Abstract

An anatomically realistic finite element (FE) model of thoracolumbar spine T11-L1 was developed based on the captured digitized-geometrical properties of the dried cadaveric vertebrae (T11, T12 and L1). The geometrical data were then exported to ANSYS 10 for the three-dimensional (3D) FE meshing. Cortical shell, cancellous core, the intervertebral disc and posterior elements were modeled using eight-noded brick elements. The annulus fibres and ligaments were represented by cable elements. The intact T11-L1 FE model was validated against experimental results reported in literature under various physiological loadings.

Spinal stenosis is one of the most frequently experienced spine diseases, and bilateral facetectomy is the surgical treatment to advocate decompression. Therefore, in this study, the validated FE model was used to investigate the effect of this surgical bilateral facetectomy procedure by resecting the two articulating facets of the stenosis T12-L1 motion segment. The objective of this study is to investigate the influence of bilateral facetectomy on the stability of the thoracolumbar spine under different physiological motions (flexion, extension, lateral bending and axial rotation) to evaluate changes in kinematics. The FE model shows that bilateral facetectomy results in increase in motion with significant increase in axial rotation and least increase in lateral bending.
The sagittal motion in flexion and extension is not considerably changed with removal of facets. The results from the current study may be helpful to improve the understanding of the role facet joints play in spinal stability and provide a basis for recommending arthrodesis for treatment of vertebral instability.