

Vibrational analysis of mandible trauma: experimental and numerical approaches

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Abstract

The aim of this study was to evaluate the effectiveness of vibrational assessment of the mandible fracture patterns. Measurement of natural frequencies and associated vibrational mode shapes was performed to determine the relationship between the dynamic behavior of the human mandible and incidence of mandibular fractures using both in vitro modal testing and finite element analysis. Our results show that the natural frequencies of the human mandible in dry and wet conditions are 567 Hz and 501 Hz, respectively. The first vibrational mode of human mandible is a bending vibration with nodes located at the mandibular body where bone fracture is less likely to occur. By contrast, high vibration amplitudes were identified in the symphysis/parasymphysis and subcondyle regions where bone fractures tend occur. These findings indicate that the vibrational characteristics of the mandible are potential parameters for assessment of the mechanisms of injury.