MAGEC rods: The new frontier for Early Onset Scoliosis

Jwalant S. Mehta

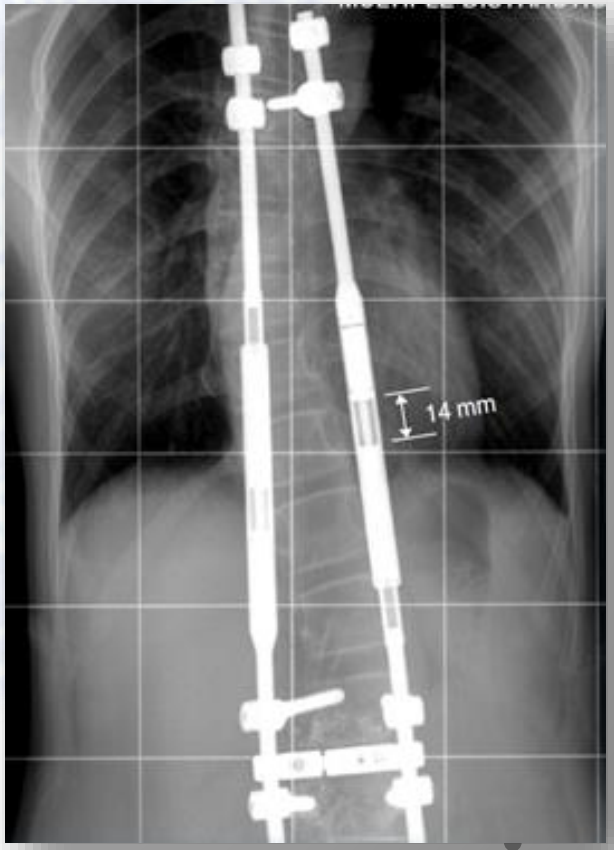
MBBS, D Orth, MS(Orth), MCh Orth, FRCS Orth

Consultant Spine Surgeon

Birmingham Spine Centre

The Royal Orthopaedic Hospital

Birmingham Childrens' Hospital



Early Onset Scoliosis (EOS)

