Force-deflection behaviour of NiTi archwires in a polytetrafluoroethylene (Teflon) bracket system

Kraft-Weg-Verhalten von NiTi-Drahtbögen in einem Polytetrafluoroethylen- (Teflon) Klammer-System

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Abstract:

In orthodontic treatment, archwire forces for tooth movement is influenced by the magnitude of friction encountered during the sliding motion of archwire along the bracket slot. Friction will reduce the archwire force, and subsequently modify the constant force delivery trend into a slope. The aim of this work is to investigate the force-deflection behaviour of nickel-titanium (NiTi) shape memory alloy archwire on polytetrafluoroethylene (Teflon) as the bracket. Sliding tests was performed to determine the coefficient of friction of polytetrafluoroethylene-NiTi material combinations. The force-deflection behaviour was evaluated from a modified bending tests, at two different configurations; commercial stainless-steel bracket and hand-made polytetrafluoroethylene bracket. During test, wires were deflected into different deflections (2 mm, 3 mm and 4 mm) by using four commercial NiTi archwires at different sizes and geometry. From the test; coefficient of friction for polytetrafluoroethylene-NiTi wire was recorded as small as 0.07. On force-deflection graphs, bending load on 3 mm and 4 mm deflection were observed higher on stainless steel (SS) bracket compared with polytetrafluoroethylene bracket. Due to small coefficient of friction on polytetrafluoroethylene-NiTi configuration, the NiTi archwire exhibited the activation and deactivation force within the plateau limit. Greater friction on stainless steel-nickel-titanium bracket configuration causes wire to release force in a slope trend. This finding highlights the potential of polytetrafluoroethylene as a material in the bracket slot to minimize friction during orthodontic treatment.