Differential Friction in Treatment with Preadjusted Fixed Appliances

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Low-friction fixed appliances have become increasingly popular among orthodontists in the past decade. These systems are designed to reduce the frictional forces that tend to counteract desired tooth movement at the bracket-archwire-ligature interface, thus allowing lighter forces to be applied during orthodontic treatment.[1-3] Three main types of low-friction systems have been described:

1. Passive self-ligating brackets, in which the slot is transformed into a tube by means of a labial "fourth wall" that does not contact the archwire.

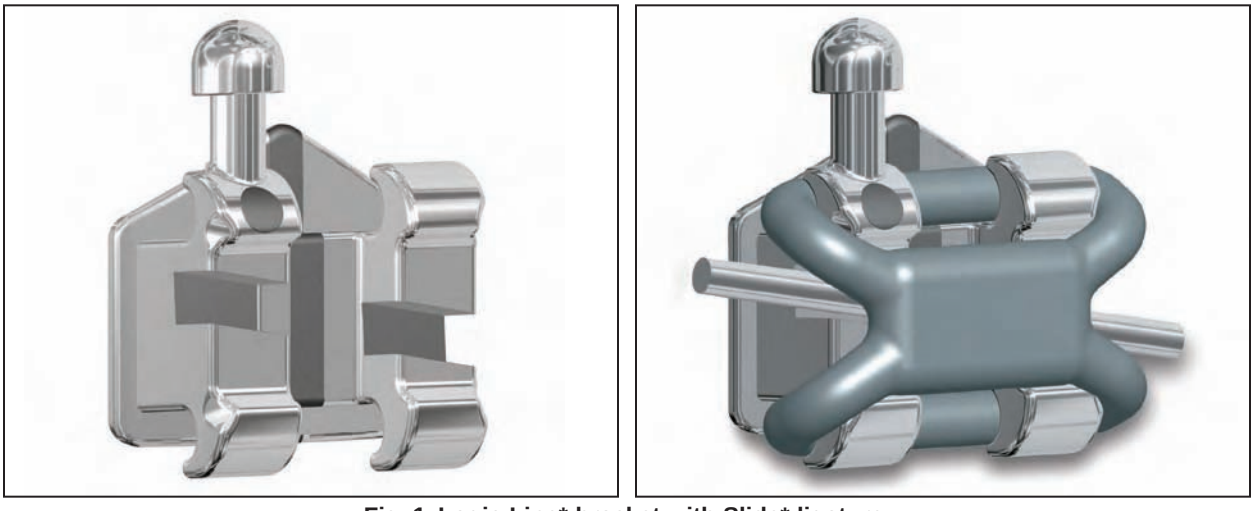

Fig. 1 Logic Line* bracket with Slide* ligature.

