

targeted) are currently employed to determine the distraction amount, however the efficacy of each is unknown. This study specifically assesses the ability of targeted distraction to achieve physiological growth.

Methods: We performed a retrospective review of European children treated with MCGR using a TGT and analyzed the post-operative clinical and radiographic outcomes, including the sitting height, standing height, coronal Cobb angle, T1-T12 and T1-S1 height. Furthermore, we compared the post-operative sitting/standing height ratio every six months to those reported for normal age and sex matched European children.

Results: Thirty-five children were included with a mean follow-up of 3.4 years (1.8–5.8 years). All clinical and radiographic parameters significantly ($p < 0.05$) improved immediately post-operatively and were maintained until final follow-up. The TGT mirrored the normative sitting/standing height ratios for expected spinal growth (Pearson correlation 0.95 for males and 0.90 for females). The mean difference between the reference values for the sitting/standing height ratio and our results was 0.0124 ($p < 0.001$) for males and 0.0068 ($p = 0.010$) for females.

Conclusion: MCGR can reliably improve the coronal deformity in children with EOS while maintaining spinal growth. A TGT to determine the distraction amount at follow-up accurately mirrors the normal growth pattern of age, sex and ethnicity matched children. However, patients treated with this technique have a statistically significant, but clinically insignificant, shorter than physiologically normal spinal height.

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Paper #19

Differential Lengthening of MCGR Does Not Improve Coronal Decompensation

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Summary: Attempted differential rod lengthening did not result in any meaningful change in coronal balance or rod length.

Hypothesis: Intended differential lengthening will result in customization of lengthening and improved coronal balance compared to symmetrical lengthening.

Introduction: Magnetically controlled growth rods (MCGR) allow for deformity correction and non-invasive spinal lengthening in the treatment of early-onset scoliosis (EOS). There are no reports in the literature on the effectiveness of differential rod lengthening in patients with MCGR constructs.

Methods: Retrospective review of EOS patients treated with MCGR between 2012 and 2015 was performed from a multicenter database. Inclusion criteria were < 10 years at index surgery, minimum 2 year follow-up and documented intended lengthening amounts. Patients with prior spinal instrumentation were excluded. Differential lengthening (DL) was defined as ≥ 2 mm difference between total intended rod lengthening on each side over the lengthening period.

Results: 33 patients with the following diagnoses met the inclusion criteria: neuromuscular ($N = 14$), idiopathic ($N = 9$), syndromic ($N = 8$) and congenital ($N = 2$). Mean age at time of index surgery was 7.2 years (range: 2.7 to 9.9 years) and mean follow-up was 2.4 years (range: 2.0 to 3.8 years). 10/33 (30%) patients underwent DL with a mean total intended length difference between rod sides of 3.6 mm (range: 2 to 10 mm) during the lengthening period while the remaining 23 (70%) had symmetrical lengthening (SL). Actual difference in lengthening between rod sides over the lengthening period was measured radiographically and was similar in

	Differential (N=10)	Symmetrical (N=23)	P- value
Total distraction difference between rods sides (mm)	1.6	2.1	0.60
Pre-Op coronal balance (mm)	33.6	25.1	0.31
Post-Op coronal balance (mm)	26.3	20.3	0.44
Final coronal balance (mm)	23.2	19.2	0.83

both the differential and symmetric groups (DL: 1.6 mm vs. SL: 2.1 mm, $p = 0.60$). No significant differences were found between groups for change in coronal balance from post-op to last radiographic follow-up (DL: -3.1 mm vs. SL: 0.9 mm, $p = 0.68$).

Conclusion: MCGR patients with DL had similar difference in distraction between rods and post-operative change in coronal balance compared to those with symmetrical lengthening. These results suggest that surgeons should not rely on differential lengthening to further improve spinal deformity following initial implantation.

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Paper #20

Comparative Outcomes of Monthly Versus Three-Monthly Distraction Protocols for Magnetically Controlled Growing Rods

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Summary: In this prospective comparative study between a monthly versus three-monthly distraction protocol for early onset scoliosis (EOS) patients treated with magnetically controlled growing rods (MCGRs), no significant difference in rod length gain and curve progression were found.

Hypothesis: Monthly distraction increase rod length gains.

Introduction: More frequent and smaller amounts of distractions per episode may better mimic physiological spine growth, and aggressive distractions may lead to frequent rod slippage. The best distraction protocol of MCGR remains unknown.

Methods: Age-, sex-, and height-matched EOS patients with minimum 4-year follow-up were prospectively recruited from two centres with standardized monthly 2 mm distractions ($n = 4$, mean age 5 yrs) or