

A Hybrid Approach Combining lingual appliance with Clear Aligner therapy: A case report

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Abstract-

Clear aligners are now a widely used option for orthodontic treatment, especially for adults who want to avoid any disruptions to their social or personal lives. However, the effectiveness of clear aligners is reduced when complex tooth movements are encountered. Clear aligners may be less effective than traditional braces when complex tooth movements are required, resulting in decreased efficiency. One of the treatment options that can be considered is the extraction of all the first premolars, to address the severely proclined maxillary incisors and crowding in the mandibular arch while maintaining Class I molar and canine relationship bilaterally with the lingual appliance, and final finishing and detailing with clear aligner therapy as when it comes to treating a malocclusion using the lingual appliance, the most challenging and difficult stage is the finishing phase. This is because of the mechanical limitations that come with it. However, proper diagnosis and case selection is an important requisite for a successful treatment result. Taking into consideration the patient's esthetic concern and the problems encountered with the lingual appliance and clear aligners, we describe here the case of a young patient whose therapy consisted of a creative hybrid aesthetic method utilizing clear aligners in conjunction with fixed lingual appliance.

INTRODUCTION

Over the past few years, there has been a noticeable rise in the number of adults opting for orthodontic treatment. As a result, there has been a surge in the demand for orthodontic appliances that are not only effective but also aesthetically pleasing.

Consequently, orthodontists are paying more attention to the design and appearance of the appliances they offer, ensuring that they are comfortable, effective, and visually appealing. Advancements in orthodontics have led to the development of better esthetic brackets, lingual appliances, and aligners. Lingual braces can effectively treat various dental issues, including severe proclination, crowding and spacing. When it comes to treating a malocclusion using the lingual appliance, the most challenging and difficult stage is the finishing phase. This is because of the mechanical limitations that come with it.

The most common and challenging problems in lingual orthodontic treatment encountered during the finishing and detailing stage usually include one or more of the following: alignment, rotations and transverse arch coordination, etc. These

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problems are typically caused by mechanical restrictions.¹

Clear aligner therapy has become a popular treatment option for patients, particularly adults, who request orthodontic treatment without affecting their social and personal lives. The most recent systematic reviews of the literature have concluded that aligners are highly effective only in simpler cases.² The effectiveness of clear aligners reduces when complex tooth movements are encountered. It should be noted that clear aligners may be less effective than traditional labial orthodontic appliances in severe cases or when complex tooth movements are required, resulting in decreased efficiency. Detailed cone-beam computed tomography studies of root position show that clear aligner therapy can create a substantial amount of coronal movement but only a small amount of root movement, indicating that it is incapable of producing bodily movement.³ Various research conducted over the last 15 years has revealed that clear aligners may not be very effective for specific types of tooth movements such as lower-incisor intrusion, canine and premolar rotation, translation into extraction spaces, expansion, and sagittal correction.⁴⁻¹⁰

A solution to address these issues is combining clear aligners with other devices. This approach is known as Hybrid Aligner Treatment or Hybrid Mechanics, which may involve the use of fixed appliances, laboratory-fabricated appliances, or auxiliaries.¹¹

The hybrid aligner treatment combines the benefits of clear aligners along with a solution for their limitations in achieving specific tooth movements. According to Kravitz, clear aligner treatment that involves a planned fixed component as a part of comprehensive clear aligner therapy should be considered as Hybrid aligner treatment. This fixed component is designed to achieve skeletal or dental movements that cannot be effectively accomplished through the use of aligners

alone. However, hybrid mechanics can be utilized by orthodontists to offer clear aligner therapy to all patients, regardless of the severity of their malocclusion or oral health.¹²

Taking into consideration the patient's esthetic concern and the problems encountered with the lingual appliance and clear aligners, we describe here the case of a young patient whose therapy consisted of a creative hybrid aesthetic method utilizing clear aligners in conjunction with fixed lingual appliance.

CASE REPORT DIAGNOSIS AND TREATMENT PLAN

A 15-year-old female patient presented with the chief complaint of forwardly placed upper and irregularly placed lower anterior teeth. Clinical examination reveals mesoprosopic facial form, straight profile, posterior divergence, and competent lips (Fig. 1). On intraoral examination, molar relation and canine relationship was Class I bilaterally and Class I caries in relation to 46,47. Overjet and overbite were 3mm and 2mm, respectively. The lower midline has shifted 1mm to the right side. The cephalometric analysis revealed Class I skeletal pattern with the orthognathic maxilla and retrognathic mandible, a normal growth pattern. Occlusal facets were there on 36 and 37 and all the third molars were present. Boltons tooth-size analysis found an anterior ratio of (79.75%) (normal = 77.2% ± 1.6%), an overall ratio of 92.17% (normal 91.3% ± 1.9%). We noted 5.7mm of crowding in upper arch and 5.47mm of crowding in the lower arch (Fig. 1). The upper and lower incisors inclination was excessive (U1 to N-A, 8mm, L1 to N-B, 5mm), (SN-Go-Me, 30°, IMPA 99°).

