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3-D experimental identification of force systems from orthodontic loops activated for first order corrections

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ABSTRACT

Intra-arch irregularities can be corrected using wire of low stiffness, wires of increasing stiffnesses, or by the activation of loops built into the appliance. While the orthodontist controls only the magnitude of force when leveling with continuous arches, the configuration and positioning of loops offer the possibility of controlling the type and direction of force. In the present study, force systems developed by the L-loop, the T-loop, and the rectangular (R-) loop were analyzed with respect to the force systems acting for first order irregularities, buccolingual movement, and rotation along the long axis of the tooth. An interbracket distance of 21 mm was chosen, and the loops were analyzed in a testing machine that made it possible to register forces and moments simultaneously in three planes of space. The activations included a symmetrical translation of 1 mm made in steps of .2 mm, corresponding to a buccolingual movement, and 10-degree rotations clockwise and counterclockwise in steps of one degree. Force systems were recorded during activation and deactivation. Loops made of TMA wire delivered 40% of the force delivered by the same loops made of stainless steel wire. The T-loop generated a force system that deviated qualitatively only slightly from that delivered by a straight wire. The L-loop generated a force system that was dependent on orientation; constancy was better corresponding to the anterior part of the loop. It was evident that the rectangular loop was capable of generating any desired moment-to-force ratio, and the R-loop demonstrated a high degree of constancy of the force system. Rectangular loops should, therefore, be preferred for making first order corrections.

KEY WORDS: Wires, Loops, First order correction, Force system.

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