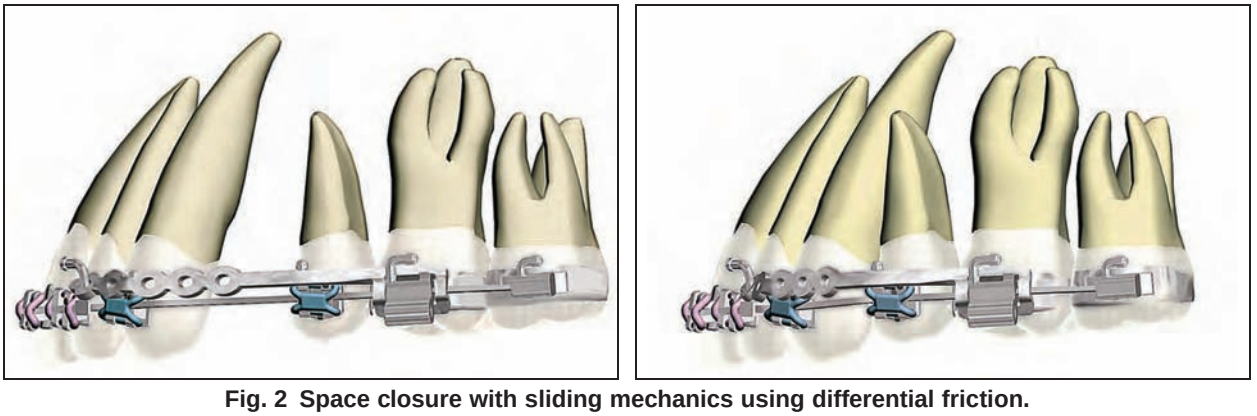

Fig. 2 Space closure with sliding mechanics using differential friction.

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2. Passive/active or interactive self-ligating brackets, with the labial fourth wall consisting of a spring clip in contact with a larger archwire.
3. Unconventional ligatures used on conventional brackets.

Among this third type, Slide* ligatures have demonstrated clinical effectiveness in both in vivo[4,5] and in vitro[6-8] studies. Originally developed for use with any conventional orthodontic bracket, the ligatures can now be combined with specially designed brackets (Logic Line*) that offer improved retention and easier clinical management (Fig. 1).

An ideal system would produce low friction during leveling and alignment and space closure with sliding mechanics, but high friction during occlusal refinement. Such a system would allow initial alignment of the teeth in the shortest possible time, while permitting the full expression of bracket information (tip and torque) during the final phases of treatment. The versatility of the Slide ligature helps the clinician achieve these goals.

*Trademark of Leone, Via Ponte a Quaracchi, 50, 50019 Sesto Fiorentino, Florence, Italy; www.leone.it.

The combination of Slide ligatures and Logic Line brackets provides an additional biomechanical advantage: the simultaneous use of different levels of friction in different parts of the dentition. For example, during space closure, Slide ligatures can generate low friction in the posterior segments while conventional ligatures are used to generate high friction in the anterior segment for optimal control of incisor tip and torque (Fig. 2). Although a similar effect can be achieved by using conventional ligatures with various types of passive self-ligating brackets, the cost is approximately triple that of the Slide-Logic Line system for treatment lasting at least six months.

The following cases illustrate the advantages of differential friction in various clinical situations.

Case 1: Space Closure after Premolar Extractions or Molar Distalization

An 11-year-old male required closure of the residual spaces between the maxillary lateral incisors and canines following distal movement of the maxillary molars with a molar-distalizing appli-

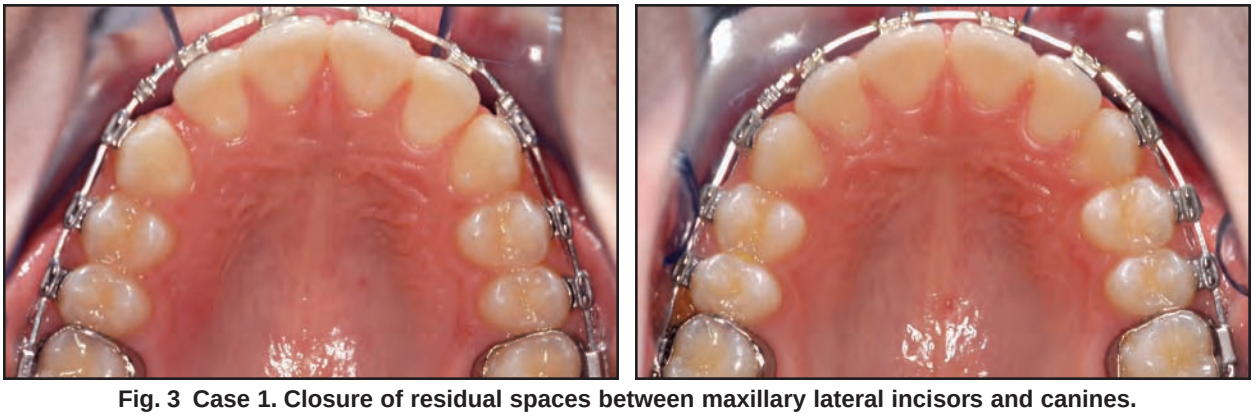
Fig. 3 Case 1. Closure of residual spaces between maxillary lateral incisors and canines.

