Posterior Cervical Surgery
What’s new?

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Disclosures

• Providence: Consultant
• Sea Spine: Consultant, IP
• Nuvasive: Consultant
History of Posterior Fusion Techniques

Alban G. Smith first successful laminectomy in a paraplegic pt.

1828

Interlaminar clamps “Halifax”, Tucker,

Steel wires

Roy Camille plate

Lateral mass screws

Early 19th century: laminectomy ~100% mortality

1980s

2010’s

What’s New?
Posteriors Cervical Fusion
Most Common Indications

• Multilevel disease > 3 levels with sagittal and coronal deformities
• Fracture
• Trauma
• C1-C2 instability
• Cervico-occipital & cervico-thoracic extension
Traditional Posterior Cervical Stabilization & Fusion

Benefits
- Large decompressions possible
- Avoids anterior exposure risks
- Access to multiple levels
- High fusion rate

Drawbacks
- Invasive approach
- Extended hospitalization
- Blood loss
- Infection
- Operating time
- Pain
Posterior Cervical Fusion Complications

- 30 day Re-admission Rate
- Postoperative infection (6.2%) \(^1\)
- Wound hematoma, dehiscence
- Vertebral artery damage
- Pulmonary infection
- Persistent CSF leak following durotomy
- Screw-related complications \(^2\)

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2. Screw-related complications in the subaxial cervical spine with the use of lateral mass versus cervical pedicle screws Hiroyuki Yoshihara, M.D., Ph.D., Peter G. Passias, M.D., and Thomas J. Errico, M.D.
Genesis of Posterior Cervical Fusion with Cages

Tissue-Sparing or Mini-open technique using posterior cages

Objectives
1) Decompress nerve roots
2) Stabilize spine
3) Fuse
4) Preserve Surrounding Soft Tissue

Does not address cord compression
Does not cause kyphosis (but does not reduce it!!)
Advantages PCF with Cages

• Less OR time
• Reduced Blood Loss
• Shorter Hospital Stay
Clinical Applications

Symptomatic non-union after ACDF
Adjacent level disease after ACDF
Stable failed total disc replacement
Circumferential fusion (360)
Laminectomy and fusion
Indirect foraminal decompression and fusion
Novel instrumentation and technique for tissue sparing posterior cervical fusion

“The instruments and technique minimize soft tissue disruption facilitate access for cervical facet joint cartilage decortication.”

“Reducing soft tissue damage with PCF is one strategy to reduce perioperative morbidity and improve ultimate outcomes.”

## Safety

### Low Rate of Complications

<table>
<thead>
<tr>
<th>Complications related procedure or implanted cervical cage(s)</th>
<th>All Patients (n=89), n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neurological complications</td>
<td>2 (2.2%)</td>
</tr>
<tr>
<td>Vascular complications</td>
<td>0</td>
</tr>
<tr>
<td>Other complications</td>
<td>2 (2.2%)</td>
</tr>
<tr>
<td>Overall complications (inclusive of ACDF and/or PCF)</td>
<td>4 (4.3%)</td>
</tr>
<tr>
<td>Overall complications related to posterior cervical fusion with cages</td>
<td>3 (3.4%)</td>
</tr>
</tbody>
</table>


### Anatomy Protects Key Structures

- Pedicle protects vertebral artery
- Nerve exits in bottom of foramen
Biomechanical evaluation of DTRAX® posterior cervical cage stabilization with and without lateral mass fixation.

Introduction: Lateral mass screws (LMS) fixation with plates or rods is the current standard procedure for posterior cervical fusion. Redundant, multiple plates between the facet joints laterally has been available as an alternative to LMS or transarticular screws for fusion with cervical spine reconstruction. The purpose of this study was to examine the biomechanical behavior of the DTRAX® cervical cage in the single and bi-level fusion and compare this to the weld fixation with lateral mass screws on both intact and two level constructs.

Methods: Laminectomy cervical spine (C4-7) specimens were tested in flexion-extension, lateral bending, and axial rotation (C5-C6) constructs with and without bilateral fusion (C4-7) constructs and implantation of lateral mass fixation at C5-C6 and C6-7, respectively. Posterior fusion was achieved with bilateral posterior cages at C5-C6 and C6-7 in patient and flexed 0° and 5° settings. In the following conditions: 1) intact C5-C6, C5-6, and C4-5 and 2) C5-C6, C6-7, and C4-5 (C5-C6/C6-7). For each condition, four intact cases were tested. The following conditions were compared: 0° (neutral) and 5° (flexed) for lateral mass fixation and bilateral posterior cages at C5-C6 and C6-7.

