

Magnetically Controlled Growing Rods: Observed Length Increases are Lower Than Programmed



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DISCLOSURES

Mark S. Schwartz, DO –	None
Sarah Gilday, PA-C –	None
Donita I. Bylski-Austrow, PhD –	None
David L. Glos, BSE –	None
Lindsay Schultz, BS, CCRP –	None
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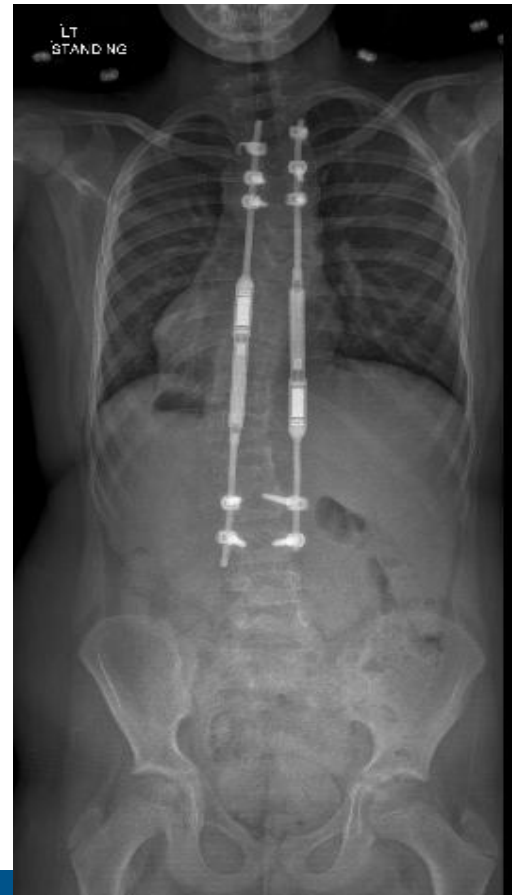
BACKGROUND

- Magnetically controlled growing rods have shown to reduced the number of surgeries
- Lengthening is performed using an External Remote Controller (ERC)
- Desired distraction length is programmed in the ERC for each lengthening.



BACKGROUND

- Lengthening is measured by ultrasound.



OBJECTIVES

- Primary goal
 - Determine whether actual rod displacements were different than the distraction programmed into the ERC



OBJECTIVES

- Secondary Goals
 - Evaluate factors that might affect lengthening
 - Previous placement of spinal instrumentation
 - Distance between the skin surface and the rod correlated with the amount of lengthening achieved

METHODS

- Retrospective review of 31 consecutive patients after implantation of a magnetically controlled growing rod construct

METHODS

Demographics

- 18 males, 13 females
- Mean age 8.1 years(± 2.5)
- Main curvature $60^\circ(\pm 14.6^\circ)$
- 12 patients with prior instrumentation
- Tissue depth measured in 20/31 patients

METHODS

Diagnosis

EOS Classification				
	Syndromic	Neuromuscular	Idiopathic	Congenital
Number of Patients	12	11	6	1

