Effectiveness of Serial Derotational Casting for Treatment of Children with Early Onset Scoliosis

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Other: CSSG - BOD
POSNA – BOD
IPOS- Chairman

None relevant
Growth as a corrective force in the early treatment of progressive infantile scoliosis

- 136 patients with infantile scoliosis treated with casting (Cotrel and Morel technique)
- "Full correction" in 94 patients
- "Partial correction" in 42 patients
- RVAD, "asthenic" body risk factors
Infantile Idiopathic Scoliosis
Natural History

- L thoracic most common
- Boys 3:2
- 90% resolve by age 2
- Treatment for other 10% variable
• 55 pts progressive EOS > 1yr f/u

• Best response if <20 mo, idiopathic, <60 deg

• Curve resolved in 17 (with avg initial RVAD 26 deg) and worsened in 6

• 9 went on to surgery
Serial casting as a delay tactic in the treatment of moderate-to-severe early-onset scoliosis.

Fletcher ND, McClung A, Rathjen KE, Denning JR, Browne R, Johnston CE

- Single center's experience with casting 29 patients older than 2.5 years with curves measuring >50 degrees
- 15 patients (51.7%) required surgical “growing” treatment for at most recent follow-up
- Additional 7 patients (24.1%) underwent AP fusion
- Casting larger curves, <2.5 years of age and with varied etiology may stall but not prevent surgery
The role of serial casting in early-onset scoliosis (EOS).

Baulesh DM¹, Huh J, Judkins T, Garg S, Miller NH, Erickson MA.

• 36 patients
  – 17% resolution
  – 31% surgery
  – 52% in brace with modest correction at f/u
Casting

Light Traction

De-rotation

Windows & Trimming
Decision Making in Casting

• Minimum 3 casts
• 3 days between casts with xray prior to reapplication
• Cast until response plateaus or curve less than 20 degrees or if no improvement after 3 casts
Patient LL: 1/2012

- 15 months old
- IIS
- 41° R Thoracic Curve
- C-EOS: I2N
Is this Natural History or Cast Success?

- **Cast #1**
  - 30°
  - 20 mo

- **Cast #2**
  - 24°
  - 22 mo

- **Cast #3**
  - 15°
  - 25 mo

- **Cast #4**
  - 10°
  - 27 mo
  - 13°
  - 37 mo
**Purpose:** to examine the effectiveness of scoliosis casting and identify factors that will affect the efficacy of casting treatment for children with EOS.

**Design:**

*Retrospective,* single-center study that reviewed EOS patients who underwent serial Mehta Derotational Casting
Participants:
• Inclusion:
  • Diagnosis of EOS
  • 1-5 years of age
  • Radiographic evaluation between casting treatments

Outcomes:
• Cobb angle correction
Patient Characteristics

16 patients who underwent serial derotational casting treatment at CUMC met inclusion criteria

<table>
<thead>
<tr>
<th>Characteristic Variable</th>
<th>Mean</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yo)</td>
<td>2.4</td>
<td>1 - 5</td>
</tr>
<tr>
<td>Pre-Cast Cobb Angle (degrees)</td>
<td>50.3</td>
<td>32 - 81</td>
</tr>
<tr>
<td>Number of Casts</td>
<td>4.4</td>
<td>3 - 8</td>
</tr>
</tbody>
</table>
16 patients who underwent serial derotational casting treatment at CUMC met inclusion criteria.

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idiopathic</td>
<td>13 (81%)</td>
</tr>
<tr>
<td>Syndromic</td>
<td>2 (13%)</td>
</tr>
<tr>
<td>Congenital</td>
<td>1 (6%)</td>
</tr>
</tbody>
</table>

5/13 “idiopathic patients” had developmental delays.
50% (8/16) had improvement in Cobb at final follow up

31% (5/16) Maintained ( < 10% Curve Progression, < 10% Correction)

19% (3/16) Progressed ( ≥ 10% Curve Progression)
Results: Cobb Correction

Cobb Correction for the 8 patients who had > 10% Cobb Improvement after the final cast (Casting Responders)

<table>
<thead>
<tr>
<th>Pre-Cast Cobb (degrees)</th>
<th>Post-Cast Final Cobb (degrees)</th>
<th>Final Cobb Correction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>47.0 ± 15.0</td>
<td>29.0 ± 19.8</td>
<td>42.7 ± 25.4</td>
</tr>
</tbody>
</table>
Results: Cobb Correction

Average Curvature Improvement among all 16 subjects:

After Initial Cast = 17.2% Cobb angle Correction

After 3rd Cast = 22.4% Cobb angle correction
Results: Cobb Correction

10 of the 16 Patients required ≥ 4 casts:

Among the 10 patients there was an average of 8.3% Cobb Angle Correction after the Final cast
Effects of Pre-Cast Cobb