Results: Biomechanically, posterior cervical cages significantly enhanced the motion and failed at intact conditions (P < 0.05). Intact conditions were compared with bilateral posterior cages and LMS in a cervical construct (C5-C6). Intact: 9.4° (±1.2°) for flexion-extension, 5° (±1.5°) for lateral bending, and 3° (±0.5°) for axial rotation. Intact vs. intact conditions for posterior cages and LMS, respectively. Posterior cages, when placed as an intact condition, resulted in a reduction of motion in comparison to intact conditions (P < 0.05).

Conclusions: Biomechanical evaluation proved the cervical sagittal stability enhanced with a LMS construct and may be an alternative surgical option for selected patients. Furthermore, dynamic evaluation of changes in cervical motion with posterior cages demonstrated core stability in sagittal and rotational conditions.

Keywords: cervical spine, posterior fusable, biomechanics, cervical flexion-extension, DTRAX cervical cage.

LMS vs PCF with Cages

<table>
<thead>
<tr>
<th>ROM (deg)</th>
<th>LMS vs PCF</th>
</tr>
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<tbody>
<tr>
<td>Flexion-Extension</td>
<td></td>
</tr>
<tr>
<td>Lateral Bending</td>
<td></td>
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<tr>
<td>Axial Rotation</td>
<td></td>
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* PMT DTRAX, CAVUX, & Cervical Cage Instructions for Use were submitted for FDA premarket approval.

** PMT DTRAX, CAVUX, & Cervical Cage is indicated for one level.
Favorable Cervical Anatomy

Cervical “Saddle Joint”

- Posterior intrafacet allograft spacer prevent translation of articular surfaces
- Large facet area relative to vertebral endplates

Facet Joints

- Comparable surface area to interbody

<table>
<thead>
<tr>
<th>Area</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Interbody Surface</td>
<td>310</td>
</tr>
<tr>
<td>Facet Surface (2)</td>
<td>260</td>
</tr>
</tbody>
</table>

- Shorter Distance for Bridging Bone
- Better Bone Quality

Panjabi, M. 1993
Xia, Q. 2010
Foraminal Expansion & Nerve Root Decompression

Multiple Publications Demonstrate Nerve Root Decompression

<table>
<thead>
<tr>
<th>Level</th>
<th>Baseline</th>
<th>After</th>
<th>Increase</th>
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<tbody>
<tr>
<td>C4−5</td>
<td>0.53</td>
<td>0.63</td>
<td>18.48%</td>
</tr>
<tr>
<td>C5−6</td>
<td>0.48</td>
<td>0.53</td>
<td>10.56%</td>
</tr>
<tr>
<td>C6−7</td>
<td>0.55</td>
<td>0.69</td>
<td>26.12%</td>
</tr>
<tr>
<td>Overall</td>
<td>0.52</td>
<td>0.62</td>
<td>18.39%</td>
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## Fusion Data

<table>
<thead>
<tr>
<th></th>
<th>6 months</th>
<th>12 months</th>
<th>24 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evidence of Bridging Trabecular Bone (%)</td>
<td>85.0%</td>
<td>93.3%</td>
<td>98.1%</td>
</tr>
<tr>
<td>Translational Motion &lt; 2 mm (%)</td>
<td>98.3%</td>
<td>100%</td>
<td>100%</td>
</tr>
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</table>


Anterior Cervical Pseudarthrosis Treated with Bilateral Posterior Cervical Cages

“Positive clinical and radiological outcomes”

“Less blood loss, shorter operating times, and briefer hospital stays compared to revision w/ lateral mass fixation or interspinous wiring.”

Fusion at one year confirmed by CT in all 17 patients w/ available scans and by x-ray in all 25 patients

Conclusion

Decompression
• Posterior cages increase foraminal area and indirectly decompress symptomatic nerve roots
• Supported by patient improvement, VAS and NDI data

Stabilization
• Posterior cages significantly reduce range of motion
• Provide excellent stabilization

Fusion
• Clinical data shows a high rate of fusion

Lordosis
• No significant change in sagittal balance
THANK YOU