The magnetic field strength and the force distance dependency of the magnetically controlled growing rods used for early-onset scoliosis

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Background

Untreated early-onset scoliosis (EOS) leads to respiratory insufficiency and reduced life expectancy. Magnetically controlled growing rods (MCGR's) have revolutionized the treatment of EOS. It is now possible to do painless lengthening in the outpatient clinic without anesthesia. However, MCGR's have inherent complications like non-functioning of the lengthening mechanism. We aimed to specify one correct indication for MCGR use by measuring the lengthening forces at varying distances between the external remote controller (ECR) and the MCGR to quantify the role of implantation depth.

Methods

The magnetic field strength was measured on new and explanted rods, at different distances between the external remote controller and the MCGR and likewise in patients before and after distractions in the outpatient clinic. All rods were from the MAGEC system (Nuvasive Inc., US). Two new and 12 explanted MCGRs was used for the lab measurements of the elicited force using a forcemeter. At the outpatient clinic we measured on four patients, each with two implanted rods.

Results

At a distance of 25 mm, the force was reduced to approximately 40% (ca. 100 N) compared to zero distance (ca. 250 N), most so for explanted rods. The magnetic field

strength of the internal actuator decayed fast with increasing distances and plateaued at 25–30 mm approximating zero.

Conclusion

Based on our findings, it is of outmost importance minimizing the implantation depth to ensure proper functionality of the rod lengthening. Therefore, we recommend a distance of 25 mm from skin to MCGR to be considered a relative contraindication to clinical use in EOS patients.