5. Abstract

Biomechanical Effects of Laminoplasty versus Laminectomy: Stenosis and Stability


INTRODUCTION: Two neurosurgical techniques for treating cervical stenosis are laminoplasty, where the bony spinal lamina is removed and reattached in a more open orientation, or laminectomy, where the lamina is removed and discarded. Laminectomy eliminates one wall of the spinal canal and theoretically should increase the cross-sectional area of the spinal canal better than laminoplasty. However, because of loss of the stabilizing contribution of the lamina, it would be expected that laminectomy would leave the spine in a less stable condition than laminoplasty. The purpose of this study was to compare simultaneously the biomechanical stability and the change in cross-section area during flexion and extension after laminectomy versus laminoplasty.

METHODS: Seven cadaveric specimens from C2 to T2 were studied. Specimens were loaded in physiological-range flexion and extension using nonconstraining pure moments while recording segmental angles using an optical tracking system. Gore-Tex tubing was placed within the spinal canal and water was continuously pumped through the tubing while measuring back-pressure upstream from the specimen. Spinal canal cross-sectional area correlated to water pressure, allowing continuous monitoring of the smallest cross-sectional area of the canal. Specimens were tested (1) normal, (2) after modeling stenosis by inserting hemispherical wooden beads in the spinal canal at 3 levels, (3) after laminoplasty at 5 levels, and (4) after expanding laminoplasty to laminectomy.

RESULTS: Range of motion (ROM) in the normal, stenotic, and laminoplasty conditions did not differ significantly (p>0.07, ANOVA/Holm-Sidak). However, laminectomy resulted in a significantly greater ROM than other conditions (p<0.02). The ROM after laminectomy was 13% greater than after laminoplasty. After modeling stenosis, the cross-sectional area decreased to 52±12% of normal. Laminoplasty restored the cross-sectional area to 70±12% of normal whereas laminectomy restored cross-sectional area to 101±4% of normal.

DISCUSSION/CONCLUSION: Laminoplasty has a significant biomechanical advantage over laminectomy, leaving the spine in a more stable condition. However, laminoplasty was unable to completely relieve stenosis. In this study, stenosis was modeled as 52% occlusion of the spinal canal area (71% linear sagittal projection). The degree of stenosis should be considered in the clinical decision of whether laminectomy or laminoplasty is more appropriate.

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