

Motion Compensation Associated With Single-Level Cervical Fusion: Where Does the Lost Motion Go?

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FROM ABSTRACT:

Study Design.

Seven adult human cadaveric cervical spines (C2-T1) were biomechanically tested.

Objective.

Compare the effects of incremental single-level fusion at different levels of the cervical spine.

Summary of Background Data.

Clinical studies have reported degenerative symptomatic disc disease at disc levels adjacent to fusion.

No known study has attempted to delineate the effects of single-level fusion at different levels of the cervical spine.

Results.

Motion compensation was distributed among the unfused segments with significant compensation at the segments adjacent to fusion.

Significant [motion] increases occurred at the level above C3-C4 and C4-C5 fusions, and below for C5-C6 and C6-C7 fusions in both flexion and extension.

Conclusions.

Increased motion compensation occurred at segments immediately adjacent to a single-level fusion.

Significant [increased motion] differences occurred at the level above the fusion site for the C3-C4 and C4-C5 fusion in both flexion and extension.

When the lower levels (C5-C6, C6-C7) were fused, a significant amount of increased motion was observed at the levels immediately above and below the fusion. However, greater compensation occurred at the inferior segments than the superior segments for the lower level fusions (C5-C6, C6-C7).

THESE AUTHORS ALSO NOTE:

175,000 cervical surgeries are performed per year in the United States for disc disease.

“Surgical fusion is a widely accepted method of treatment for cervical spine disease. However, cervical fusion has the possibility of increasing the biomechanical stress on adjacent segments.”

Studies show that a cervical fusion causes “degenerative symptomatic disc disease to occur at adjacent disc levels, particularly in the inferior disc.”

Fusion causes increased motion at the adjacent levels, and there is “accelerated degeneration of adjacent disc segments in an alarming number of cases over time.”

The common pathologic conditions found at adjacent segments to a cervical disc fusion are “disc degeneration, disc herniation, instability, spinal stenosis, spondylosis, and facet joint arthritis.” **[Important]**

“It is common for a patient to require additional anterior cervical fusion at other levels following an initial fusion procedure, and the additional surgical procedure's success rate diminishes rapidly as the number of fused levels increases.”

The objective of this study was to determine the biomechanical effects of single-level fusion on the cervical spine.

These authors used an in vitro testing protocol that replicates the physiologic motion response of the entire cervical spine of these cadavers.

RESULTS:

“Application of fusion caused a significant reduction in motion at the fused level. The reduced motion at the operated site was compensated for by increased rotation at the adjacent segments during flexion/extension, lateral bending, and axial rotation.”

DISCUSSION:

“When the lower levels (C5-C6, C6-C7) are fused, a significant amount of increased motion is observed at the levels immediately above and below the fusion.”

Following fusion, the adjacent increased motion increases biomechanical stress on those segments. “This increased motion at the adjacent segments may accelerate degeneration of adjacent disc segments.” **[Important]**

“This biomechanical study emphasizes the increase of motion at the adjacent segments after surgical fusion.”

"The increased compensation at the adjacent levels is an indication that fusion causes increased strain and/or changes in motion at levels adjacent to fusion."

"The increased compensation at the superior segment suggests that the stress due to fusion is not necessarily always greater at the inferior segment but depends on the location of the segment fused."

"These results support the notion that single-level fusion contributes to adjacent level [disc degenerative] disease."

KEY POINTS FROM AUTHORS:

1) "Fusion causes increased compensation at the adjacent segments, which is postulated to accelerate the degenerative process at those levels."

2) "When the lower levels (C5-C6, C6-C7) are fused, a significant amount of increased motion is observed at the levels immediately above and below the fusion."

KEY POINTS FROM DAN MURPHY

1) 175,000 cervical surgeries are performed per year in the United States for disc disease.

2) Clinical studies report degenerative symptomatic disc disease at disc levels adjacent to levels of spinal fusion.

3) This study shows that there is significant increased motion at spinal segments immediately adjacent to a single-level spinal fusion.

4) Cervical fusion increases the biomechanical stress on adjacent segments, accelerating disc degenerative disease, "particularly in the inferior disc."

5) Spinal fusion causes an increased motion at the adjacent levels, and there is "accelerated degeneration of adjacent disc segments in an alarming number of cases over time."

6) The common pathologic conditions found at adjacent segments to a cervical disc fusion are "disc degeneration, disc herniation, instability, spinal stenosis, spondylosis, and facet joint arthritis." **[Important]**

7) "It is common for a patient to require additional anterior cervical fusion at other levels following an initial fusion procedure, and the additional surgical procedure's success rate diminishes rapidly as the number of fused levels increases."

8) "These results support the notion that single-level fusion contributes to adjacent level [disc degenerative] disease."