UPTIGHTING OF MOLARS

Tips to solve severe cases with the pseudoelastic NiTi-steel uprighting spring

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I. Summary

Uprighting of mesially inclined molars has always been one of the most challenging single tooth movements within orthodontic treatment since numerous side effects can be expected. Particular attention needs to be drawn to the applying biomechanics. The larger root surface of the movement unit represented by the molar that is to be uprighted in comparison to the anchoring segment often only presented by the adjacent premolars takes the requirement for a special anchoring technique into account. The main side effects are extrusion of the uprighted molar which creates an occlusal trauma to the opposing dentition, mesial attachment loss of the molar and anchorage loss within the dental arch associated with intrusion and distal movement. The uprighting procedure is complicated considerably if the tipped molar is impacted and surgical exposure becomes necessary.

II. Introduction

Uprighting of tipped molars is one of the standard exercises in orthodontic treatment since first molars can incline mesially in terms of a secondary crowding or following an early loss of the second primary molar or premolar.

Classical uprighting springs handmade of cobalt chromium (Elgiloy®), 8-titanium or stainless steel are disadvantageous, because forces and moments can be set-up predictably at the beginning of treatment, but will decline as progressive movement starts by uprighting the tooth and accordingly deactivating the spring. The functionality and efficiency of the system is restricted, so that reactivations will become necessary. Frequent activations require great effort due to time-consuming disassembling for the practitioner and patient’s discomfort. Overcoming side effects such as unfavorable extrusive forces (Fig. 1) and a lingually directed moment, the NiTi steel spring uses the NiTi section to allow movement with light continuous forces thereby minimizing the anchorage loss and by combination with the steel segment adding a vertical force component to deliver a simultaneous uprighting moment (10 to 20 Nmm) and intrusion (-0.3N to +1N) (Fig. 2).

The presented uprighting technique with the pseudoelastic NiTi steel spring has been proven to be successful especially considering the technical difficulties of impacted molars.

III. Technical Design

The applied uprighting technique uses the Forestadent Memory Titanol® Feder with cross-tubes developed by Prof. F. G. Sander (Fig. 3).

To stabilize the anchoring segment and counteract the expected anchorage loss lingual or palatal arches are attached and a heavy stainless steel wire is ligated after the leveling the arch.

In cases of surgically exposed teeth the uprighting technique uses a maxillary molar tube from the contralateral molar that is turned 180° and has to be bonded during or shortly after surgical exposure perpendicular to the long axis of the tooth with a self-etching adhesive. The incorrect molar tube will be exchanged for the appropriate one after completion of the uprighting process. The prescription of the upper molar tube incorporates a molar offset of 14° (Roth) which facilitates the spring insertion (Fig. 4), but will otherwise generate a slight but neglectable mesial rotation of the molar. Besides, the insertion of the NiTi section will be nearly impossible using the correct molar tube due to the surrounding structures.

After the adaption of the steel part to the individual clinical situation (Fig. 5), the α bend (Fig. 6) is placed according to the desired effect between 90° – 135° and the spring is inserted into the crosstube or vertical slot bracket located between canine and 1st premolar (Fig. 7). The vertical force elongating or intruding the molar can be applied by changing the α angle and modifying the vertical length of the α leg, whereby the constant uprighting moment is generated primarily from the NiTi material due to its pseudo-elasticity (Fig. 8). An α angle of 135° is synomonic to the geometry α > β and generates an intrusion upon the molar, whereas an α angle of 90° or smaller referring to the geometry α < β creates an extrusion.

A loose steel ligature can be ligated between the hook of the molar tube and the anchoring segment (Fig. 9) to achieve a pure mesialization of the molar root and avoid distal tipping of the crown (Fig. 10).

In the following appointment after tissue granulation occurred, the steel section runs partially subgingival and is no longer assessable but still delivers the uprighting moment. The unique benefit of combining both materials with different material properties makes the pseudoelastic NiTi steel uprighting spring the ideal technique for uprighting even severely tipped and impacted molars.

IV. Case Presentation

The patient presents with posterior crowding in both lower quadrants and an impacted lower left second molar. The panoramic x-ray shows that the lower left second molar is severely tipped towards the mesial (Fig. 11). After the application of the pseudoelastic NiTi steel uprighting spring the lower left second molar uprighted successfully with only minor distal tipping of the crown (Fig. 12).

Bonding of the contralateral tube (from tooth 16) turned upside down and oriented perpendicular to the long axis of the tooth 37 after surgical exposure (Fig. 13). During the final stages of the uprighting process the lower left second molar is erupting. The incorrect tube is exchanged for the adequate one and a leveling archwire is ligated. Tooth 37 is uprighted and aligned after removal of the fixed appliances (Fig. 14).


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