• BIOMECHANICAL EVALUATION OF STAND-ALONE INTERBODY FUSION CAGE IN THE CERVICAL SPINE.

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INTRODUCTION

Anterior cervical interbody fusion is well accepted for the surgical management of cervical spondylosis. Recently, interbody fusion cage devices have been developed and applied to the cervical spine, however, no studies have investigated the biomechanical properties of stand-alone interbody cage devices. The purpose of the present study was to compare the segmental stiffness afforded by an interbody cage, an anterior locking plate, and "gold standard" autograft.

METHODS

Six human cervical specimens (C0-C7) (age range 61-91 yr., 70.4 $\pm$ 12.3) were utilized in the current study. Non-destructive biomechanical testing included axial rotation ($\pm$ 1.5Nm, 50N preload), flexion/extension ($\pm$ 1.5Nm) and lateral bending ($\pm$ 1.5Nm) loading modes. Following intact spine analysis, each spine underwent a Smith-Robinson-type discectomy at the C4/5 level. Each specimen was then reconstructed anteriorly in the following order: [1] RABEA cage (Newport Medical, Chanhassen, MN) **(cage)**; [2] Tricortical bone graft (Smith-Robinson procedure) **(autograft)**; [3] Cervical Spine Locking Plate system (SynthesSpine, Paoli, PA) **(anterior plate)**. Unconstrained three-dimensional segmental range of motion (degree) at C4-C5, the level above and below were measured using an Optotrak 3020 motion analysis system. Statistical analysis included a one-way analysis of variance and Fisher's post hoc test.

RESULTS

In flexion/extension, the anterior plate showed significantly lower range of motion than the cage and autograft ($p<0.005$), while the cage demonstrated significantly higher range of motion than the intact spine ($p<0.05$) *(Figure 1)*. Under axial rotation the anterior plate indicated significantly lower range of motion than all other groups ($p<0.05$) *(Figure 2)*. No significant differences among the four groups were observed in lateral bending. At the adjacent levels, an increase in range of motion was observed in flexion /extension and axial rotation, although no significant differences were indicated ($p>0.05$). In lateral bending, a decrease in the range of motion was also observed ($p>0.05$).

DISCUSSION/CONCLUSIONS

The annulus fibrosis and anterior longituidal ligament in the cervical spine serve to stabilize the spine as a tension band in extension. However, cervical discectomy and decompression results in significantly less annulus to tension the graft, and therefore less functional unit stabilization. The decreased stability in flexion/extension observed in the cage and autograft treatments are a result of this. In axial rotation, no differences were observed except between the anterior plate and all other groups. These findings may be attributable to bilateral facet joints. An interesting finding was that range of motion at the adjacent levels during lateral bending seemed to decrease following reconstruction, although no significant differences were observed. As the cervical spine is susceptible to the degenerative process secondary to its large range of motion, the increase in the range of motion in flexion/extension and axial rotation after reconstructions may provide a strong argument for acceleration of the degeneration process. The current study recommends the use of an anterior plate to augment the construct stiffness when using interbody fusion cage in the cervical spine.

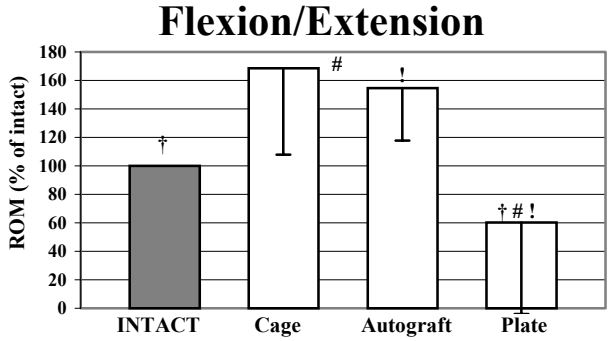

Figure 1: Mean range of motion and standard deviations in flexion/extension are shown. There are significant differences between anterior plate and the intact (†:$p<0.05$), cage (#:$p<0.001$), and autograft (!:$p<0.005$).

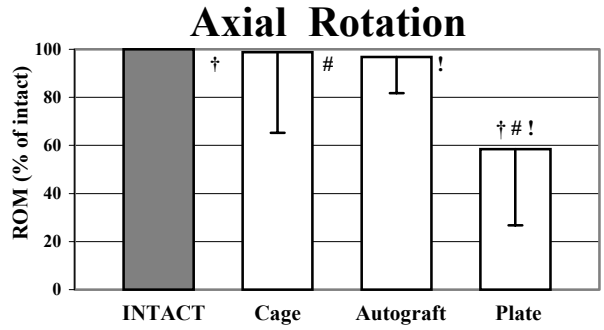

Figure 2: Mean range of motion and standard deviations in axial rotation are shown. There are significant differences between anterior plate and the intact (†:$p<0.05$), cage (#:$p<0.001$), and autograft (!:$p<0.005$).

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