Introduction

Background
- Anterior cervical discectomy and fusion (ACDF) remains the standard of surgical care for cervical spondylotic radiculopathy.
- Approximately 25% of patients who undergo ACDF will develop adjacent segment disease (ASD), and two-thirds of patients who develop ASD will require reoperation.
- The etiology of ASD remains unclear, but it has been theorized it may be prompted by iatrogenic factors.

Aim
- Determine the effect of iatrogenic factors on adjacent segment kinematics.

Hypothesis
- Adjacent segment kinematics will be affected by graft height and sagittal alignment at the operated site but not by fusion plate placement or graft type.

Methods

Data Collection
- 27 participants (13M, 14F; avg. age 49.6 ± 5.3 years; 11 single-level arthrodesis, 16 double-level arthrodesis) were imaged using dynamic biplane radiography before surgery and 1-year after surgery.
- C2-C7 Cobb angle, fusion mass Cobb angle, graft height, and plate placement were measured on 1-year post-op sagittal radiographs. All measures were performed by two observers and inter-rater reliability was very good (κ: 0.89-0.97).

Data Processing
- A validated model-based tracking process was used to match subject-specific bone models derived from CT to the dynamic radiographs (Figure 2).
- Intervertebral rotations were calculated using ordered rotations of anatomic coordinate systems created within each vertebra.

Data Analysis
- The change in adjacent segment motion during dynamic full ROM movements was compared between autograft (n = 9) and allograft (n = 18) using Student's t-test.
- Pearson's correlation coefficients were calculated to identify relationships between the change in adjacent segment ROM and the following factors: the change in sagittal balance, graft heights, and plate-to-disc distances.
- Results were considered significant if p < 0.05.

Results

- **Autograft vs. Allograft**: Patients with autografts demonstrated a greater increase in superior adjacent segment axial rotation ROM than those with allograft (p = 0.01) (Figure 3). There were no noted differences in the change in inferior adjacent axial rotation or flexion/extension ROM at either the superior or inferior adjacent segment (all p > 0.64).

- **Graft Height**: There was a negative relationship between graft height and change in flexion/extension ROM of the inferior adjacent segments, (Pearson’s correlation coefficient = -0.566, p = 0.03) (Figure 4). No other relationships were identified between graft height and change in adjacent segment ROM.

- **Sagittal Balance and Fusion Plate Placement**: There was no significant correlation between sagittal balance or fusion plate placement and change in flexion/extension or axial rotation ROM at either the superior or inferior adjacent segments (all p > 0.11).

Discussion

- The main findings of this study are that fusion plate placement and change in sagittal balance do not affect adjacent segment flexion/extension or axial rotation range of motion one year after ACDF, but graft height and graft type do affect adjacent segment kinematics.

  - **Strengths**: Direct in vivo tracking of cervical segments.
  - **Weaknesses**: Small sample size and relatively short follow-up.
  - **Future Studies**: A larger sample from this ongoing study will be required to increase confidence in these results, and longer follow-up is underway to assess the effects of these iatrogenic factors on the development of ASD.

Clinical Significance

- Surgeons may be able to personalize several iatrogenic factors based upon surgeon preference and anatomic restrictions without affecting postoperative superior and inferior adjacent segment range of motion.

References and Acknowledgements


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