Archwire Sequence for a Passive Self-Ligating Lingual Bracket System with an 0.018-in Square Slot

Abstract

Archwire sequencing is the key to efficient treatment with an advanced lingual bracket system. To ensure patient comfort, maximize the potential for each phase of treatment, and progress to the final archwire as soon as possible, clinicians must carefully sequence the mechanics in a specific order. There are four stages for comprehensive orthodontic treatment: (I) alignment and leveling, (II) torque control, (III) space closure, and (IV) finishing. This article presents a simplified rationale for efficient sequencing of the specific archwires that are required for each stage of treatment. (Int J Orthod Implantol 2017;45:86-90)

Key words:
Alias® lingual appliance, passive self-ligating, square slot, archwire sequencing

Introduction

Alias® (*Ormco, Glendora, CA*) is the first passive self-ligating (*PSL*) lingual bracket with a square slot. The device was invented and developed by Drs. Kyoto Takemoto and Giuseppe Scuzzo.[1] The self-ligating slide on the bracket facilitates archwire changes and simplifies the application of mechanics. The 0.018x0.018-in square slot with a PSL mechanism is designed for a straight-wire technique, that improves rotational and torque control for achieving more efficient alignment. A low profile bracket with rounded contours enhances patient comfort and improves clinical performance. The small size of the brackets provide a superior fit for accurate placement. Simplicity, efficiency, and comfort are unique benefits of the Alias® lingual system (*Fig. 1*).[1-5] However, clinicians must carefully utilize a progressive archwire sequence that is specifically designed for the appliance to optimize the treatment response.[6]

Stage I: Alignment and Leveling

The objective of the first stage of treatment is to gently level and align both arches with resilient archwires that have specific material properties: low load-deflection relationship, resistance to fatigue fracture, and inherent material strength (*toughness*). The initial leveling and alignment requirements are achieved with an

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0.013-in copper-nickel-titanium (*CuNiTi*) archwire (*Fig. 2*). The small dimension of the 0.013-in round archwire in an 0.018x0.018-in slot minimizes friction and binding of the archwire within the lumen (*tube*) of the engaged PSL bracket. The brackets are free to slide along the wire as the teeth are leveled and aligned. Light force, resilient round archwires in free-sliding tubes are designed to minimize necrosis (*hyalinization*) of the periodontal ligament (*PDL*).[7-8] Schwarz[9] proposed that PDL pressure (*stress*) exceeding capillary pressure (*~16kPa*) produced hyalinization, but more recent biomechanics studies utilizing finite element modeling have demonstrated that irreversible cell damage and necrosis occurs at a much lower levels of PDL stress (*~8-10KPa*).[10-11] PDL necrosis decreases the rate of tooth movement and is also associated with expression of external apical root resorption (*EARR*).[10-13] It is particularly important to minimize applied force during the tooth tipping mechanics of initial alignment to avoid apical necrotic sites, that may be expressed as EARR in susceptible patients.[12] Furthermore, very low levels of force (*~56cN*) enhance the rate of premolar translation with sliding wire mechanics[14] and minimize EARR.[10-13]

Once optimal initial alignment is achieved, an 0.016-in CuNiTi archwire is used for additional alignment and leveling of the arch. This progression of highly resilient archwires with low force to deflection

Fig. 1:
An 0.018x0.018-in slot PSL bracket has minimal play between the slot and the archwire, so the bracket must be precisely positioned on each tooth to achieve proper alignment of the arch with a straight archwire.

rates is to minimize PDL necrosis relative to tooth tipping during initial alignment. The purpose of the 0.013-in and 0.016-in CuNiTi wires is to achieve the provisional alignment necessary to receive the subsequent archwire, but not to resolve all of the rotations.

Stage II: Torque Control

The objective of the second stage of treatment is complete rotations and establish torque control with an 0.016x0.016-in CuNiTi wire (*Fig. 3*). The archwire must be inserted with minimal active engagement; otherwise, the arch is not ready for stage II, and additional round wire alignment is indicated. To enhance esthetics during active treatment, spaces are closed between the six anterior teeth with elastic ligature. Then an 0.018x0.018-in CuNiTi wire is inserted to complete torque control and prepare the arches for the insertion of the 0.018x0.018-in stainless steel (*SS*) archwire. At the end of Stage II, all alignment, leveling, and torque control are completed.

