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INNOVATIVE METHODS OF BONDING A LINGUAL RETAINER: AN OVERVIEW

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ABSTRACT

Introduction: Fixed lingual bonded retainer is the choice for many orthodontists in both the maxillary and mandibular arches as they provide better patient compliance and cooperation.However, there is a significant disadvantage with fixed retainers its placement procedure and technique sensitive. **Aim:** This article aims to emphasize the various chair-side innovative techniques for bonding a lingual retainer wire. **Materials and Methods:** The materials used in this study are regularly and commonly used in the daily practice of dentistry. They are economical, readily available, and easy to perform in a simplified manner. **Results:** The purpose of this paper is to emphasize 14 simplified techniques in bonding a lingual retainer wire into one area so that any practioner can choose any of the simplified technique of his own interest. **Discussion:** Over the decades various techniques has been advocated for bonding a lingual retainer wire. The most critical step to the orthodontist is stabilization of retainer wire in its stable position to prevent relapse. In order to overcome the above problem these simplified methods is the solution to the orthodontist to perform better bonding, reduces chairside time and comfortable to the patients. **Conclusion:** These simplified methods are easy to fabricate and makes the orthodontist to perform better bonding procedure. It can be carried out at the chairside with or without laboratory work. It effectively stabilize the retainer wire in its position. It also provides better isolation while bonding and reduces chairside time.

KEYWORDS: Retention, Lingual bonded retainer, Chairside time, Clinical innovations.

INTRODUCTION

Moyer's has defined "The phase of retention is required after orthodontic therapy to stabilize the teeth in its ideal aesthetic and functional position. "The real challenge to the orthodontist not only lies on attaining well-finished occlusion but to maintain the results accomplished through active orthodontic treatment for over a longer period.[1,2]

Angle stated that "the problem involved in retention is so great as to test the utmost skill of the most competent orthodontist, often being greater than the difficulties being encountered in the treatment of the ease up to this point. Keeping this in mind that orthodontist should plan the retention protocol at the time of treatment planning itself not at the end of the treatment.[1,3]

It is considered as a major step in stabilizing the results for a period of few months by allowing the teeth to reorganize the alveolar bone and periodontium in their new desired position.[4] According to Reitan, "Teeth relapse in the direction of their original position due to elastic recoil of periodontal fibers."

Various authors have reported types of retainers, techniques, the material of choice and its diameter, etc., To summarize most commonly employed retainers after orthodontic treatment are 1) Removable retainer 2) fixed retainer. Keeping the risk of relapse in mind one should plan their retention phase.[3,4]

Prevention of relapse can be obtained by maintaining the equilibrium between the forces derived from periodontium, occlusal, oro-facial soft tissues, and post-treatment facial growth.[5] For this reason, a retainer appliance is needed.

However, there is a significant drawback with fixed retainers its placement procedure and technique sensitive. Any problem during placement of retainer leads to bond failure, and stress fracture at wire segments leads to orthodontic relapse. The orthodontist should be skilled enough to plan the retention protocol and to retain the teeth in its position after active orthodontic therapy.[3,6,7]

This article aims to emphasize the various chair-side innovative techniques for bonding a lingual retainer.

METHODS AND METHODOLOGY

The materials used in this study are regularly and commonly used in the daily practice of dentistry. They are economical, readily available, and easy to perform in a simplified manner. Most of the orthodontists prefer to use fixed lingual retainer extending from cuspid-to-cuspid/bicuspid-to bicuspid to obtain optimal retention both functionally and aesthetically.[4]

Chair side construction of retainer wire

To construct the retainer wire, hold two or three strands of 0.010" stainless steel ligature wire together at both ends with mosquito forceps then twist the strands into a single wire and bend the wire into a gentle curve and cut the desired length.[4]

Isolation protocol

Isolate the arch using cotton rolls and slow salivary ejectors and retract the lips using a cheek retractor. Before bonding perform thorough oral prophylaxis and clean the lingual surfaces of the teeth with pumice, rinse with water and dry it.[8]

Bonding technique

After etching the lingual surface of the tooth by using 37% phosphoric acid for 30 secs and primer was applied and light-cured for 10 secs for the formation of resin tags followed by bonding of retainer wire with light-cured orthodontic adhesive and cured for 30 secs by using light-curing unit.[9,10,11,12]

Chairside innovative techniques

Previously holding the retainer wire on the lingual surface of the teeth using finger pressure, which is difficult for the orthodontist simultaneously to perform bonding in indirect vision with the help of mouth mirror. Following are some of the innovative chairside techniques with commonly available materials in daily orthodontic practice.

