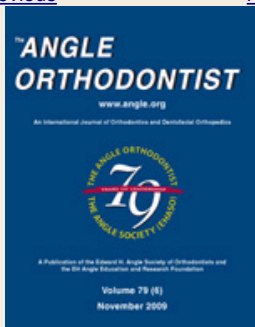


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Original Articles

Third-Order Torque and Self-Ligating Orthodontic Bracket–Type Effects on Sliding Friction

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Abstract

Objective: To examine the influence of third-order torque on kinetic friction in sliding mechanics involving active and passive self-ligating brackets.

Materials and Methods: Wire-slot frictional forces were quantified and compared across five sets of brackets and tubes within a simulated posterior dental segment with -15° , -10° , -5° , 0° , $+5^\circ$, $+10^\circ$, and $+15^\circ$ of torque placed in the second-premolar bracket; a working archwire was pulled through the slots.

Results: Increasing the torque from 0° to $\pm 15^\circ$ produced significant increases in frictional resistance with all five sets of brackets and tubes. At 0° and $\pm 5^\circ$ of torque, generally less friction was created within the passive than within the active self-ligating bracket sets, and the conventional bracket sets with elastomeric ligation generated the most friction. At $\pm 10^\circ$ of torque, apparently with wire-slot clearance eliminated, all bracket-and-tube sets displayed similar resistances, with one exception at $+10^\circ$. At $\pm 15^\circ$ of torque, one passive set and one active set produced significantly larger frictional resistances than the other three sets.

Conclusions: Third-order torque in posterior dental segments can generate frictional resistance during anterior retraction with the archwire sliding through self-ligating bracket slots. With small torque angles, friction is less with passive than with active self-ligating brackets, but bracket design is a factor. Frictional forces are substantial, regardless of ligation if the wire-slot torque exceeds the third-order clearance.

Keywords: [Self-ligation](#), [Torque](#), [Friction](#)

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