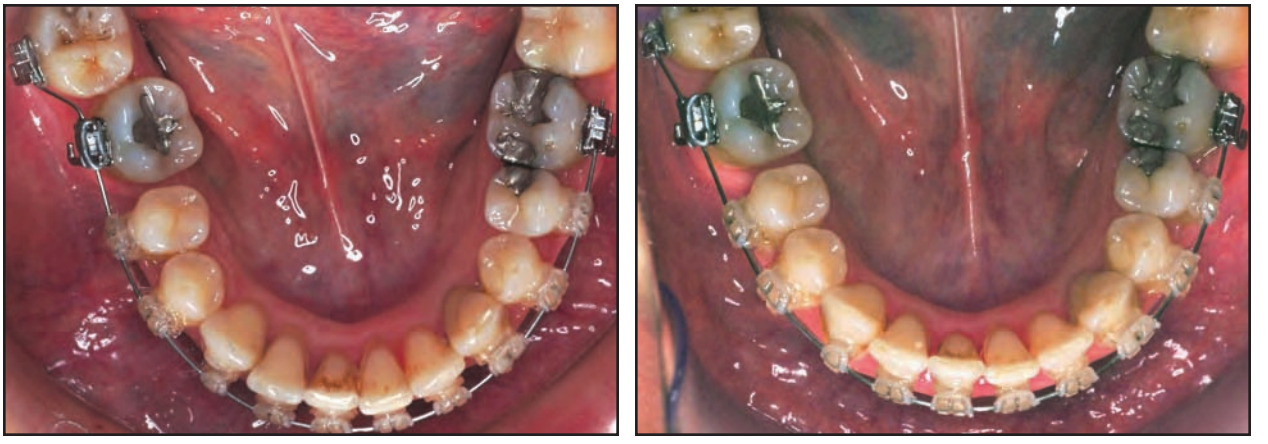

Fig. 4 Case 2. Buccal movement of lingually displaced mandibular right first molar.

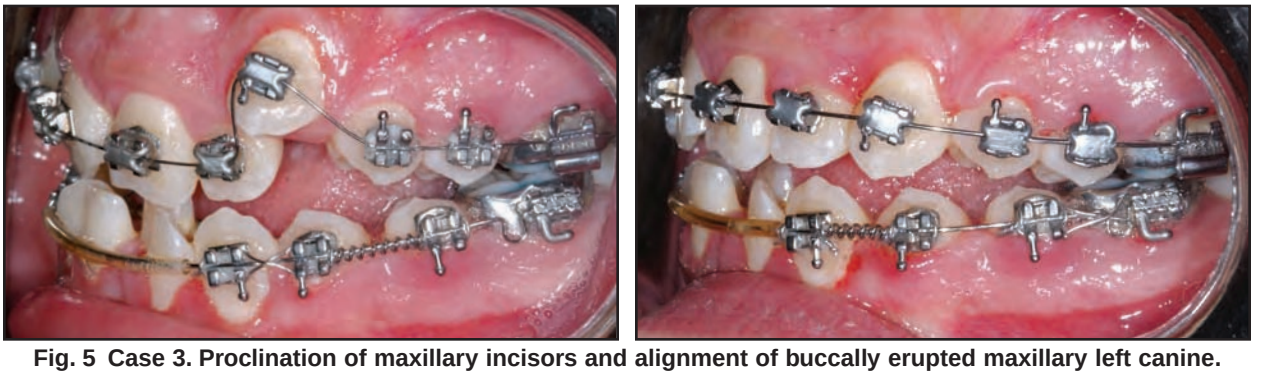

Fig. 5 Case 3. Proclination of maxillary incisors and alignment of buccally erupted maxillary left canine.

ance (Fig. 3). Conventional ligatures were used on the maxillary central and lateral incisors to control tip and torque, and Slide ligatures were used on the maxillary canines and premolars to facilitate sliding mechanics with an .019" × .025" stainless steel archwire and active tiebacks. The duration of treatment was three weeks.