1) Using elastics[13]

A Fixed lingual retainer wire offers good stabilization and follows the contours of the teeth, without any occlusal interference's and patient compliance free. It can be achieved by using elastics.[13]

The advantage of this innovative chairside technique is time-efficient, easy to perform, economical, and patient co-operation is likely high, no need for laboratory procedure.

MATERIALS AND METHODS

1. long stainless steel ligature wire
2. Band separators or elastics
3. Ligature cutter
4. Non-cutting edge fissure bur
5. Finishing bur

Technique

A. Construction of retainer wire with ligature wire.
B. Place the elastics between incisors and canines along the crown portion. [Fig: 1 A]
C. Now pass the retainer wire above the Cingula, adjust between the elastics and the Lingual Surface of each tooth. [Fig:1B]
D. Now bond the lingual retainer with light cure adhesive by following strict isolation protocol and bonding technique.
E. Remove the elastics
F. Remove the excess adhesive with non-cutting edge fissure bur and polish the composite surface to prevent plaque accumulation.
G. Check for any occlusal interferences.

Fig 1A: Placing elastics between anteriors.[13]

Fig 1B: Position the retainer wire between lingual surface of the teeth and elastics.[13]

2) Using wax transfer tray[14]

This method of placing lingual retainer using modeling wax, which is easy to construct and materials was readily available in any clinical practice.[14]

Advantage of this method is easy to construct, economical, less chairside time, stabilization of retainer wire in its position, and more importantly, it precisely etch the tooth surface and limits the adhesive application. Hence it reduces the risk of unwanted effects caused by improper bonding procedure.

Materials and Methods

1) 0.0175" retainer wire or SS ligature wire

2) Modeling wax sheet

3) Etching and bonding materials

Technique

- First, take the impression and prepare the working models.
- Take a small sheet of modeling wax mould it onto the cast firmly extending from premolar to premolar, and it should cover the labial and lingual surfaces of the teeth.
- Make small holes on the lingual surface of the wax sheet at the center of each tooth. This forms the wax transfer tray.
- Place the retainer wire onto the cast and press firmly against the tooth surface with transfer try. [Fig: 2A]
- Now retainer wire along with wax tray acts as a single unit. This whole unit is ready to transfer into the patient mouth. [Fig: 2B]
- Follow the proper isolation and bonding protocol
- Check for the retention at the junction between wire and composite.
- Remove the wax sheet and cut the excess wire.

Fig 2A: Position the retainer wire over working model.[14]

Fig 2B: Fabrication of wax transfer tray.[14]

3) S-shaped auxiliary hooks[15]

In this method, a simple wire-bending can aid in better stabilization and visualization of the area to be bonded. It improves the mechanical retention of the wire by sandblasting with Al_2O_3.[15]

Few authors have reported that the use of multistranded wires or twisted retainer wires has an adverse effect of tooth movement due to lack of passivity to overcome this effect minimum of 3-5 strands should be used. Hence they suggested the use of SS wire that increases the rigidity.

SS wire offers longevity, resistance to fracture, increased toughness, and passivity.

MATERIALS AND METHODS

- SS wire
- Universal plier
- Hand welding unit

Technique

- First, take the impression of upper and lower arches and pour the cast with dental stone and check the maximum intercuspation.
- Take a stainless steel wire of dimension 0.016 X 0.016 inches (0.4 X 0.4 mm)
- Using universal plier place optimal V- bends that increases the wire surface area for bonding.
- The wire should fit closely to the tooth surface and then stabilize in the desired position by using sticky wax on the patient model/ casts.
- Fabricate two-s-shaped auxiliary hooks of 0.0175 X 0.0175 inches (0.45 X 0.45 mm).