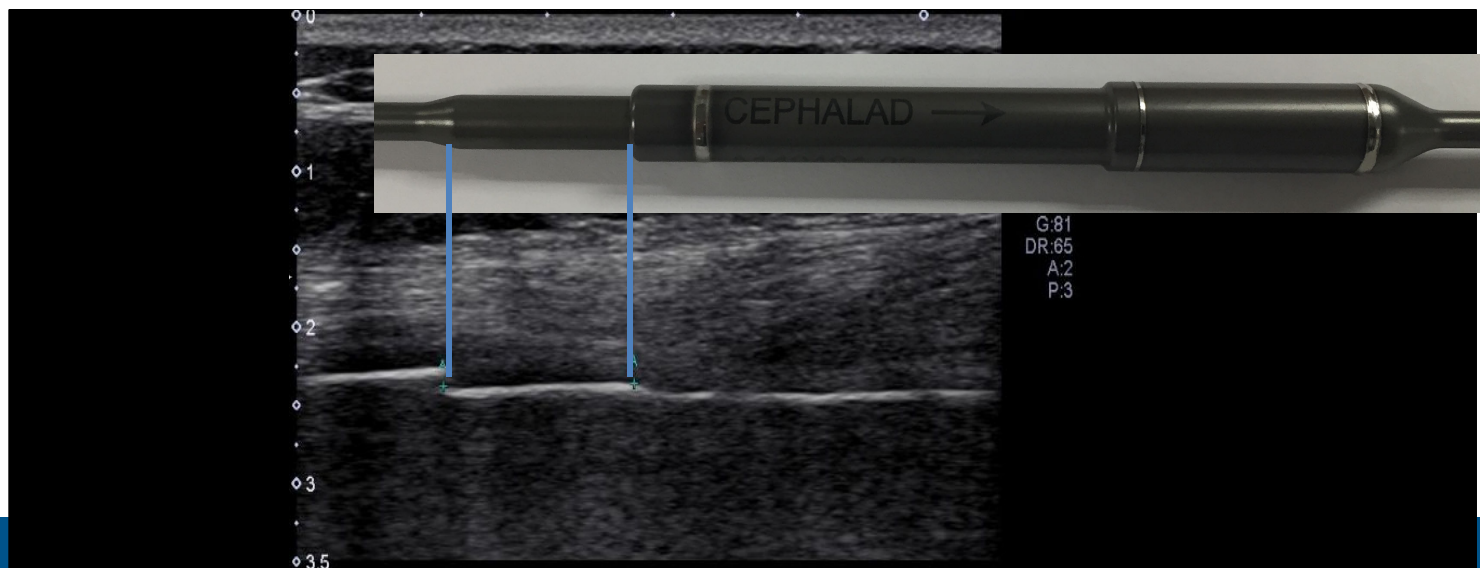
*One patient with diagnosis of kyphosis associated with Hurler Syndrome

METHODS

- All 31 patients followed up
- Lengthening at 3 months
- ERC programmed to lengthen 3 mm.
- The same provider
- Same technicians each visit

METHODS: Ultrasound

- The rods were measured before and after each lengthening
- Measurements were made from the edge of housing to the proximal edge of the rod taper



METHODS

- 81 lengthening sessions
- In 70 out of 81 lengthening sessions, lengthening results were achieved during the first attempt
- In 11 of the lengthening sessions a second attempt was necessary to achieve lengthening results
 - Gentle traction
 - Reverse Trendelenburg position

