Effect of Facetectomy on Lumbar Spinal Stability under Sagittal Plane Loadings

K. K. Lee, BEng (Hons), E. C. Teo*, PhD, T. X. Qiu, MEng, H. W. Ng, MEng and K. Yang, MD

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Study Design. A study using an anatomically accurate FE model of a L2-L3 motion segment to investigate the biomechanical effects of graded bilateral and unilateral facetectomies of L3 under flexion and extension loadings.

Objective. To predict the amount of facetectomy on lumbar motion segment that would cause segmental instability, therefore enhancing the understanding concerning the role of the facet under sagittal loadings.

Summary of Background data. This study provides a quantitative study on the role of facets in preserving segmental lumbar stability. Previous analytical models lack the 3D structural characterization and insufficient element representation for facet joints.

Methods. A validated FE L2-L3 model was subjected to sagittal loadings at 7.5 Nm. Effects of ligaments and facets were examined to establish their relative importance on segment response. The effect of iatrogenical changes (graded unilateral and bilateral facetectomy) was then investigated under these loadings to predict the alterations in terms of gross external (angular and coupled) responses, flexibilities and facet load.

Results. This study shows the importance of preserving ligaments to prevent rotational instabilities for motion segment under flexion. The effect of the facetectomy on the motion segment is insignificant under flexion. In extension, unilateral facetectomy and resection on contralateral facet markedly alters the rotational motion and flexibilities as well as coupled motions. Also, unilateral complete facetectomy with resection of less than 100 % on contralateral facet generates high facet load.

Conclusions. Clinically, this study suggests that it may be appropriate to incorporate additional stabilization procedure in restoring the spinal strength and stability for surgical intervention of unilateral complete facetectomy and resection on contralateral facet. The exploitation of the FE method to simulate clinically related situations permits an improved understanding of lumbar spinal stability to assist in defining clinical expectation for various forms of surgical intervention of the operative procedures.

Mini Abstract: An anatomically accurate 3-D finite element model of the human lumbar spine (L2-L3) was used to study the biomechanical effects of graded bilateral and unilateral facetectomies of L3 under physiological flexion and extension loadings. Relative importance of ligaments and facets were also examined.

Keywords: Facets, Facetectomy, Finite Element Method, Stenosis, Stability