- The two s-shaped hooks are welded on to the retainer using hand welding machine.[Fig: 3A] But the attachment should not be too firm so that it can be easily removed.
- Wire sections to be bonded are sandblasted with aluminum oxide to increase mechanical retention.
- Follow the isolation and bonding procedure thoroughly.
- Check for the bonding at the junction then remove the attachments.[Fig: 3B]
- After removing the attachments, check for any irregularities in composite and unwanted primary contacts.

Fig 3A: Fabrication of appliance with V bends and S shaped hooks were hand welded.[15]

Fig 3B: Easy removal of the appliance after bonding.[15]

4) Rest Appliance: Retainer Stabilizing Appliance[16]

It is a custom made and easy to fabricate, can be universally used and comfortable for the operator while positioning and bonding the retainers without any visible obstruction and occlusal interferences. This appliance can especially beneficial while rebonding /repairing the broken retainers because it holds the retainer in well-adapted position.[16]

Technique

- First take the patient records, I.e., upper and lower impressions and models were prepared. Fabrication of this appliance done on working models.

- Prepare V-shaped wire bendings with 0.7mm round SS wire with helices at their ends facing away from tissue to avoid iatrogenic injuries.
- To stabilize the V components, they were soldered to the labial wire made of 0.9mm SS wire. [Fig: 4A]
- Twisted ligature wire or multistranded wire is used as a retainer and passed below the appliance.
- Perform isolation and polishing protocol thoroughly
- Now place the retainer wire in patient mouth and hold the retainer wire with Rest appliance.
- Bond the teeth with flowable composite.

Fig 4A: Fabrication of appliance using 0.7mm SS wire "V" shaped bends and stabilization with labial wire 0.9mm SS wire.[16]

5) Modified Kesling spring separator[17]

Conventional Kesling's spring separator is used to gain space inter-dentally.In this method, the conventional Kesling separator is modified in such a way that one end of the arm is bent perpendicular to a form of "U" it should exert adequate pressure on lingual retainer wire against the palatal tooth surface.[17]

The advantage with this method is simple, easy to fabricate, time-saving, comfortable to the patient, economical.

Materials and methods

- 0.014"AJ Wilcock wire
- Twisted coaxial wire or multistranded wire
- Mosquito forceps
- Cutter

Technique

- Upper and lower impressions were taken, and working models were prepared.
- Prepare modified keslings separator using 0.014" AJW Wire with 2 to 3mm internal diameter helices at the top of the spring, and one arm with retentive tag and other with longer U shaped bend, it should exert sufficient pressure to hold the retainer wire in position.[Fig: 5A]
- Before transferring into the patient mouth, check it in the working models.
- Now the modified Keslings separator is ready to transfer into the patient mouth.[Fig: 5B]
- Follow the through isolation and bonding protocols.
- Check for the retention with the help of the probe and then remove the separators.

Fig 5A: Construct modified keslings separator with retentive arm one side and U shaped bend on other side.[17]

Fig 5B: U shaped bend exerts sufficient pressure to hold the wire.[17]

6) Lingual Retainer Stabilizer (LIAR)[18]

Majority of the relapse cases that occur due to bond failure, loosening of retainer wire, breakage of wire, etc., the stability of the retainer wire at the time of bonding is also a major concern with the help of this appliance we can overcome the negative effects and ensure better results.[18]

The advantage with the above appliance is it acts as a stabilizer and also as isolation unit of the lip during bonding the retainer. It ensures tight contact without causing iatrogenic damage to the adjacent soft tissues. [Fig: 6B].

Materials and methods

1. Young's Universal Plier
2. 24 Gauge round stainless steel wire.
3. Used modules strip
4. Lingual retainer (twisted ligature wire)

Technique

- Upper and lower impressions were taken and fabrication of appliance done on the working models.
- Using 24 gauge round SS wire fabricate simple wire bending which is similar to keslings tooth separator with two concentric helices of internal diameter 2 to 3mm at the top and simple U loop at its one end on the other end, or palatal arm is gently curved so as to adapt well to the palatal surface.
- Now the stabilizer is fabricated.
- Take the used module strip, and 5-6 holes were punched with equidistant to each other.
- The 'U' loop end of the fabricated stabilizer is engaged in one of the holes of the module holder, and similarly, the remaining units were engaged. [Fig: 6A]
- The number of stabilizers to be engaged in module stripper is depends on the operator choice.