STATISTICS

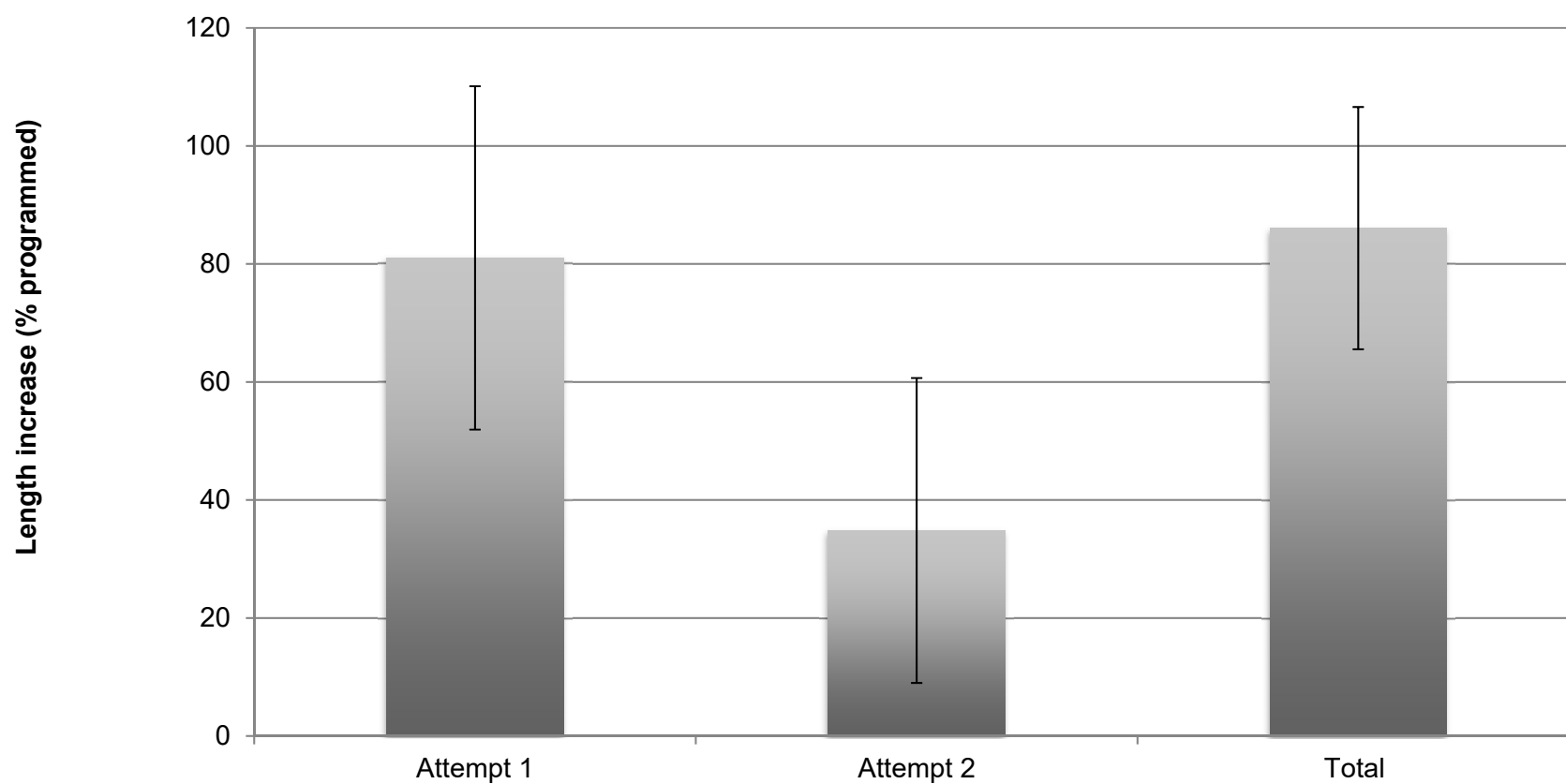
- The % change in length relative to programmed was determined
- Statistically, differences between programmed and actual total length change were determined by **paired t-tests**

RESULTS

- The total length increase achieved relative to the programmed distraction was **86.1% ($p < 0.001$)**
- Most of the increase was elicited during the first attempt, 81%
- For the subset with a second attempt, the additional length increase was 34.8%

