Effect of cage design, supplemental instrumentation and approach on stability of a lumbar interbody fusion

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Lumbar interbody fusion (LIF)

- Indicated for structural failures due to degeneration, spinal deformity or disc herniation which cannot be treated conservatively

Techniques differ in
- Access to disc
- Interbody fusion device
- Additional instrumentation / fixation

Aim of the study was evaluation of
- Approach to the disc (ELIF vs TLIF)
- Cage type (standard vs enlarged footprint)
- Supplemental posterior instrumentation (bilateral internal fixator vs unilateral internal fixator and vs none)

on the primary stability of LIF procedures
Clinical Background

Access to the disc in lumbar fusion

- **Transforaminal lumbar interbody fusion (TLIF)**
  - Usually includes hemifacetectomy

- **Extraforaminal lumbar interbody fusion (ELIF)**
  - Preserves the facet joint (Recoules-Arche et al. 2014)

Interbody fusion device - cage

*Differ in* (Oxland and Lund 2000)

- Shape, Footprint, Surface area
- Static or expandable
**Clinical Background**

- **Posterior instrumentation**
  - Supplemental posterior instrumentation
    - further reduces motion
    - provides immediate postoperative stability

**Instrumentation ranges from**

- Bilateral internal fixator
- Unilateral internal fixator
- Stand alone cage

**Clinical meta analysis show controversial results**

(Ambati et al. 2015, Kotil et al, 2013, Wang et al. 2014)

- Unilateral reduces surgical trauma and cost
- Bilateral reduces cage migration – symmetrical load distribution
Specimen
- 12 monosegmental FSU (6 x L2-3, 6 x L4-5)
- Mean age 71; BMD 83 ± 23 mg HA/ccm
- Randomly distributed in 2 Test Groups

Loading
- Pure moments ±7.5Nm

Motion planes
- Flexion / extension
- Lateral bending
- Axial rotation

Evaluation
- RoM normalized to native state
Tested states
- for both groups/cage types
  n=6, 3x L2-3, 3xL4-5

(1) Native
  ELIF procedure with intact facet joints
(2) Stand alone - cage without internal fixator
(3) Supplemental bilateral internal fixator
(4) Supplemental unilateral internal fixator
  TLIF procedure with hemifacetectomy
(5) Supplemental bilateral internal fixator
(6) Supplemental unilateral internal fixator
(7) Stand alone - cage without internal fixator

Statistics
  • Results normalised to native state
  • GLM with repeated measures to compare effects of
    • Facetectomy
    • Supplemental instrumentation
    • Cage type
Results

Flexion / Extension

- GLM for cage type: p=0.002
- GLM for facetectomy: p<0.001
- GLM for posterior instrumentation: p<0.001
Lateral bending

GLM for cage type $p=0.028$
for facetectomy $p<0.001$
for posterior instrumentation $p<0.001$
Axial Rotation

- GLM for cage type: $p=0.322$
- GLM for facetectomy: $p<0.001$
- GLM for posterior instrumentation: $p<0.001$
Within the specimen (repeated measurement)

- Significant effect of facetectomy (p<0.001)
- Significant effect with combination of facetectomy and supplemental posterior instrumentation (p=0.001) – most pronounced for stand alone cage

Between the states

- Significant effect of type of posterior instrumentation (p<0.001)
- Significant effect of cage type in flexion/extension and lateral bending but not in axial rotation
Conclusion

- For both ELIF and TLIF procedures, the in situ curved cage provides a higher initial stability than conventional standard cages.

- Of the investigated parameter (access approach, cage type, and posterior instrumentation), the additional posterior instrumentation was the most dominant factor influencing the initial stability of a lumbar interbody fusion.
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Thank you !!!