Anterior versus Posterior Fixation for an Isolated Posterior Facet Complex Injury in the Sub-axial Cervical Spine

INTRODUCTION

Traumatic injuries to the sub-axial cervical spine are relatively common, but can present with a wide-ranging spectrum of osteoligamentous damage. Guidelines for the appropriate treatment of these injuries are unclear with both operative (posterior and/or anterior approaches) and non-operative management advocated [1].

Previous biomechanical analyses have compared anterior versus posterior fixation in the cervical spine, with posterior instrumentation generally considered to be biomechanically superior [2,3]. However, these treatments have only been compared for a small portion of the entire injury spectrum, typically of a worst case scenario, catastrophic injury model [2,3]. Therefore, the purpose of this study was to evaluate the biomechanical effectiveness of anterior versus posterior instrumentation for an isolated posterior facet complex injury in the sub-axial cervical spine.

MATERIALS & METHODS

Six fresh-frozen cadaveric C2-C5 cervical spines (mean age: 64 ± 5 years) were used. Prior to testing, each specimen was thawed and cleaned of musculature, and potted at the cranial and caudal ends.

A spinal loading simulator, capable of applying independent flexion-extension, lateral bending, and axial rotation to the spine, was used in this study. Specimens were loaded at 3°/s up to the target load of 1.5 Nm for each simulated movement. Each motion trial was repeated for three cycles, with the final cycle used for analysis.

3D spine motion was captured using an Optotrak® Certus tracking system (NDI, Waterloo, ON, Canada). Optotrak “smart” markers were attached to each level, with anatomic landmarks digitized in order to create a local coordinate system on each vertebra.

The magnitude of C3-4 range of motion (ROM) for each simulated movement was analyzed using a one-way repeated measures analyses of variance (factor = injury treatment) and post-hoc Student-Newman-Keuls tests (α=0.05).

RESULTS

In flexion-extension, all instrumentation were found to reduce ROM from the injured state (p < 0.05), but were not different from each other (p > 0.05). For axial rotation, both posterior and posterior-anterior combined lead to a decreased ROM compared to anterior fixation and injured state (p < 0.05) (Figure 2). ROM for axial rotation with anterior instrumentation alone was not different from the injured state (p > 0.05). For lateral bend ROM, only anterior instrumentation was found to be different from both posterior and posterior-anterior combined (p < 0.05), with no difference found between any instrumentation and the injured state (p > 0.05).

DISCUSSION

The goal of this study was to evaluate the effectiveness of anterior and posterior instrumentation for an isolated posterior facet complex injury with a preserved anterior discoligamentous complex (prior to discectomy for anterior fixation).

The results of this study found that anterior instrumentation alone in an isolated posterior injury was ineffective at reducing the ROM beyond the injured state. This suggests that disruption of the anterior longitudinal ligament, anterior annulus, and nucleus pulposus, required to perform the anterior stabilization, creates more instability than by leaving these structures intact despite the addition of the plate. The results of this study are consistent with similar biomechanical investigations that found posterior instrumentation to be superior to anterior fixation [2].

While an isolated posterior injury represents only a small portion of the complete injury spectrum, the results of this study will help to guide the surgeon’s approach when faced with managing this condition with no apparent damage to the anterior structures. While this study was not designed to compare operative vs. non-operative treatment, it provides insight into the ineffectiveness of anterior instrumentation in treating an isolated posterior injury. This suggests that, in the early post-operative period, the sacrifice of anterior discoligamentous stabilizers inadvertently produces more instability than is re-established by the current anterior fusion technique.

REFERENCES