Case 2: Orthodontic Movement of Single Teeth

A lingually displaced mandibular right first molar needed to be aligned in a 36-year-old female patient (Fig. 4). A superelastic .014" nickel titanium archwire was placed with conventional ligatures in esthetic brackets from the mandibular right to left second premolar; a tube was bonded to the mandibular right second molar, and a convertible tube with a Slide ligature was bonded to the displaced mandibular right first molar, allowing it to be moved buccally. The duration of treatment was four weeks.

Case 3: Incisor Proclination

A 12-year-old male presented with a Class III malocclusion. Proclination of the maxillary incisors was required to correct his anterior crossbite and create space for a buccally erupted maxillary left canine (Fig. 5). A superelastic .012"

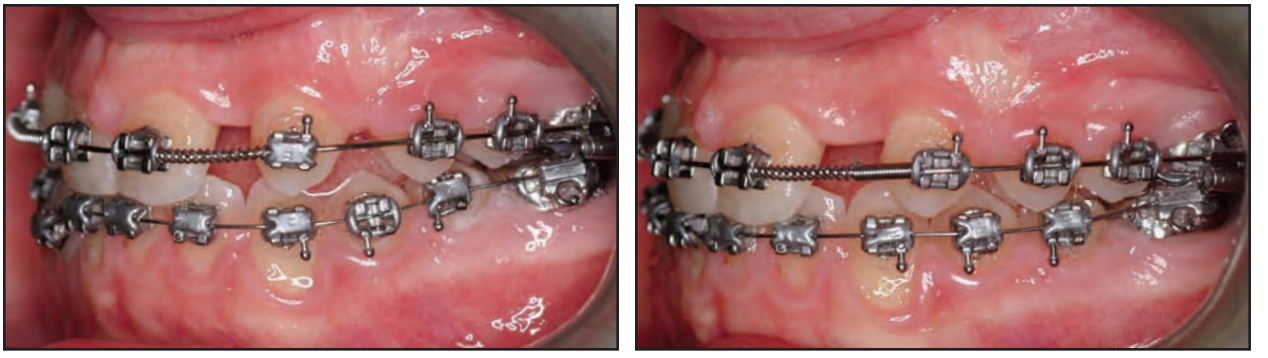

Fig. 6 Case 4. Space opening in maxillary arch for prosthetic replacement of missing left lateral incisor.

nickel titanium archwire was used with conventional ligatures on the maxillary premolars and Slide ligatures on the maxillary incisors and canines. The maxillary incisors were proclined and space was gained by blocking the archwire posteriorly, allowing anterior extension of the maxillary arch. The duration of treatment was 12 weeks.

Case 4: Space Opening

A 13-year-old male needed space in the maxillary arch for prosthetic replacement of a missing left lateral incisor (Fig. 6). Conventional ligatures were used on the maxillary central incisors and premolars, and a Slide ligature on the maxillary left canine. The canine was distalized with a nickel titanium open-coil spring on an .016" stainless steel Australian archwire; the Slide ligature allowed the canine to move within the otherwise-blocked system. The duration of treatment was eight weeks.

Conclusion

In the past, orthodontic treatment with preadjusted appliances required a choice between a low-friction and a conventional-friction bracket system. The versatility of the Logic Line appliance allows the orthodontist to combine the best features of both systems to create the most effective and efficient treatment plan for each individual patient. The use of differential friction maximizes the range of possible tooth movements while minimizing both treatment duration and cost.

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