Fig 6A: Fabrication of LIAR appliance.[18]

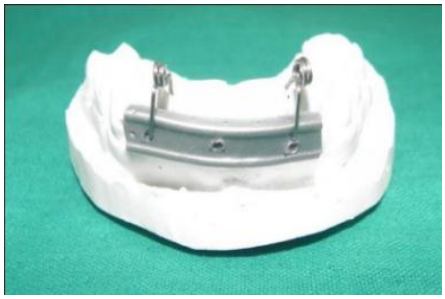


Fig 6B: Isolation and stabilization of retainer wire.[18]

7) W-shaped lingual retainer wire stabilizer[19]

This innovative approach enables the orthodontist to hold the retainer wire perfectly between the anterior's and to ensures easy bonding to the lingual surface of the teeth.[19]

The advantage of this innovative approach is the precise placement of the retainer, time-saving, simultaneous bonding can be done, economical.

Materials and methods

- Straight probe
- 19 gauge wire
- Soldering material
- Working models

Technique

- Twisted Ligature wire or coaxial wire.
- A Straight probe is taken.
- Two pieces of 19 gauge wire of the desired length are taken
- They were soldered together with the probe at an angle of 45^0, and they resemble like W-shape. [Fig: 7A]
- Middle arm - guiding arm which is placed between central incisors.

Lateral arms - hold the wire interdentally between lateral incisors and canines. [Fig: 7B]

- They provide optimal stabilization while bonding the retainer wire.

Fig 7A: Fabrication of appliance.[19]

Fig 7B: Stabilize the retainer wire.[19]

8) Bonding a V-loop lingual retainer with a DuraLay transfer tray[20]

In this method bonding a 3-3 V-shaped lingual retainer, using a DuraLay transfer tray, it provides easy and stable position of the retainer and optimal moisture control while bonding. It enables the patient to access for better oral hygiene thus reduces the plaque accumulation.[20]

Material and methods

0.024" SS wire

Young's universal plier

Acrylic material

Sticky wax

Technique

- Upper and lower impressions were taken with alginate and pour with dental stone.
- V or U shaped bends were incorporated into the wire and checked in the cast for passivity.
- The retainer wire was stabilized with Duralay acrylic at its ends.[Fig: 8A]
- The wire component was sandblasted with AL_2O_3
- Now transfer the duralay transfer tray into the patient mouth and stabilized with sticky wax on the premolars.[Fig: 8B]
- Follow the isolation and bonding procedure cut the excess edges of the retainer wire; It enables easy removal of the tray.
- Dental floss used to check retainer height and interproximal spaces.

Fig 8A: Fabrication of Duralay transfer tray with acrylic resin.[20]

Fig 8B: Stabilize transfer tray with sticky wax in patient mouth.[20]

9) Bracket holding tweezer[21]

In this method a simple instrument, i.e., bracket holding tweezer to hold the retainer wire in its position.[21] The advantage of this technique is time-saving, and no need for any assistance and it is comfortable for both the patient and orthodontist.

Materials and methods

- Twisted retainer wire
- Bracket holding tweezer
- Working models
- Bonding materials

Technique

- First take the upper and lower impressions and pour the working models
- Prepare the retainer wire using ligature wire.
- Place it on the cast and adapt according to the contours of the tooth.
- Now hold the retainer wire with bracket holding tweezer and check for any distortions in the wire and its adaptation
- Transfer the wire into the patient mouth and hold it with bracket holding tweezer. [Fig: 9A]
- Now bond the retainer wire.

Fig 9A: Adapt the retainer wire and hold it with tweezer.[21]

10) **Using silicone impression material[22]**

In this method silicone impression material along with SS wires enhance stability to the retainer wire, and design of the appliance provide better isolation during bonding a direct lingual retainer.[22]

Materials and methods

- Heavy body silicone impression material
- 0.0175" stainless steel or twisted SS ligature wire
- 0.019 X 0.025” or 0.9 mm gauge SS wire
- Youngs universal plier
- Sticky wax
- Bonding materials

Technique

- Upper and lower impressions were taken, and working models were prepared.
- Retainer wire is temporarily stabilized with sticky wax on the working models. [Fig: 10A]
- A small amount of heavy body silicone impression material was mixed and prepared in the shape of a rectangle and adapted over the posterior region covering occlusal, buccal and lingual surfaces on both sides.
- A 0.019 x 0.025" or 0.9 mm SS wire is bent and inserted into the right and left, buccal and lingual flanges of the silicone impression material.
- The ends of the wire were provided with retentive tags to enhance retention, so the wire doesn't displace.
- The fabrication of the transfer tray is completed. [Fig: 10B]
- Transfer the tray positioned into the patient mouth and bond the retainer.