The primary treatment objectives were to resolve anterior crowding while maintaining Class I molar relation and a favorable profile and satisfy the patient's request for esthetic. It was also desired to attain ideal overjet, overbite, and coincident

midlines, as well as optimize facial esthetics and attain facial balance.



Fig. 1 15-year-old female patient with Class I molar and canine relationships, lower midline deviated .5mm to right, crowding in lower anterior region Class I skeletal pattern with crowding in lower anterior region.

TREATMENT PLAN

Considering the patient's aesthetic concerns, the treatment plan considered was extraction of all the first premolars, to address severely proclined maxillary incisors and crowding in the mandibular arch while maintaining Class I molar and canine relationship bilaterally with the lingual appliance, and final finishing and detailing with clear aligner therapy.

TREATMENT PROGRESS

Both upper and lower arches were bonded after the extraction of all first premolars with .022" lingual appliance and all first molars were banded. The alignment was successfully achieved using .012" and .016" x .022" Nickel Titanium archwire (3M Unitek nitinol super elastic in the USA) (Fig. 2).

First stage treatment:

The treatment began with bonding of the upper and lower arch using lingual appliance (7th Generation brackets, ORMCO, USA, Horizontal slot). The arches were leveled and aligned using .014" and .016" Niti arch wires. After a period of five months, a .017" x .025" stainless steel archwire was put in place. The bite was raised with Glass Inomer Cement at first molars. A 5/16" Class II elastic (6.5 oz) was attached from upper canine to lower second molar on left side for the mesialization of lower molar. Additionally, Class I power chains were placed in the upper arch from the canine to the first molar to begin retraction of upper canines (Fig.3).

No	MEASUREMENTS	RANGE	ACTUAL	
			PRE-TREATMENT	POST-TREATMENT
Skull				
1	SN	22°	21°	21°
2	SNS	32°	34°	34°
3	SNB	2°	3°	3°
4	S perpendicular to post A (S-A-P-A)	0-3 mm	1 mm	0 mm
7	S perpendicular to Pogonion (S-Pog)	-4 to 0 mm	-1 mm	-1 mm
8	Mandibular plane angle (MP-Go-Me)	22°	20°	20°
7	Angle of inclination (Pog plane to P-A)	87°	90°	90°
8	Y-axis (S-N to S-On lower angle)	69°	61°	60°
8	Facial axis angle (S-N to Pns-On (Lower angle))	92°	94°	94°
20	Right max (axis of premolar angle)	104° ± 2°	107°	107°
Jaws				
11	U1 to N-A (mm)	4mm	4 mm	3 mm
12	U1 to N-A (angle)	22°	40°	20°
13	L1 to S-CB (mm)	4mm	5 mm	3 mm
14	L1 to S-CB (angle)	22°	20°	20°
15	U1 to L1 (dissimilarity angle)	111°	110°	120°
16	Upper incisor to S-P plane	100° ± 20	120°	120°
15	L1 to S-Pog line distance	1 = 2mm	3 mm	3 mm
19	SNB (facial mandibular plane angle)	90°	90°	85°
Soft tissue				
20	U line to Upper lip	0-2 mm	2mm	0 mm
21	L line to Lower lip	0-2 mm	1.5 mm	0 mm
22	H angle	7° - 13°	10°	12°
23	Mandibular angle	90° - 110°	80°	100°
24	Mandibular rotation	3mm ± 2	4 mm	3 mm

Table 1. Cephalometric Analysis



Fig. 2 First stage treatment: initial levelling and alignment with 0.012 NiTi



Fig. 3 Class I force on right and Class II force on left side for the closure of lower residual spaces.



(A)



(B)

Fig. 4 (A) Virtual setup (B) Settling elastics with clear aligners.



(A)



(B)

Fig. 5 (A) Patient after 28 months of treatment. (B) Superimposition of pre- and post-treatment

After undergoing 14 months of treatment, the lingual appliance was removed, and an intraoral scanning was conducted for clear aligners.

To obtain good root parallelism, a virtual setup was performed using ODONTO clear aligners after removing lingual appliance. An Essix retainer was delivered to the patients while waiting for the aligners to be fabricated.

Second stage treatment:

At the second stage of treatment, when the first aligner was delivered, buttons were bonded directly onto teeth 16, 26, 36, and 46. A transfer tray with high flexibility was used to accurately reproduce the positions of all the attachments as planned in the setup.

