from that expressed in vestibular techniques (3, 8-10).

Lingual orthodontics did not have a large diffusion probably due to biomechanical reasons, a difficult development of brackets and performing methods, the particular lingual anatomy of the dental elements, and the necessity of an indirect bonding (11). In the last twenty years, several lingual orthodontic techniques have been developed (12, 13). A technique without brackets, which involved the use of active retainers with arches on the lingual surfaces of teeth from cuspids to cuspids, has been described to treat anterior dental crowding (14, 15).

The aim of our study is to evaluate the differences between two orthodontic alignment techniques. The first technique involves the use of active retainers. Cu Ni-Ti orthodontic round section arches are used. They are free to slide in the composite modeled on the palatal surfaces of the dental elements. The second technique involves the use of the lingual passive self-ligating straight wire system with square slot brackets.

## MATERIALS AND METHODS

### *Lingual orthodontic technique with active retainer*

This technique involves the use of Cu Ni-Ti round section arches for aligning frontal teeth. The arches are applied to the lingual surfaces of the teeth. To attach arches to teeth, attachments are created with the composite. These composite bases hold the wire in the desired position and then the composite is modeled to stabilize the arch (Fig. 1). Dentists must check that the arch could flow through the composite after bonding every tooth. The arch is stabilized starting from the marginal ridge of the premolars. Cuspids and incisors are attached to the arch. The occlusion points are checked after every arch change to obtain a bilateral occlusion.

The treatment is carried out with three arches 0.013-in, 0.014-in, and 0.016-in (DAMON OPTIMAL-FORCE Cu Ni-Ti, ORMCO, Orange, CA, USA). Acceptable results can be achieved after at least six months of therapy (Fig. 2).

### *Lingual orthodontic technique with passive self-ligating straight wire with square slot brackets*

The technique involves the use of passive self-ligating low friction straight wire and attacks with a square slot 0.018-inX0.018-in (Alias lingual straight wire bracket system, ORMCO, Orange, CA, USA) (Fig. 3-4). Only “frontal teeth” cases were treated. The technique needs a digital setup study phase. The patient models are loaded into the Eline System website (<https://www.elinesystem.net>). The laboratory prepares a preview of the finished case which must be



**Fig. 1.** Occlusal view of active retainer after bonding (0.013 Cu Ni-Ti).



**Fig. 2.** (a): Frontal view at the beginning of treatment; (b): Occlusal view at the beginning of treatment; (c): Frontal view after six months; (d): Occlusal view after six months.

approved by the clinician (Fig. 5).

Brackets' position is carried out on a digital model and subsequently positioning jigs are printed for bonding. Positioning jigs allow a proper attachment of the standard bracket to the lingual surface of each dental element. There are arches of three different sizes (Small, Medium, and Large) to adapt to the patient's dental arch. Finally, a transfer template with customized brackets inside is created in the laboratory. These brackets are subsequently bonded on the lingual surfaces of the patient. Furthermore, positioning jigs are stored for a possible rebonding (if the bracket is loose for a chewing trauma).

Arches in Cu Ni-Ti (Alias Small, Medium, Large Cu Ni-Ti, ORMCO, Orange, CA, USA) of various sizes were used. The use of low friction and square arches have made treatments for the frontal alignment quick (about 6 months) and precise because it allows better regulation of tip and torque. (Fig. 6).

*Rebonding lingual brackets*

The original rebonding technique after a chewing trauma involves an indirect procedure through the repositioning jig and the plaster model. A direct technique in the patient's oral cavity was used in this study: it is possible to eliminate the jig points which are in contact with adjacent teeth (Fig. 7). After cleaning the tooth and brackets it is possible to proceed with bonding. The bracket must have the flap closed when is inserted in the appropriate jig space. Care must be taken to ensure that the composite does not come in contact with the plastic of the jig when placing the jig on the tooth. In this way it will be easier to remove it after photopolymerization (Fig. 8).

*Post-treatment*

In "frontal teeth" treatments, the post-treatment phase with stainless steel passive retainer or clear thermoplastic retainer is very important. The tension between the dental elements can lead to a relapse. For this reason, it is important to evaluate the amount of stripping needed and examine any incisive pre-contacts that may occur at the end of the therapy and perform a light selective grinding if necessary (Fig. 9).

