Magnetically controlled Growing Rod technique in 33 patients with Early Onset Scoliosis - preliminary results

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Disclosures

• Consultant
  – Synthes GmbH
  – Ellipse
Problems associated with growing rods

- Repeated surgeries
- Infections
- Junctional kyphosis
- Psychological distress
- Autofusion
Patients

• 33 patients had surgery with MCGR (MAGEC*) since 6’2011
• 24 fulfilled **inclusion criteria** for study
  – EOS of any etiology
  – > 40° scoliosis and > 5° progression / year
  – Minimum follow-up of 12 months or at least 3 lengthening procedures (lengthening is performed every 4 months)

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★ Cleared by FDA 2’ 2014
Patients

- 16 female, 8 males
- Age: 8.9 (4.6-14.4 years)
- 9 syndromic, 5 neuromuscular, 4 neurofibromatosis, 3 idiopathic, 2 thoracogenic, 1 congenital scoliosis
- 20 thoracic, 1 thoracolumbar, 3 lumbar curves
- Average F/U – 21.1 months
Surgical technique

- 2 separate incisions
- 4 screws as distal fixation
- 4 screws + 2 clamps proximally
- Dual 5.5 mm rods
- Contouring
- Testing of distraction
- Subfascial positioning
- Cross linking
Distractions

- Outpatient procedure
- Use of Dimeglio data
- X-rays pre and post lengthenings
- Ultrasound documentation of lengthening
- 4 months intervals
  - Logistic reasons
  - Reduce radiation exposure
Radiographic analysis

- Cobb angle
- T1-T12 length
- T1-S1 length
- Kyphosis (T1-T12)
- Lordosis (L1-L5)
## Results

<table>
<thead>
<tr>
<th></th>
<th>Pre-op</th>
<th>Post-op</th>
<th>Change (%)</th>
<th>FU</th>
<th>Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cobb (°)</strong></td>
<td>63 ± 15</td>
<td>29 ± 11</td>
<td>54</td>
<td>26 ± 12</td>
<td>58</td>
</tr>
<tr>
<td><strong>Kyphosis (°)</strong></td>
<td>43 ± 24</td>
<td>27 ± 12</td>
<td>37</td>
<td>32 ± 12</td>
<td>26</td>
</tr>
<tr>
<td><strong>Lordosis (°)</strong></td>
<td>41 ± 15</td>
<td>31 ± 12</td>
<td>24</td>
<td>35 ± 11</td>
<td>15</td>
</tr>
<tr>
<td><strong>T1-T12 (cm)</strong></td>
<td>18.2 ± 2.4</td>
<td>20.3 ± 2.5</td>
<td>12</td>
<td>21.7 ± 2.6</td>
<td>19</td>
</tr>
<tr>
<td><strong>T1-S1 (cm)</strong></td>
<td>29.6 ± 4.2</td>
<td>33.1 ± 4.0</td>
<td>12</td>
<td>35.0 ± 3.9</td>
<td>18</td>
</tr>
</tbody>
</table>

= statistically significant (p < 0.05)

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Changes of Cobb angle

54% correction after index procedure, 58% correction at follow-up
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T1-T12 in cm

<table>
<thead>
<tr>
<th>Time</th>
<th>Pre</th>
<th>Post</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>18.2</td>
<td>20.3</td>
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<tr>
<td>Post</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Follow-up</td>
<td></td>
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</tbody>
</table>

T1-S1 in cm

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<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>29.6</td>
<td>33.1</td>
<td>35</td>
</tr>
<tr>
<td>Post</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Follow-up</td>
<td></td>
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</tr>
</tbody>
</table>

★ = signifikant
Complications
(neurologic injury, unplanned surgery, infection)

• 1 loss of distraction
  – First case with 1. generation MCGR
  – All other cases were done with 2. generation rods

• 2 junctional kyphosis needing revision

• 1 screw pull out needing revision

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<table>
<thead>
<tr>
<th>Author</th>
<th>Patients</th>
<th>Primary / Revisions</th>
<th>Complications</th>
<th>Distractions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheung et al 2012</td>
<td>5</td>
<td>5 / 0</td>
<td>1 superficial infection, 1 loss of distraction</td>
<td>1 / month</td>
</tr>
<tr>
<td></td>
<td>1 single rod 4 dual rods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dannawi et al 2013</td>
<td>34 patients</td>
<td>32 / 2</td>
<td>2 superficial infections, 2 loss of distractions, 1 pullout of hook, 1 prominent screw, 2 rod breakage</td>
<td>every 3 months</td>
</tr>
<tr>
<td></td>
<td>12 single rod 22 dual rods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Akbarnia et al 2013</td>
<td>14 patients</td>
<td>14 / 0</td>
<td>1 superficial infection, 1 prominent hardware, 3 loss of distraction</td>
<td>variable</td>
</tr>
<tr>
<td></td>
<td>5 single rod 9 dual rods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hickey et al 2014</td>
<td>8 patients</td>
<td>4 / 4</td>
<td>Proximal screws pullout + junctional kyphosis, 1 rod fracture (only primary procedures)</td>
<td>Individual decisions</td>
</tr>
<tr>
<td></td>
<td>2 single rods 6 dual rods</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
## Curve correction and T1-S1 growth

<table>
<thead>
<tr>
<th>Author</th>
<th>Cobb before surgery (only primary procedures)</th>
<th>Cobb after surgery Correction in %</th>
<th>Cobb at follow-up Correction in %</th>
<th>T1-S1 growth/month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheung n=2</td>
<td>67°</td>
<td>25° (67%)</td>
<td>29° (57%)</td>
<td>1 mm</td>
</tr>
<tr>
<td>Dannawi n=34</td>
<td>69°</td>
<td>47° (32%)</td>
<td>41° (41%)</td>
<td>0,9 mm</td>
</tr>
<tr>
<td>Akbarnia N=14</td>
<td>60°</td>
<td>34° (43%)</td>
<td>31° (48%)</td>
<td>1,6 mm</td>
</tr>
<tr>
<td>Hickey n=4</td>
<td>74°</td>
<td>42° (43%)</td>
<td>42° (43%)</td>
<td>0,4 mm (2 patients)</td>
</tr>
<tr>
<td>Hamburg N=24</td>
<td>63°</td>
<td>29° (54%)</td>
<td>26 (58%)</td>
<td>0,9 mm</td>
</tr>
</tbody>
</table>
MCGR - preliminary results

• Results in terms of correction and maintaining correction comparable to traditional growing rods
• Safe technology
• No serious complications
• Distraction mechanism reliable

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Questions to be answered

• What is the complication rate after longer follow-up?
• Is distraction mechanism reliable after longer follow-up?
• Can autofusion be avoided?
• What is the best distraction protocol?
Thank you