

عنوان مقاله:

Displacement and Force Distribution of Splinted and Tilted Mandibular Anterior Teeth under Occlusal Loads: An in Silico 3D Finite Element Analysis

محل انتشار:

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تعداد صفحات اصل مقاله: 1

نویسندگان:

Allahyar Gerami - *Department of Orthodontics, Dental Faculty, Tehran University of Medical University, Tehran, Iran*

.Sepideh Dadgar - *Department of Orthodontics, Dental Faculty, Mazandaran University of Medical Sciences, Sari, Iran*

Puya Jannati - *Student Research Committee, Faculty of Dentistry, Mazandaran University of Medical Sciences, Sari, Iran*

Farhad Sobouti - *Department of Orthodontics, Dental Faculty, Mazandaran University of Medical Sciences, Sari, Iran*

Ali Malekzadeh Shafaroudi - *Student Research Committee, Faculty of Dentistry, Mazandaran University of Medical Sciences, Sari, Iran*

خلاصه مقاله:

Background and Objective: Fixed orthodontic retainers have numerous advantages, but it is not known whether they can exert pathological forces on supporting tissues around the splinted teeth. The purpose of this study was to investigate how the inclination of the lower anterior teeth can affect dental displacement and also change the direction of occlusal loads exerted to dental and its supporting tissues. **Materials and Methods:** Four three-dimensional finite element models of the anterior part of the mandible were designed. All the models contained the incisors and canines, their periodontal ligament layers (PDLs), the supporting bone (both spongy and cortical), and a pentaflex splinting wire placed in the lingual side of the teeth. Teeth inclination was considered to be 80° (model 1), 90° (model 2), 100° (model 3), and 110° (model 4) to the horizontal plane. The lower incisors were loaded with a 187-N vertical force. Their displacement patterns and the stress in their PDLs were evaluated. **Finding:** In incisors with 80° of inclination, less than a 0.1-mm lingual displacement was seen on the incisal edge and a similar distance of displacement towards the labial was seen on their root apices. However, in models with 90°–110° of inclination, the incisal edge displaced labially between about 0.01 and 0.45 mm, while root apices displaced lingually instead. By increasing the angle of the teeth, the strain in the periodontal ligament increased from about 37 to 58 mJ. The von Mises stresses around the cervical and apical areas differed for each tooth and each model, without a similar pattern. Increasing the angle of the teeth resulted in much higher cervical stresses in the incisors, but not in the canines. In the lateral incisor, cervical stress increased until 100° of inclination but reduced to about half by increasing the angle to 110°. Apical stress increased rather consistently in the incisor and lateral incisors, by increasing the inclination. However, in the canines, apical stress reduced to about half, from the first to fourth models. **Conclusion:** Increasing the labial inclination can mostly harm the central incisors, followed by the lateral incisors. This finding warns against long durations of splinting in patients with higher and/or patients with reduced labial bone thickness.