RESULTS

Length Increase Relative to Programmed

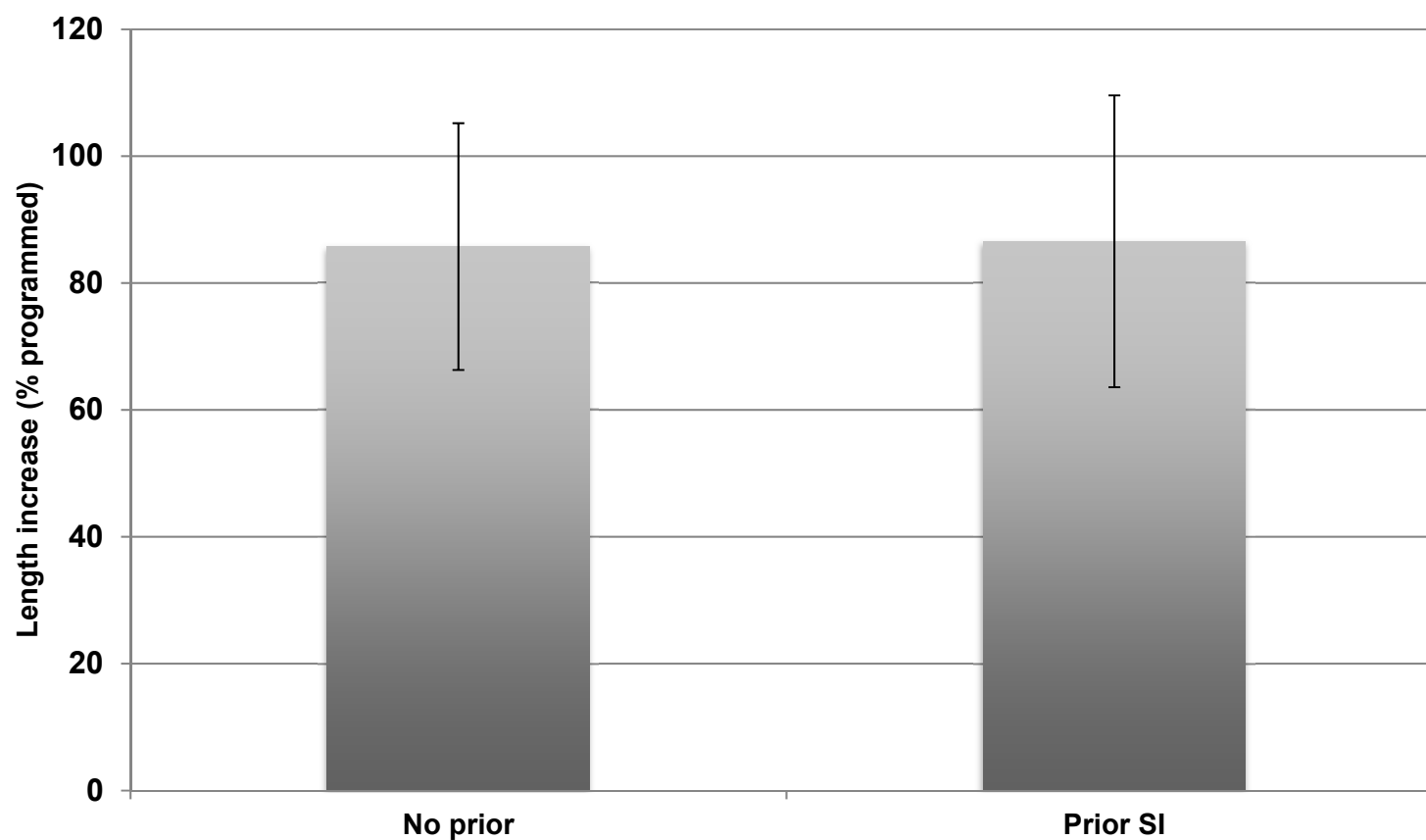


RESULTS

- 12 patients were converted to magnetic growing rods
- 19 has no history of prior spine instrumentation
- Increases in rod length for patients with and without prior surgery were **86.6%** and **85.8%** respectively

