No Profile Cervical Interbody Cage with Lag Screw Fixation Increases Graft Loading and Reduces Bone Resorption Signal when Compared with Static and Dynamic Cervical Plating

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Intro: Cervical intervertebral cages are often supplemented with anterior plates for additional stability. Despite increased fusion and reduce failure rates, cervical plating is associated with increased likelihood of adjacent level degeneration, chronic dysphagia, and the potential for screw migration-induced soft tissue injury. No-profile systems, which increase stability of the cage through vertebral screws, have the potential to provide the stabilizing benefits of plating, improve graft loading characteristics with lag screws design, and reduce complications related to plate prominence. The current study evaluated graft loading and vertebral body remodeling stimulus after fusion using a cage supplemented with a static plate, a dynamic plate, and no-profile lag screws. We hypothesized that a cage supplemented with lag screws would increase graft loading and reduce bone resorption signal when compared to either a locked or dynamic plates.

Methods: An intact finite element model of C4-C7 was utilized. C5-C6 was altered to include an intervertebral cage, which was supplemented with either a locking anterior plate, dynamic anterior plate, or lag screws. All models utilized the STALIF C™ (Centinel Spine, Inc, New York, NY) intervertebral cage with an ideally conforming bone graft. The dynamic plate allowed 0.1 mm of translation at the fixation points. All models were exposed to 100 N of compression and either 2.5 Nm of flexion or extension. Remodeling stimulus and resultant force through the graft was compared between models.

Results: In general, the dynamic plate or lag screws resulted in increased loading through the graft when compared to the locking plate. The lag screws provided the greatest increase in loading through the graft (Figure 1). The bony resorption signal was minimized, and formation was maximized for the lag screw system when compared with both the dynamic and locking plates (Figure 2).

[Figure 1. Load Increase Through Graft]
Discussion: The results supported the hypothesis that a lag screw fixation system increases the amount of loading experienced by the graft and reduces bone resorption in the vertebral bodies when compared with plating, which may optimize the mechanical environment to achieve a solid bony fusion. Whether or not the improved interbody cage compression profile with the STALIFC™ lag screw design leads to shorter fusion times or increased fusion rates will need to be assessed in a clinical population.