- After bonding cut the ends of wire distal to canine with a cutter then remove the tray from the patient's mouth and smooth the ends of retainer wire with a bur.

Fig 10A: Stabilize the retainer wire with sticky wax.[22]

Fig 10B: Silicone impression material is molded into rectangle shape with wire components on labial and lingual segments.[22]

11) Using boxing wax:[23]

This method is to ease the difficulty in bonding a lingual retainer without any need for fabrication of special trays or additional wire bendings. It is a simple, easy, time-saving procedure.[23]

Material and methods

- Boxing wax
- Retainer wire
- Cutter
- Bonding materials

Technique

- Prepare the working models and retainer wire
- Place the retainer wire extending from canine to canine or occlusal surface of premolar to premolar from right side to life side and adapt it well against palatal surface of the teeth.

- Now stabilize the retainer wire using boxing wax in the working models. [Fig: 11A]
- Now transfer the wire along with wax into patients mouth and adapt firmly against the tooth surface. [Fig: 11B]
- Now follow the through isolation and bonding protocols.
- After bonding the anterior's remove the wax and bond the premolar region . If any excess material is present cutoff the wire with cutter.

Fig 11A: Stabilize the retainer wire with boxing wax.[23]

Fig 11B: Transfer into patient mouth.[23]

12) Using dental floss[9]

This method is a conventional and older technique of bonding a fixed lingual retainer using dental floss.[9] The advantage with this method is that retainer wire can be adjusted either mesiodiatlly or occlusogingivally to the desired position, reduces chairside timing, easy and economical.

Materials and methods

- Dental floss
- Twisted ligature wire or 0.0175" SS retainer wire
- Bonding materials

Technique

- Before placing the retainer wire, do through oral prophylaxis and clean the palatal surface with pumice to remove any debris, plaque, and calculus.
- Use 0.010" SS wire of 3 - 4 strands of equal length and hold it at both ends with mosquito forceps and twist it until it forms a single multi-stranded wire or use preformed 0.0175" SS wire.
- Adapt the retainer wire along the palatal surface of the tooth on the working models.
- Cut the dental floss of the desired length and pass it inter-dentally between the anterior teeth from labial to lingual side followed by lingual to labial side to form a loop.[Fig: 12A]
- Pull the floss labially to ensure snug fit till the retainer wire adapted to palatal surface passively. [Fig: 12B]
- This loop acts as a stabilizer to hold the retainer wire. It can adjust occluso-gingivally and mesiodistally until a stable desired position is achieved.
- Hold the loop of the dental floss with retainer wire in its position and continue with the bonding procedure.
- Check for retention at the junction between wire and adhesive then remove the floss.

Fig 12A: Pass the dental floss interdentally between the anteriors to form a loop.[9]

Fig 12B: Place the retainer wire and pull the floss labially to ensure snug fit.[9]

13) Using separators[24]

This is a simple method of stabilizing a lingual retainer wire during direct bonding. It doesn't require any special equipment or transfer trays for holding the retainer wire in position.[24]

Materials and methods

- Orthodontic separators
- 0.0175" twisted ligature wire
- Wire Cutter
- Bonding materials

Technique

- Upper and lower impressions were taken using alginate impression material and working models were prepared.
- Fabricate 0.0175" SS twisted retainer wire of the desired length it should extend from left side second premolar to the second premolar of the right side.
- Place the separators between first and second premolars with a portion of each separator extending from the occlusal surface.[Fig: 13A]
- Prepare the lingual surface of anterior teeth by following the through isolation protocols.
- Pass the ends of the retainer wire through the separators and ensure its snug fit.
- Retainer wire should be in passive contact with the lingual surface of the tooth.
- Follow the bonding procedure and remove the excess material
- Cut the distal ends of the retainer wire and takeout the separators. [Fig:13B]

