Graded posterior release in scoliosis surgery: how much is enough?

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Introduction

- In scoliosis surgery, posterior spinal ligaments and facet joints are removed (i.e. Ponte osteotomy) to increase spinal flexibility and thus facilitate sagittal, coronal and rotational correction.

- Clinical results are promising, although the effectiveness of this technique is unclear [1]:
  - Ponte osteotomy versus less invasive inferior facetectomy [2]:
    - increases operative time;
    - increases blood loss, and;
    - provides no additional correction.
  - Biomechanical studies examining the increase in spinal flexibility after spinal releases are lacking.

Goal

To analyse the effect of subsequent spinal releases on thoracic spinal range of motion.
Materials & Methods (1)

- Specimens: ten human cadaveric spines (T6-T11) including 5 cm of the ribs (mean age 73.5 years, SD 21.2 years).

- A pure moment of 2.5 Nm was applied to the spines using a spinal motion simulator to induce flexion, extension, lateral bending and axial rotation (Fig. 1).

- Outcome: increase in range of motion (ROM).
Fig. 1. The experimental setup is shown with the thoracic spinal specimen positioned in the spinal motion simulator. Loads were applied to the two points denoted by the arrows. The specimen was rotated 90° to test lateral bending. To test axial rotation, the left cup was rotated using a steel cable powered by the materials testing machine (AR).
Materials & Methods (3)

Testing conditions:

1. Intact;
2. Partial Ponte osteotomy (supra/interspinous and flaval ligament resection + inferior facetectomy), and;
3. Full Ponte osteotomy (sequential superior facetectomy).
The partial Ponte osteotomy increased ROM (p < 0.05) in:
- flexion (23.3%);
- extension (10.5%);
- lateral bending (4.5%), and;
- axial rotation (13.2%).

The full Ponte osteotomy only provided an additional increase in flexion (6.3%, p < 0.05).
Effect of superior facetectomy (full Ponte) after combined removal of posterior ligaments and inferior facetectomy (partial Ponte) on:

- **ROM (this study):**
  - Flexion (sagittal correction): +6.3%
  - Extension (sagittal correction): no increase
  - Lateral bending (coronal correction): no increase
  - Axial rotation (derotation): no increase

- **Clinical results [2]:**
  - ↑Blood loss
  - ↑Operative time
  - No additional correction

Conclusion

The full Ponte osteotomy provides minimal biomechanical advantages, and increases blood loss and operative time. Therefore, this technique should not be used in routine scoliosis surgery.

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