Dynamic Finite Element Analysis of Dental Trauma in Upper Central Incisor

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(damping ratio)

14.6 %

77.5 70.9

10.1

13.8

There are no publications about the directions of impact force as to the structure properties of damping effect in relation to dental trauma. It is still an enigma in propagation of force inside tooth and the pathogenesis of dental trauma. Upper central incisor is considered to be the most frequently involved tooth when an impact occurs. The outcome of such impact could be enamel fracture, crown fracture, root fracture, crown and root fracture, avulsion, luxation and chronic or acute pulp necrosis etc, but the exact mechanism is still unclear.

This study uses the dynamic finite element method to simulate the conditions of tooth under impact force. The input force is drained from an impact record from documents and the damping ratio is from the calculation of an in vivo model testing study. The

young’s modulus, Poisson’s ratios and density of all parts of tooth are from documents. Stress analysis was made by change the directions of impact force and the damping ratios of the model. Our results revealed that the damping ratio of upper central incisor is 14.6 %. When structure damping increased, the maximum equivalent stress decreased and the time is delayed. The directions of impacting forces play an important parameter for assessing the fracture patterns. Intrusive force can cause stress accumulation more easily than extrusive force. Horizontal force is the reason for horizontal crown fracture, while vertical force is liable to oblique root fracture and labial alveolar bone fracture.