Stage III: Space Closure

The third stage is dedicated to closure of extraction spaces, as needed. For optimal esthetics, en-masse retraction of the anterior segments is indicated. An 0.0175x0.0175-in titanium-molybdenum alloy (*TMA*) wire is used for loop-activation space closure (*Fig. 4*). For sliding mechanics, a straight 0.018x0.018-in stainless steel (*SS*) archwire is preferred (*Fig. 5*) to take advantage of the minimal friction and simplified mechanics associated with PSL brackets.

For maximum anchorage, miniscrews are superior to headgear or other appliances that require patient compliance (*Fig. 5*). Moreover, vertical and transverse bowing effects of the archwire are unlikely with

Fig. 2:
An 0.013-in CuNiTi archwire is used to initiate tooth movement. The terminal ends of the archwire are horizontally cinched back to avoid soft tissue irritation.

Fig. 3:
An 0.016x0.016-in CuNiTi wire is used in stage II to initiate torque control, and the ends of the archwire are cut flush with the molar tubes.

Alias Archwire Sequencing			
I	Alignment & Leveling	0.013 0.016	CuNiTi CuNiTi
II	Torque Control	0.016x0.016 0.018x0.018	CuNiTi CuNiTi
III	Space Closure	0.018x0.018 0.0175x0.0175	SS TMA
IV	Finishing	0.0175x0.0175	TMA

Table 1: Summary of the archwire sequence for the Alias® lingual bracket system

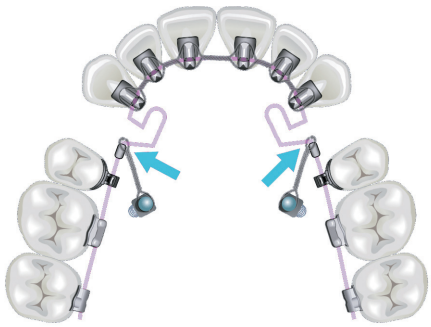

Fig. 4:
An 0.0175 x0.0175-in TMA wire is used for loop-activation mechanics to close extraction space. Two stops are crimped at the distal base of the L-loops to activate space closure (blue arrows). For en-masse retraction of the anterior segment, the L-loops are activated bilaterally with SS ligatures tied back to the miniscrews.

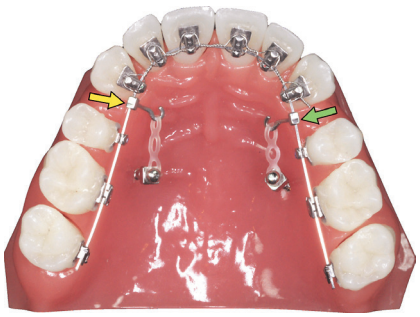

Fig. 5:
An 0.018x0.018-in SS wire is used for sliding mechanics to close space. The anterior segment is ligated from canine to canine with an 0.008-in SS ligature. Miniscrews are inserted mesial to the first molars to provide anchorage for en-masse retraction. Power chains are stretched between the miniscrews and power arms to deliver 150g (cN) of force bilaterally to retract the anterior segment. As illustrated, one power arm is ideally positioned (yellow arrow) but the other power arm (green arrow) is too distal.

miniscrew anchorage, because accentuated anchorage bends are unnecessary.

Stage IV: Finishing

The objective of the fourth (*finishing*) stage is final detailing with an 0.0175x0.0175-in TMA archwire. The flexible archwire is readily adjusted by the clinician and the gentle forces are relatively comfortable for patients.

Conclusion

Archwire sequencing for the Alias® lingual appliance system is summarized in Table 1. This innovative esthetic appliance with low profile PSL brackets has transformed lingual treatment into an application of simple, efficient, and comfortable mechanics. The archwire sequence is an effective guide to help clinicians master the new system quickly and confidently.

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