The setup also ensured that the aligners would fitting tightly and reducing patient discomfort. The close fit of the aligners would thus enable the planned movements to be performed accurately and effectively. All the spaces were closed, and torque correction was done for upper and lower incisors using vertical rectangular

attachments. Root control attachment was given on upper canines and right premolar and retention attachments on all first molars (Fig.4(A)). Intermaxillary elastics were prescribed to resolve the lateral open bite (3/16", 4.5 oz) (Fig.4(B)). The prescribed digital setup included 28 sets of aligners, which were to be replaced every 15 days and worn for a total of 14 months. Intermaxillary elastics were used to extrude molars. After 28 months of active treatment, all treatment goals were achieved and fixed lingual retainers were placed in the upper arch from premolar to premolar, and in the lower arch from canine to canine.

TREATMENT RESULTS

All of the treatment goals have been accomplished and the patient expressed complete satisfaction and was delighted with the outcome (Fig. 5). The crowding in the upper and the lower arches were effectively corrected with coincident midline, appropriate overjet, overbite and good intercuspation (Fig.5). Post-treatment cephalometric radiograph (Table 1) showed improvement in the incisor inclination (U1 to N-A, 3mm, °, L1 to N-B, 2mm), (SN-Go-Me, 30°, IMPA 85°). Post-treatment panoramic radiograph revealed favorable root parallelism without significant root resorption.

Additionally, the patient is further advised to undergo the extraction of the upper right third permanent molar.¹³

DISCUSSION

All orthodontists aim to achieve the best possible functional and aesthetic outcomes through treatment methods that cause minimal discomfort to the patient and require minimal compliance. Proper application of light forces can have positive effects on both dental and skeletal structures, and can also assist in the treatment process by minimizing the requirement for excessive anchorage.¹⁴ This case report emphasizes the importance of

accurate diagnosis and comprehensive treatment planning of a case treated with lingual appliance first and finished with clear aligners showing the successful handling of a patient presented with Skeletal Class I crowding case.

When it comes to orthodontic treatment, especially for adults, it is important for clinicians to prioritize fulfilling the patients' concerns and expectations. This includes not only achieving the desired outcome but also providing the most aesthetically pleasing appliance available. Keeping in mind the aesthetic concern of the patient, we present here a hybrid approach that unites the benefits of clear aligners and lingual appliances.

This approach was chosen to facilitate tooth movement which proved challenging with clear aligners, while also reducing overall treatment costs and time. Specifically, extrusion, canine and premolar rotation, bodily movements, and root torque were difficult to achieve with clear aligners.

Anchoring the anterior teeth in lingual orthodontics presents a challenge for the orthodontist. Like torque control, uprighting and rotational movements can be challenging with this technique. It is possible for some side effects to occur while undergoing treatment, such as mesial tipping of molars and lateral bite opening.¹ Since, torque control is difficult with lingual appliance, lateral open bite can be seen in this case which is further corrected with the clear aligners. Lingual orthodontics was thought to have limited control over anchorage of the front teeth.¹⁵ In the present case, treatment with clear aligners alone would have necessitated a considerable number of additional stages, probably including one or more finishing steps.^{16,17} It is important to remember, however, that bodily movements and root torque or tip are still more difficult to achieve with aligner therapy.^{2,18,19}

To overcome all the limitations, we opted for a hybrid approach. Defining the technique of hybrid aligner treatment can

be challenging because not all uses of fixed appliances with aligners fall under this category. It is important to note that the transition from noncompliance to fixed appliances should not be classified as hybrid aligner treatment.¹⁷ A hybrid approach combines the benefits of clear aligners with the biomechanical efficiency of a fixed lingual appliance to provide an effective, efficient, aesthetic, and comfortable treatment that meets the demands of the patient.

This case demonstrate that the clear aligner system can be more effective when used in conjunction with fixed lingual appliance.⁶ The advantages are that the major rotation correction and closure of extraction spaces do not have to be coordinated with staging of clear aligners, and that fewer aligners are likely to be required.

After 14 months of treatment and the planned 28 sets of aligners, the results were not entirely satisfactory. All the residual spaces were closed but canine uprighting was not completely corrected. However, the patient was happy with the result, so we merely departed as scheduled with the additional refining aligners.

The combination of fixed appliance and clear aligners offers orthodontists greater flexibility in treating complex malocclusions. As more patients are becoming aware of clear aligners, orthodontists can rely more on hybrid therapy to achieve the best possible outcome.

CONCLUSION

A combination of clear aligners and a fixed lingual appliance is a better option for esthetic treatment when dealing with certain cases that involve limited and unpredictable movements of specific teeth. This hybrid therapy is not only efficient and effective but also reduces overall treatment time.

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