

movement of implants (0%, 0/9), unintended lengthening/shortening (0%, 0/9) or heating of MCGR (0%, 0/10) were not observed. No problems were observed with function of the MCGR following MRI and a mean of 2.1 mm was obtained at the next lengthening (range, 0.5–3mm). Eight patients had MRIs of the cervical and thoracolumbar spine. All cervical spine MRIs could be interpreted without excessive artifact (100%, 4/4). Four patients had MRIs of the thoracolumbar spine but these were considered uninterpretable as a result of artifact from the MCGR (0%, 0/4).

Conclusions: Perhaps MRIs should not be contraindicated in patients with MCGRs, as no adverse events were noted, and MRIs of the cervical spine were clinically useful.

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Paper #3

Magnetic Resonance Imaging Safety of Magnetically Controlled Growing Rods in an In vivo Animal Model



Mehmet Eroglu, Gokhan Demirkiran, Ismail Aykut Kocyigit, Hasan Bilgili, Mehmet Burak Kaynar, Ali Bumin, Sadan Ozcan, Muharrem Yazici

Summary: Magnetically controlled growing rod (MCGR) is increasingly used in the treatment of early onset scoliosis. However, MRI requirement in patients with MCGR is of concern. This study investigated MRI safety of the MCGRs in an animal model and indicated that lower magnet MRI is safe in an animal model with MCGRs with no adverse effects regarding the MCGR or the animal.

Hypothesis: MRI is safe in an animal model with MCGRs and it causes no serious adverse effects regarding the patient and the MCGR.

Design: Experimental Animal Study.

Introduction: Growing rod treatment through serial operations results in adverse effects on the patient and high treatment costs. MCGRs can be lengthened noninvasively in an outpatient setting and with lower treatment costs. When MRI investigation is required, the interaction between

MCGRs and MRI is an issue of concern in patients with MCGRs. This study investigated MRI compatibility of MCGRs in an in vivo setting.

Methods: The study was conducted on three sheep. A standard posterior approach was used. One polyaxial pedicle screw at the ends was placed. Two sheep were instrumented unilaterally and one bilaterally with MCGRs. Temperature change was measured using MR-compatible sensors. Thoracic and lumbar MRIs were obtained using a 0.3T MRI unit. MRI waves were applied for 45 minutes and temperature changes were recorded every 3 minutes. The lengths of the MCGRs were measured and anteroposterior and lateral spine radiographs were obtained pre- and postoperatively.

Results: No displacement in the positions of the MCGRs occurred. The lengths of the MCGRs did not change compared to the preoperative length. The ability of the MCGRs to elongate were not impaired after MRI scanning. There was a mean increase in the temperature of the MCGRs by 1.45°C (0.5–2.4°C). The MCGRs had a strong scattering effect on MRI of the related segments.

Conclusions: This study indicated that lower magnet MRI is safe in an animal model with MCGRs, with no displacement of the rods and no changes in their length, no significant heating, and no adverse effects on the lengthening mechanism but with a significant scattering effect on visualization of the surrounding tissues. Further investigations are needed to clarify the exact distance where an MRI investigation of distant organs may be done without scattering.

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Paper #4

Pulmonary Function Evaluation in Children Affected by Neuromuscular Scoliosis Treated for the Spine Deformity With Magnetically Controlled Growing Rods



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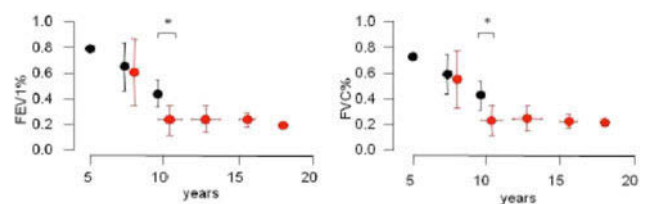
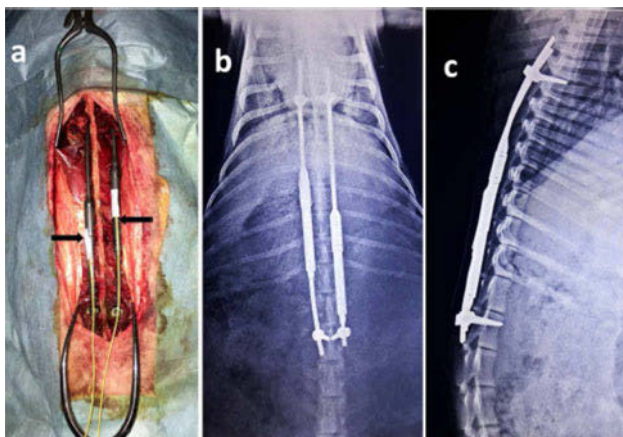
Summary: Since November 2012 we treated 10 children affected by neuromuscular disease with magnetically controlled growing rods (MCGR). Patients are lengthened at intervals of 3 months. At every lengthening, they performed a spirometry. We matched data with a group in conservative treatment. We observed an higher FEV1 and FVC in treated group. We also found a weak correlation between FEV1 and FVC variation and Cobb angle variation. After implantation of MCGR, the pulmonary function stopped worsening.

Hypothesis: Control if the pulmonary function improve after surgery treatment with mcgr in children affected by neuromuscular disease.

Design: Match the spirometry data between the surgical group and a conservative contro group same age with the same pathology.

Introduction: When spine deformity worsen rapidly in patients affected by neuromuscular disease we treated theme with magnetically controlled growing rods (MCGR). The lack of repeated surgeries and anaesthetics is beneficial in children with neuromuscular disease and impaired pulmonary function that we supposed improve after surgery.

Methods: Since November 2012 we treated with MCGR 10 children affected by neuromuscular scoliosis (7 by Spinal Muscular Atrophy type II - SMA II - 3 by metabolic myopathy). Children were 6.8±1.2 years old.



(Figure1: black points MCGR group, red points control group)