Title: Evaluation of Cervical Kinematics of Laminoplasty vs Laminectomy/Lateral Mass Fusion using Finite Element Modeling

Background: Cervical laminoplasty is projected to surpass laminectomy and laminectomy with fusion for posterior decompressive procedures for cervical spondylosis with stenosis. In cases of 1 or 2 level spondylotic disease, anterior procedures are typically performed. In older patients or multilevel spondylotic disease with stenosis, posterior procedures are frequently performed.

Research question- How does ROM for laminoplasty compare to laminectomy/lateral mass fixation/ fusion and intact spine using FEM?

Design- finite element models

Methods: Validated 3-d model of C2-T1 was used as intact spine. It was modified with laminectomy at C3-6-with lateral mass fixation using 14mm screws and 4mm connecting rods and fusion was simulated. Intact spine was also modified to simulate C3-C6 laminoplasty. A cut was made at the lamina-lateral mass junction. A 3mm hinge was created along the contralateral side. Ligaments at C2-3 and C6-7 were resected to allow for laminar opening. The lamina was stabilized using laminoplasty plates, screws (4mm), and fusion bone. All models were fixed at T1, and load was applied at the superior endplate of C2. A follower load of 75 N and a bending moment of 1.5 Nm under flexion and extension were applied to the 3 groups. Range of motion (ROM) was obtained at the index and each level under each loading mode.

Results: Laminectomy/ lateral mass fixation/fusion demonstrated the least ROM (42^0 in flexion, and 20º in extension) over C2-T1 spine. Laminoplasty demonstrated improved ROM with flexion of 54^0 and 32^0 in extension. Intact spine showed best ROM in flexion 53^0 and extension 54^0.

Discussion: It is expected to see more adjacent segment degeneration above and below the laminectomy/ lateral mass fixation/ fusion due to the overall increase in ROM to compensate for fused C3-C6 segments. The plated laminoplasty from C3-C6 demonstrates improved ROM over the fusion model and should result in less adjacent degeneration.