*Hospital for Children, Stryker, Wolters Kluwer Health - Lippincott Williams & Wilkins, JBT Medical Technologies*

**Paper #16**

**Can You Stall a Baclofen Pump During a Magnetic Rod Lengthening?**

*Christina Hardesty, Michelle Janas*

**Summary:** During magnetic rod lengthening, the field created by the External Remote Controller (ERC) has the potential to stall a baclofen pump. In this study, bench testing demonstrated both the minimum distance from and rod lengthening time required to stall a baclofen pump.

**Hypothesis:** The field generated by the ERC was unlikely to stall a baclofen pump, based on distance alone (the ERC generates a 4cm field) but the exact safe distance was unknown as well as the safe length of time for exposure.

**Introduction:** A growing number of children are being implanted with magnetically controlled growing rods. Some also have baclofen pumps, a device that delivers a neuromodulating medication using a magnet. There has been no previous testing to determine if the External Remote Controller (ERC) would stall the baclofen pump during magnetic rod lengthening, a potentially life-threatening event.

**Methods:** Two baclofen pumps, 20 mL and 40 mL, were placed in varying proximity to the ERC while the magnetic field was generated. The speed (dose) of the baclofen pump, the distance from the ERC, the length of time the ERC was run, the position of the pump in relationship to the magnetic field, and the presence or absence of a stall were recorded.

**Results:** To stall a baclofen pump, the ERC needed to be running continuously for at least 30 mm of lengthening (about 3 minutes). The pump would not stall if it was more than 1 cm away from the ERC, even if the ERC generated a field for 3 minutes. The speed of the pump did not affect the instance of a motor stall. The pump was more likely to stall if it was positioned in front of or behind the magnetic field, as opposed to the center of the field.

**Conclusion:** Baclofen pumps are always more than 1 cm away from the magnetic rods when both are implanted in a child. The typical lengthening interval is under 10 mm, much less than what was required to stall a baclofen pump. The ERC is highly unlikely to stall a baclofen pump during a magnetic rod lengthening, making a life-threatening event almost impossible.

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**Paper #17**

**Contouring the Magnetically Controlled Growing Rod Impacts Its Expansion Capacity**

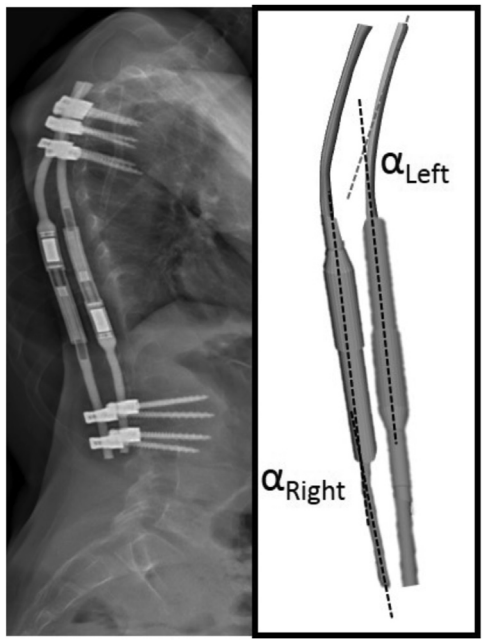
*Saba Pasha, John Flynn*

**Summary:** The relationship between the contouring of the magnetically controlled growing rods (MCGR) and its expansion capacity was studied. The 3D curve of 45 MCGR in 23 early onset scoliosis patients was related to the rod expansion. Increased 3D curve at the expandable end of the MCGR was significantly related to the imparted expansion.

**Hypothesis:** It was hypothesized that contouring the expandable end of the MCGR can reduce the axial loading of the rod, increasing its expansion capacity.

**Introduction:** The impact of several patient- dependent factors such as the tissue depth, previous surgery, curve severity and flexibility on the expansion capacity of the rod has been studied. However, the mechanical impact of the rod contouring on the expansion of the rod in consecutive intervals has not been evaluated clinically.

**Methods:** A total number 23 patients with early onset scoliosis who had received MCGRs for their scoliosis were included retrospectively. All patients had 2 view X-ray images and at least 3 expansions after their initial surgery. The rod expansions was measured on 2D ultrasounds. A 3D model of the MCGR rods was created from the frontal and sagittal X-ray images and the 3D rod curve only on the expandable side was measured (Fig.1). The rod expansion at each visit was correlated to the 3D curve of the rod.




**Results:** A total number of 45 rods with at least 3 expansion [range 3-6 time, average 4.8 expansion visits] were analyzed. The average 3D curve of the rods at the expandable end was 5.2±8.3 degrees and 11.0±10.9 degrees for the convex and concave rods, respectively. The reverse correlation between the rod 3D curve and its expansion was significant third and fourth visits only for the rod on the concave side (r (3rd visit) = 0.58, r (forth visit) =0.38, $p < 0.05$). The sample size was not adequate for the 5th and 6th expansion.

**Conclusion:** While the expansion capability of the MCGRs is expected to be affected by several patient-specific factors, the mechanics of the rod described by the 3D contour of the expandable section of the rod with respect to the actuator was found to be a significant factor in rod expansion capability. Unloading the rod axially on the concave side seemed to be linked to improved the expansion capacity of the MCGR.

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**Paper #18**

**Targeted Distraction: Spinal Growth in Children with Early Onset Scoliosis Treated with a Tail-Gating Technique for Magnetically Controlled Growing Rods**

*David Kieser, Mihai Mardare, Chrishan Thakar, Shahnawaz Haleem, Thejasvi Subramanian, Adil Ahmad, James Wilson-MacDonald, Colin Nnadi*

**Summary:** This prospective cohort of European patients with early onset scoliosis treated with magnetically controlled growing rods compared to normal age and sex matched European children reveals that a tail-gating-technique determining the distraction amount results in patients having a minimally shorter than average spinal height but a normal pattern of growth.

**Hypothesis:** A tail-gating technique (TGT) mirrors the normal spinal growth of children with early onset scoliosis (EOS) treated with magnetically controlled growing rods (MCGR).

**Introduction:** MCGR allow outpatient distraction and guided spinal growth without the need for repeat surgery. Two techniques (maximal and