**DISCUSSION**

Crowding is a loss of integrity in the dental arch due to tension



**Fig. 3.** (a): Frontal view at the beginning of treatment; (b): Occlusal view at the beginning of treatment; (c): Red lines indicate the wrong angle of the incisors after a few months of treatment; (d): In this case, it was not possible to resolve the dental crowding with active retainer technique; (e): Occlusal view of the case after bonding the brackets ALIAS ORMCO.



**Fig. 4.** Frontal (a) and occlusal (b) view of the end of therapy 6 months after bonding the brackets.

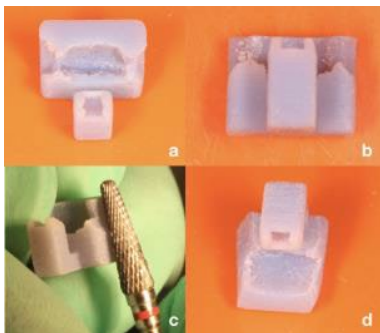


**Fig. 5.** Digital case study: superimposition of the setup on the malocclusion and 3D preview of finished case on Eline System software.





**Fig. 6.** (a): Occlusal views at the beginning of treatment; (b): Occlusal views after 2 months; (c): Smile at the end of therapy after 6 months.



**Fig. 7.** (a-b): Positioning jig with wings; (c): How to remove the wings; (d): Jig with wings removed.



**Fig. 8.** (a): Jig modified with the bracket inserted with the flap closed before re-bonding; (b): Intraoral view of re-bonding after trauma.



**Fig. 9.** Passive retainers after “frontal teeth” treatments.

**Table I.** Comparison between two orthodontic treatments.

TECHNIQUE WITH ACTIVE RETAINER	
ADVANTAGES	DISADVANTAGES
Well tolerated by patient	Difficult tip and torque management
Low costs	Use only round section arches
Less initial phonetic problems	Very operator dependent
	Lack of predictability
	Long appointments for changing arches

SELF-LIGATING PASSIVE TECHNIQUE WITH SQUARE SLOT	
ADVANTAGES	DISADVANTAGES
Extreme predictability	Not well tolerated by patient
Good tip and torque management	High costs
Short time to change arches	Difficulty to rebond brackets
Possibility of closing diastemas in simple way	In deep-bites high occlusal build-up
Digital calibration of stripping	

and not simply a consequence of lack of space. Dental arch instability determinant factors should be identified before starting therapy (1). One of the most critical aspects of “frontal teeth” treatments is the possibility of post-treatment relapse (16). These treatments do not fully correct malocclusions, consequently, dental elements could return to their initial position. For this reason, after these treatments very careful and constant retention has to be applied (14,17-21). Furthermore, “frontal teeth” treatments are aesthetic procedures which are evolved in recent years. Both techniques are recent evolutions of others used in the past (12,14). In this study, these methods have only been applied to adults.

An alternative to these treatments is the use of transparent aligners, but only totally invisible methods were analyzed in this paper (22).

In literature there are not articles that compared these two techniques exposing the advantages and disadvantages (Table I). Active retainer technique is operator dependent and has difficult predictability of result. Lingual technique with passive self-ligating straight wire with square slot brackets was a great innovation. Moreover, the classic mushroom shape for lingual arches was eliminated (23). Straight wire was used similarly to the vestibular techniques. The concept of vestibular low friction has moved to lingual technique, and it can also be applied to complete therapies for solving malocclusion. Frequent limitations of lingual therapy with brackets are tongue discomfort, speaking difficulties and problems in maintaining adequate oral hygiene, although no differences for eating and caries risk were detected (5, 24). Certainly, these aspects are less evident in the technique with active retainers. The “frontal teeth” treatment needs a careful study of the case. An aesthetic and functional study with photos and plaster models was always carried out (25). Radiographs are needed only in cases of diagnostic doubts about bone quality or root parallelism. In one case of active retainer, it was necessary to end the therapy with the application of passive self-ligating lingual orthodontic brackets, because it was not possible to manage tip and torque with the first method.

## CONCLUSION

In conclusion, the active retainer technique can be used for an approximate alignment, while the passive self-ligating lingual straight wire technique with square slot brackets is reliable in the anterior alignment treatments. To increase the effectiveness and the precision of the treatment with passive self-ligating lingual brackets a modification could be made: premolars can be bonded, and the action of the arches can also be extended to them to avoid any unwanted movement of the cuspids. Therefore, additional cases are needed to get more information in regards the advantage and disadvantages of both orthodontic techniques.

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*Conflict of Interest*

The authors declare no conflict of interest.

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