Fig 13A: Place the separators between premolars or canine to premolar.[24]

Fig 13B: Bond the teeth and cut the extensions.[24]

14) A robust method[25]

This is a simplified technique for fabricating and bonding a lingual retainer wire using an elastomer. The elastomer used in this method is memosil2 which is a medium body, clear and dimensionally stable once it has set in.[25]

Materials and methods

- 0.0175" SS coaxial wire
- Memosil2
- Toothpick
- Bonding materials

Technique

- Working models were prepared
- 0.0175" SS flexible coaxial wire is of the desired length is taken for bonding lower anterior, and it should extend from mesial pit of premolar from one side to the opposite side of the same arch.
- Stabilize the retainer wire in its desired position using memosil2 on working models.
- A toothpick is cut equal to interpremolar width at mesial pits of lower premolars is cut and placed over the Memosil2 before it sets. [Fig: 14A]
- Apply finger pressure for uniform distribution of memosil2 and securing the assembly firmly.
- Now the whole assembly is removed and transferred into the patient's mouth.[Fig: 14B]
- Follow the through isolation and bonding protocols.
- After bonding, remove memosil2 and toothpick gently at premolar ends, and bonding at its end is done followed by smoothening of the retainer.
- Repeat the same procedure in the upper arch.

Fig 14A: Fabrication of applaince using memosil2 and toothpick.[25]

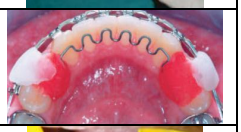
Fig 14B: Transfer the appliance to the patient mouth.[25]

RESULTS

These 14 simplified techniques in bonding a lingual retainer wire are into one area so that any practioner can choose any of the simplified technique of his own interest. The aim of this article is to emphasize the clinical innovative techniques with commonly available materials in clinical practice which helps the practioner to perform better bonding a lingual retainer wire, reduces which has direct influence on long term stability of corrected malocclusion.

Table 1: 14 simplified innovative techniques.

Sl.no	Method	Image	Advantages
1	using elastics:		*Simple *Easy to fabricate *Time saving *Comfortable *Enables accurate positioning *Economical *No need of patient coperation
2	Using wax transfer tray:		
3	S-shaped auxiliary hooks:		
4	Rest Appliance:		

5	Modified kesling spring saparator:		
6	Lingual Retainer Stabilizer (LIAR)		
7	W-shaped lingual retainer wire stabilizer:		
8	DuraLay transfer tray:		
9	Bracket holding tweezer:		
10	Using silicone impression material:		
11	Using boxing wax:		
12	Using dental floss:		
13	Using separators:		
14	A robust method:		

DISCUSSION

The fixed retainer is the retention protocol of choice for many orthodontists, I.e., bonded lingual retainers because of its advantage over removable appliances with minimal effects on speech, mastication, oral hygiene, comfort and the general health of the oral tissue and mainly it provides patient compliance.[3]

One of the means of maintaining the incisor alignment after orthodontic treatment is by bonded fixed lingual retainer. Over the decades various techniques has been advocated for bonding a lingual retainer wire.

The most critical step to the orthodontist is stabilization of retainer wire in its stable position to prevent relapse. In order to overcome the above problem these simplified methods is the solution to the orthodontist to perform better bonding, reduces chairside time and comfortable to the patients.

This article is to emphasize the simplest methods which is easy to fabricate without any need of tedious laboratory procedures and stabilizes the retainer wire while bonding.

Post Instructions To The Patient[26]

1. Bonded retainers should be reviewed regularly and monitored at-least once a year
2. Regular flossing and proper oral hygiene maintenance is necessary to prevent plaque accumulation.
3. If any distortion in the retainer wire is observed refer to orthodontist immediately, delaying increases the chances of relapse.
4. Encourage the patient to wear his/her removable retainers in the meantime until the retainer can be repaired.

CONCLUSION

These simplified methods are easy to fabricate and makes the orthodontist to perform better bonding procedure.

It can be carried out at the chairside with or without laboratory work.

It effectively stabilize the retainer wire in its position.

It also provides better isolation while bonding and reduces chairside time.

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ABBREVIATIONS

SS - Stainless Steel

AJW - AJ Wilcock wire or Australian wire

Al_20_3 - Aluminium oxide.

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