RESULTS

Length Increase by Instrumentation History



RESULTS

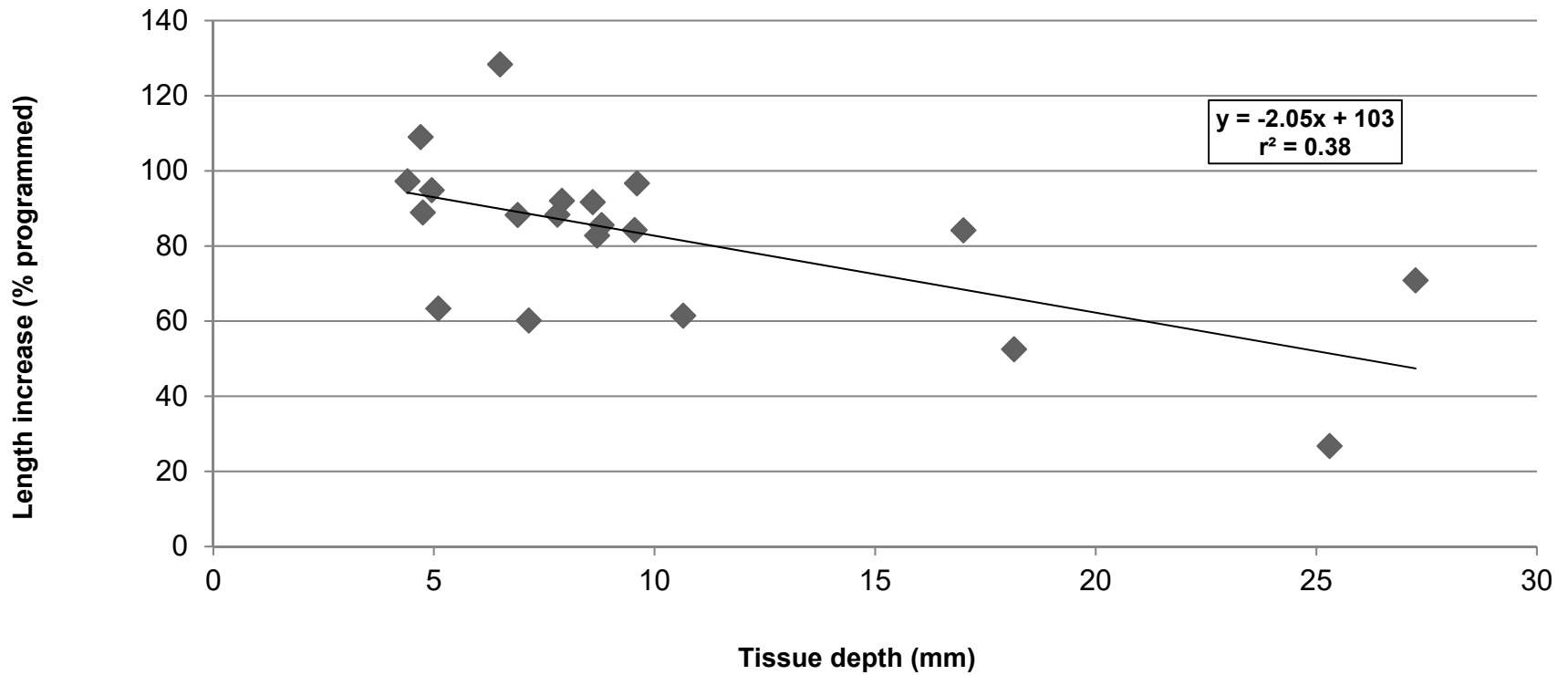
- In 20 of the 31 patients, tissue depth was measured using ultrasound
 - Regression and Pearson's correlation applied with distraction length
 - Probability the slope was zero was tested

RESULTS

- The range of tissue depths was 4mm-27mm,
- 16/20 were below 12mm
- Total lengthening was inversely proportional to tissue depth
 - $r^2=0.38$
 - $p<0.005$
- The rate of relative decrease in lengthening achieved was **2.05%/mm** of tissue depth

RESULTS

Length Increase by Depth of Tissue



DISCUSSION

- Lengthening of the magnetic growing rods was 86% of the programmed length (or 14% less than expected)
- There was a fairly high standard deviation of 21%
- Spine lengths were not measured.

DISCUSSION

- In a previous study by Sankar et al, there appears to be a law of diminishing returns in the lengthening of dual traditional growing rods

Spine

DEFORMITY

Lengthening of Dual Growing Rods and the Law of Diminishing Returns

Wudbhav N. Sankar, MD, David L. Skaggs, MD, Muharrem Yazici, MD, Charles E. Johnston II, MD, Suken A. Shah, MD, Pooya Javidan, MD, Rishi V. Kadakia, BS, Thomas F. Day, MD, and Behrooz A. Akbarnia, MD

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DISCUSSION

- Our findings do not show a statistically significant difference between these two subsets of patients
- Our original hypothesis that the patients with prior growing rod constructs would have a lower percentage of lengthening is not supported by our data
- This favors exchange to a magnetic growing rod

DISCUSSION

- A negative correlation between tissue depth and the amount of lengthening achieved was identified ~2% per mm.
- May be an important factor to consider prior to using this technology in overweight or obese patients

LIMITATIONS

- Retrospective
- Wide range of diagnoses
- Variation in constructs
- Variability in lengthening process
- Only rod length was studied, which may or may not correlate with actual changes in spine length

CONCLUSION

- Actual increases in rod length are significantly lower than the programmed displacement (14%)
- Prior instrumentation did not decrease lengthening effectiveness
- The distance between the rod and skin surface affected the magnitude of distraction (2% per mm)

THANK YOU

