Five to Sixteen-Year Results of 201 Growing Rod Patients: 
Is There a Difference Between Etiologies?

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## Disclosures

<table>
<thead>
<tr>
<th>Name</th>
<th>Disclosures</th>
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</thead>
<tbody>
<tr>
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<td>DePuy Spine (a,), Ellipse (b,c), K2M (b), KSpine (b,c), Nuvasive (a,b,c)</td>
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<td>John B. Emans, MD</td>
<td>Medtronic (b), Synthes (b,e)</td>
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<td>Biomet (b,d,e), Medtronic (b,d,e), Stryker (d)</td>
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<td>Growing Spine Study Group</td>
<td>Growing Spine Foundation (GSF)</td>
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Vitale Classification of EOS (C-EOS)

Etiology
- Congenital/Structural
- Neuromuscular
- Syndromic
- Idiopathic

Cobb Angle
1: <20°
2: 21-50°
3: 51-90°
4: >90°

Kyphosis
(−): <20°
N: 21-50°
(+): >50°

APR Modifier
P₀: <10°/yr
P₁: 10-20°/yr
P₂: >20°/yr
Purpose:
To compare long-term results of growing rod treatment between different etiologies in a large Series of patients.
Methods

• Review of a multicenter EOS database
  – 574 growing rod patients were reviewed
  – 201 patients met the inclusion criteria:
    • Minimum 5-year follow-up
    • Data available for analysis

• Patients were grouped based on C-EOS classification

• Latest follow-up was defined as most recent visit prior to final fusion
Methods

Annual T1-S1 Growth (mm/year) = \frac{\Delta \text{ in T1-S1 from post index to latest F/U}}{\text{Length of follow-up}}
## Results

<table>
<thead>
<tr>
<th></th>
<th>Congenital</th>
<th>Neuro-muscular</th>
<th>Syndromic</th>
<th>Idiopathetic</th>
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</thead>
<tbody>
<tr>
<td><strong># of Patients</strong></td>
<td>47 (24%)</td>
<td>49 (24%)</td>
<td>62 (31%)</td>
<td>43 (21%)</td>
</tr>
<tr>
<td><strong>Age at Index Surgery</strong></td>
<td>4.7 y</td>
<td>6.1 y</td>
<td>4.9 y</td>
<td>5.8 y</td>
</tr>
<tr>
<td><strong>Mean Length of F/U</strong></td>
<td>7 y</td>
<td>7.2 y</td>
<td>7 y</td>
<td>7.2 y</td>
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<tr>
<td><strong>Mean # of Lengthenings</strong></td>
<td>5.1</td>
<td>4.6</td>
<td>6.2</td>
<td>5</td>
</tr>
<tr>
<td><strong>Mean # of Revisions</strong></td>
<td>3.1</td>
<td>2.6</td>
<td>2.1</td>
<td>1.4</td>
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</tbody>
</table>
Results: Cobb Angle Correction

* Correction from pre-op to latest
Results: T1-S1 Length

T1-S1 Increase at Index Surgery:

- **Neuromuscular patients**
  - Largest T1-S1 increase at index surgery
- **Congenital patients**
  - Smallest T1-S1 increase at index surgery
Results: T1-S1 Length

T1-S1 Increase at Index Surgery:

- **CONGENITAL**: 29 mm
- **NEUROMUSCULAR**: 45 mm
- **SYNDROMIC**: 38 mm
- **IDIOPATHIC**: 38 mm
Results: T1-S1 Length

Annual T1-S1 Growth:

- **Neuromuscular patients** had the lowest annual T1-S1 growth

- However, annual T1-S1 growth was **comparable** between all etiologies (8-10 mm/year)
Results: T1-S1 Length

Annual T1-S1 Growth:

- **CONGENITAL**: 10 mm
- **NEUROMUSCULAR**: 8 mm
- **SYNDROMIC**: 10 mm
- **IDIOPATHIC**: 9 mm
Conclusions: Cobb Angle

- Comparable initial improvement (33-47%) at index surgery for all etiologies
- Variable overall improvement (25-58%) from pre-op to latest follow-up for all etiologies
Idiopathic patients had the most curve correction and maintained curve correction.

However, all non-idiopathic patients lost some correction during the lengthening period, with congenital patients having the least overall correction.
Conclusions: T1-S1 Length

• Annual T1-S1 growth was similar (8-10 mm per year) during lengthenings for all four etiologies
Thank You

Dervish with a snake-headed staff

Courtesy of Ladan Akbarnia, PhD
The British Museum