9 of the 16 Patients had initial Cobb < 50° and were 5x more likely to have at least 10% curvature improvement after the final cast compared to the 7 patients with initial curve ≥ 50°
Effects of Age at Initial Casting

7 of 16 Patients were < 20 mo at Initial Casting and were 5x more likely to have at least 10% curvature improvement after the final cast compared to 9 patients who were ≥ 20 mo
Current Disposition of Patients

• Observation only: 2 (12.5%)
• Patients in Casts: 1 (6.3%)
• Patients in Braces: 12 (75%)
• Patients who progressed to surgery: 1 (6.3%)
Conclusions

• 50% of patients undergoing serial derotational casting improvement at follow up

• 81% of the patients either had significant Cobb correction (> 10%) or Maintained their Curve
Conclusions

- Children younger than 20 months old or with Cobb < 50° at time of initial casting were More Responsive to Casting Treatment
Previous Work has Demonstrated QOL Negatively Affected by Casting

Quality of Life and Burden of Care In Patients with EOS Undergoing Casting

*Vitale et al, ICEOS 2013*

- *EOSQ Scores from patients treated in CSSG and GSSG*
At **Pre-Casting Visits**, Only Daily Living and Financial Burden Were Significantly Lower Among EOS Patients

<table>
<thead>
<tr>
<th>Domain Name</th>
<th>Pre-Casting (N = 22)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>EOS</td>
<td>Norm</td>
<td>P</td>
</tr>
<tr>
<td>General Health</td>
<td>72 ± 23</td>
<td>81 ± 3</td>
<td></td>
<td>0.830</td>
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<tr>
<td>Pain/Discomfort</td>
<td>91 ± 17</td>
<td>89 ± 4</td>
<td></td>
<td>0.591</td>
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<tr>
<td>Pulmonary Function</td>
<td>98 ± 6</td>
<td>97 ± 2</td>
<td></td>
<td>0.606</td>
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<tr>
<td>Transfer</td>
<td>98 ± 11</td>
<td>97 ± 2</td>
<td></td>
<td>0.854</td>
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<tr>
<td>Physical Function</td>
<td>86 ± 23</td>
<td>94 ± 3</td>
<td></td>
<td>0.104</td>
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<tr>
<td>Daily Living</td>
<td>70 ± 25</td>
<td>88 ± 4</td>
<td></td>
<td>0.004</td>
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<tr>
<td>Fatigue/Energy Level</td>
<td>90 ± 15</td>
<td>90 ± 3</td>
<td></td>
<td>0.993</td>
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<tr>
<td>Emotion</td>
<td>93 ± 14</td>
<td>96 ± 2</td>
<td></td>
<td>0.434</td>
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<tr>
<td>Parental Burden</td>
<td>78 ± 21</td>
<td>85 ± 6</td>
<td></td>
<td>0.173</td>
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<tr>
<td>Financial Burden</td>
<td>82 ± 25</td>
<td>95 ± 2</td>
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<td>0.020</td>
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<table>
<thead>
<tr>
<th>Domain Name</th>
<th>Post-Casting (N = 54)</th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>EOS</td>
<td>Norm</td>
<td>P</td>
</tr>
<tr>
<td>General Health</td>
<td>70 ± 19</td>
<td>82 ± 5</td>
<td></td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Pain/Discomfort</td>
<td>80 ± 19</td>
<td>88 ± 5</td>
<td></td>
<td>0.003</td>
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<tr>
<td>Pulmonary Function</td>
<td>91 ± 16</td>
<td>98 ± 2</td>
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<td>0.007</td>
</tr>
<tr>
<td>Transfer</td>
<td>86 ± 26</td>
<td>98 ± 2</td>
<td></td>
<td>0.001</td>
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<tr>
<td>Physical Function</td>
<td>71 ± 29</td>
<td>98 ± 3</td>
<td></td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Daily Living</td>
<td>62 ± 32</td>
<td>89 ± 6</td>
<td></td>
<td>&lt; .001</td>
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<tr>
<td>Fatigue/Energy Level</td>
<td>80 ± 28</td>
<td>94 ± 4</td>
<td></td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Emotion</td>
<td>83 ± 23</td>
<td>96 ± 2</td>
<td></td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Parental Burden</td>
<td>63 ± 17</td>
<td>91 ± 5</td>
<td></td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Financial Burden</td>
<td>73 ± 24</td>
<td>98 ± 2</td>
<td></td>
<td>&lt; .001</td>
</tr>
</tbody>
</table>

**All HRQoL Sub-Domain Scores at Post-Casting Visits Were Significantly Lower Than Age-Matched Norms**

Caregivers also rated higher Parental and Financial Burdens
Question

• If most curves resolve by 2 years of age and...

• If most patients treated > 2.5 years progress and...

• If casting/anesthesia is assd with negative effects on QOL....

• What are ideal indicatons for casting?
THANK YOU

Michael G. Vitale, MD MPH

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Patient MS

Cast #1

Cast #3

37°

25°

13°

8°