The orthodontic center of rotation of the maxillary central incisor

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The success of orthodontic treatment depends on the ability of the clinician to move teeth into improved positions, from the standpoint of both function and appearance, in which they will remain stable after appliances are withdrawn.

When a simple force is applied to the crown of a tooth by a spring on a removable orthodontic appliance, the tooth tilts initially by fluid displacement from the supporting periodontal tissues and later by remodeling of the surrounding alveolar bone. The final attitude of the tooth will depend upon the distance the crown is moved, the location of the fulcrum about which tipping occurs, and the initial angulation of the tooth. When using removable appliances, the clinician has very little control over the final position of the teeth he is retracting. Nevertheless, in the United Kingdom in the planning of removable appliance treatment it is almost universally accepted that anterior teeth tip about points lying within the apical thirds of their roots, provided that light forces are used.1-3

While there is considerable evidence to support this long-held belief,4-14 recent animal and human experiments have suggested that the rotation axis of single-rooted teeth can lie in other parts of the root.15-21 Mathematical studies, on the other hand, offer a high degree of agreement despite the variety of simplifications and assumptions made in the various mathematical models used. Almost all place the instantaneous center of tipping in the middle third of single-rooted teeth.22-28

Christiansen and Burstone20 have shown that there can be a close agreement between calculated and clinically determined instantaneous centers of rotation in human incisors and found that these were largely independent of the magnitude of the applied force. Whether such axes are the same as those encountered during orthodontic tooth movement remains in doubt. There have been few human studies of the orthodontic center of rotation of single-rooted teeth, and all of these have been based on small numbers of individuals. Some have found rotation axes in the apical third of the tooth root,5, 13, 14 and others have found them in the midroot.20, 21 There is also little agreement between the results of studies that have been made of the relationship between the magnitude of the applied force and the location of the orthodontic center of rotation.9, 16-21, 30

Some of the disagreement between investigators can be explained in terms of the variation in root anatomy31 or the differing degrees to which the alveolar bone was deformed.21 To this must be added the possibility of errors due to growth and eruption and

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