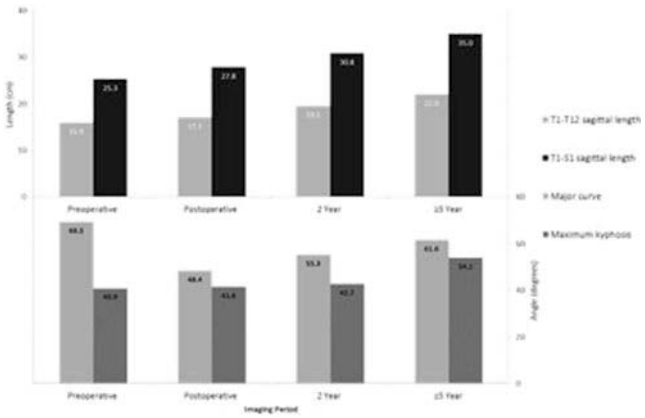
Children's Spine Foundation; CPIRF; CSSG; OMEGA; Pediatric Orthopaedic Society of North America; Biomet; International Healthcare Leadership; Cerebral Palsy Foundation; Children of China; Global Health Pass; Global Health Pass; International Healthcare Leadership; Medtronic; OMEGA; OMeGA Medical Grants; Stryker. Michael Vitale: Childrens Spine Foundation; IPOS; Pediatric Orthopaedic Society of North America; SSG; Medtronic Sofamor Danek; Stryker; Wellinks; Biomet; CSSG, Scoliosis Research Society, OSRF; DePuy; DePuy, A Johnson & Johnson Company; FOX; Medtronic; OMEGA; Synthes.

Paper #24

VEPTR Treatment of Early Onset Scoliosis (EOS) in Children without Rib Abnormalities: Long-Term Results of a Prospective, Multicenter Study

Ron El-Hawary, Kevin Morash, Muayad Kadhim, Michael Vitale, John Smith, Amer Samdani, John Flynn, Children's Spine Study Group

Summary: A prospective, multicenter study demonstrating the long-term efficacy of VEPTR treatment in EOS without rib abnormalities.
Hypothesis: At minimum 5 year follow-up, VEPTR controls scoliosis and allows spinal growth in EOS without rib abnormalities.
Design: Prospective, multicenter, observational.
Introduction: In 2007, a prospective study on VEPTR treatment of EOS without rib abnormalities was initiated. Two year follow-up results from this cohort have previously demonstrated that scoliosis is controlled and spinal growth continues.
Methods: Participants underwent traditional VEPTR implantation ⩾5 years prior to analysis. Pre-implantation and last available images were compared, regardless of whether VEPTR remained in vivo. Additional analysis was performed if VEPTR was in vivo ⩾5 years.
Results: 59 patients (mean age at VEPTR insertion 6.1±2.4 years; mean follow-up 6.9±1.4 years). Currently 24 patients still have VEPTR, while 24 have converted (13 fusions, 6 MCGR, 3 growing rods, 1 hybrid, 1 Shilla). Three have had VEPTR explanted, 6 are unknown, 2 have deceased. On last available imaging (n=59; mean follow-up 4.8±1.9 years), scoliosis improved from 71.8±18.0° preoperatively to 60.9±20.3° (p<0.001) and T1- T12 height increased (15.8±3.2cm to 19.3±3.8cm, p<0.001). T1-S1 height also increased (24.8±4.4cm to 31.2±5.3cm, p< 0.001), representing 119% age-matched growth (Dimeglio JPO-B, 1992). Composite improvement of scoliosis, T1-T12 and T1-S1 height was achieved in 79%.
A subset of 29 VEPTR patients was analyzed at most recent follow-up ⩾5 years while VEPTR remained in vivo (24 VEPTR patients above, plus 5 who later had VEPTR removed). Mean age at insertion 5.0±2.2 years; mean duration 6.2±1.1 years. Scoliosis improved from preoperatively (69.3±14.5° to 61.6±16.1°, p=0.006), with mild recurrence from post-op to 5 years (Figure 1). T1-T12 height increased (15.0±3.3cm to 18.7±3.3cm, p<0.001) and T1-S1 height increased (23.7±4.5cm to 30.1±4.6cm, p<0.001), representing 83% age-matched growth. Composite improvement was achieved in 83%.
Conclusion: At minimum 5 year follow-up, VEPTR treatment continues to control scoliosis and allow spinal growth.



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Paper #25

Quantifying the ′Law of Diminishing Returns′ in Magnetically Controlled Growing Rods

Adil Ahmad, Thejasvi Subramanian, Pavlos Panteliadis, James Wilson-Macdonald, Dominique Rothenfluh, Colin Nnadi

Summary: The ′law of diminishing returns′ can also be observed following serial distraction in MCGR. In comparison to previously published data for CGRS, there is a gradual linear decline as opposed to a rapid initial decline in lengthening. In the older, heavier child a reduced distraction ratio in the concave rod of the MCGR device is noted over time.
Hypothesis: The study's primary aim was to quantify the effect of the ′law of diminishing returns′ in Magnetically Controlled Growing Rods over sequential distractions.
Design: Thirty-five consecutive patients with maximum follow-up of 57 months were included in the study. True Distraction (TD) was determined by measuring the expansion gap on fluoroscopy. This was compared with Intended Distraction (ID) and expressed as the 'TI' ratio. The TI ratio and the Cobb angle were calculated at several time points during follow-up.
Introduction: Magnetically Controlled Growing Rods (MCGR) allow non-invasive spinal lengthening for treatment of early-onset scoliosis. Conventional Growing Rod Systems (CGRS) require repeated surgical distractions which are associated with the effect of the ′law of diminishing returns′. The study's primary aim was to quantify this effect in MCGRs over sequential distractions.
Methods: Thirty-five patients with maximum follow-up of 57 months were included in the study. True Distraction (TD) was determined by measuring the expansion gap on fluoroscopy. This was compared with Intended Distraction (ID) and expressed as the ′TI′ ratio. The TI ratio and the Cobb angle were calculated at several time points during follow-up.
Results: There was a significant decrease in the mean TI ratio over time (convex rod 3 months 0.81±0.58 vs. 51 months 0.17±0.16, p=0.0001; concave rod 3 months 0.93±0.67 vs. 51 months 0.18±0.15, p=0.0001). A linear decline of the mean TI ratios was noted for both convex rods (r^2=0.90, p=0.004) and concave rods (r^2=0.81, p=0.015) over 51 months. At the 24-month follow-up stage there was a significant negative correlation between the concave rod mean TI ratio with weight (r=0.59, p=0.01), age (r= -0.59, p=0.01) and BMI of the child (r= -0.54, p=0.01).
Conclusion: The ′law of diminishing returns′ can also be observed following serial distraction in MCGR. In comparison to previously published data for CGRS, there is a gradual linear decline as opposed to a rapid initial decline in lengthening. In the older, heavier child a reduced distraction ratio in the concave rod of the MCGR device is noted over time.

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