Scoliosis with age of onset under 10 years, regardless of aetiology

Skaggs et al EOS Consensus Statement

SRS Growing Spine Committee 2015

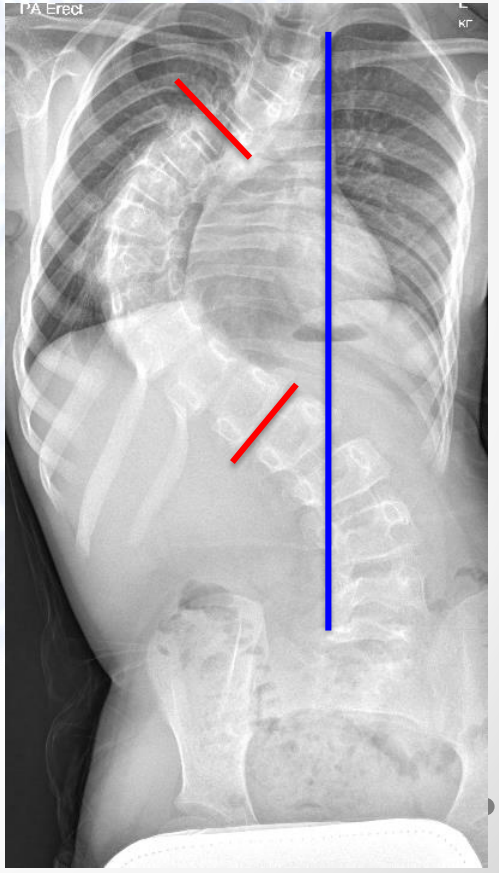
Principles of treatment

allow scoliosis curve correction / control without fusion

so that spinal growth and thus thoracic and lung growth can continue

Thompson JPO 2007

Karol JBJS Am 2008



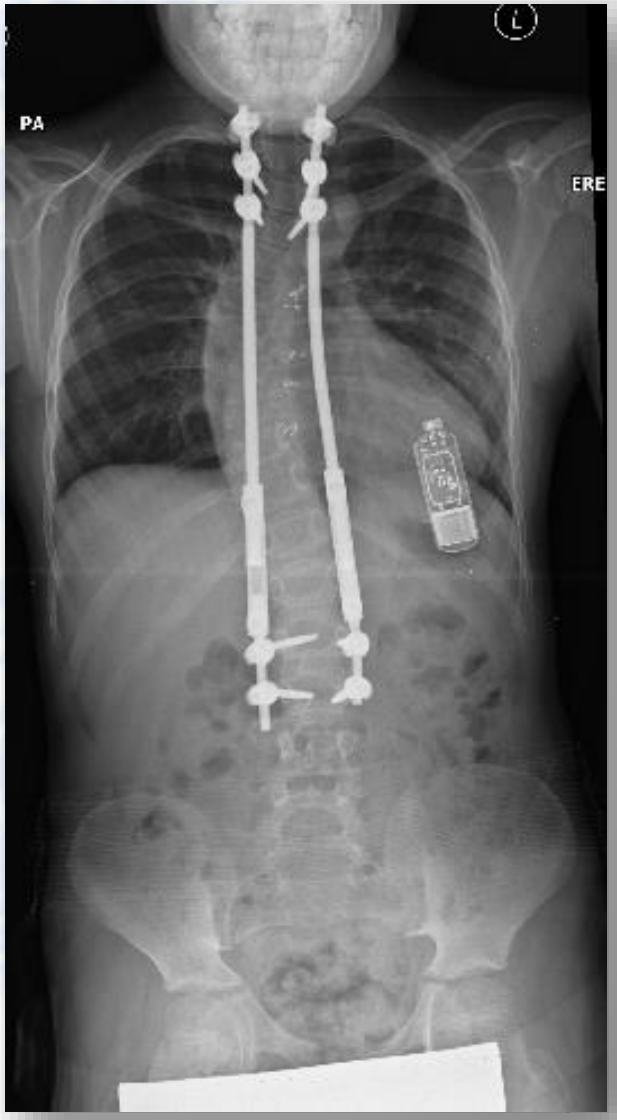
Cobb angle: curve magnitude

T1 S1: trunk height

Traditional Growing Rod (TGR)

- Harrington, Luque
- Pedicle based foundations
- Unfused apex
- Rods into a ‘connector’

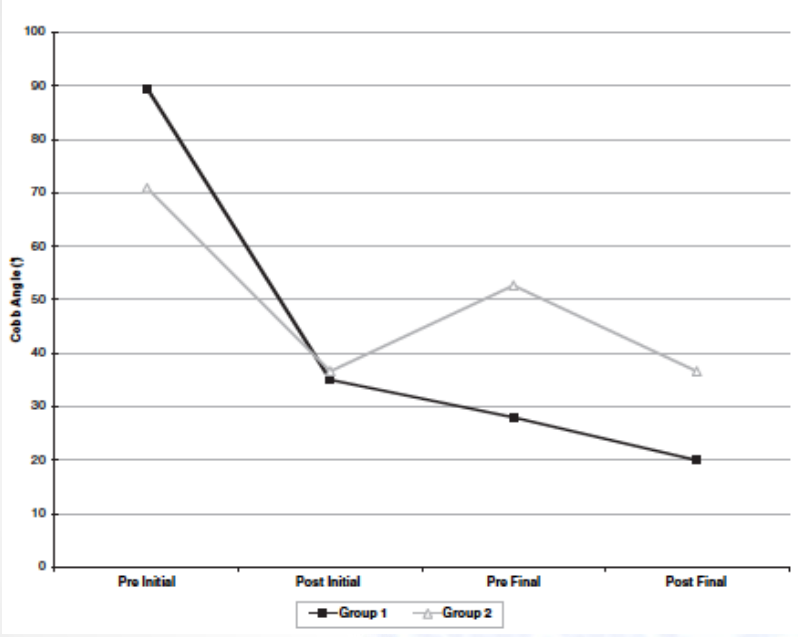
1. Multiple ‘planned’ returns to theatre
2. Frequency of lengthening (6 mo)

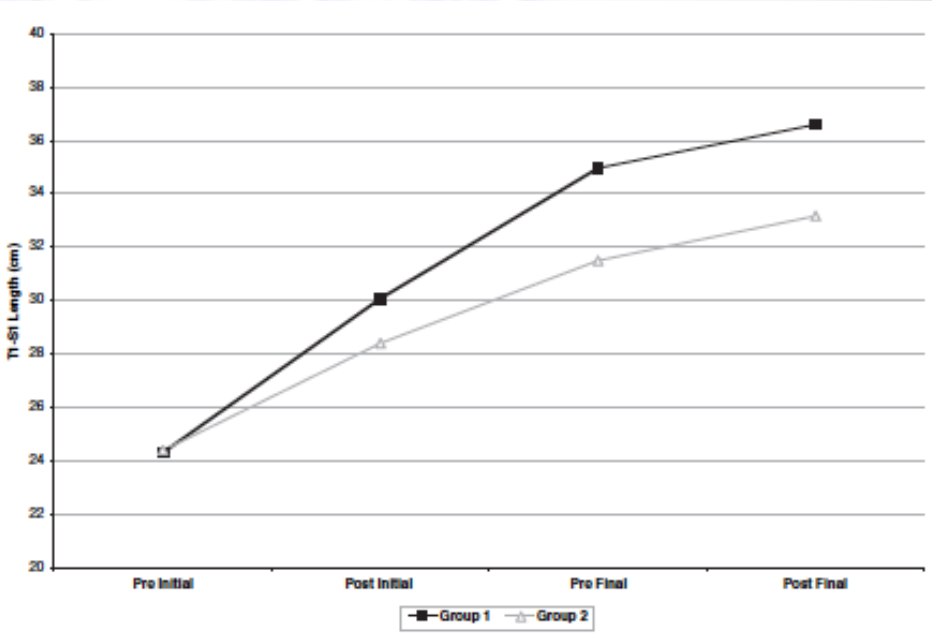


Dual Growing Rod Technique Followed for Three to Eleven Years Until Final Fusion

The Effect of Frequency of Lengthening

Akbarnia et al Spine 2008





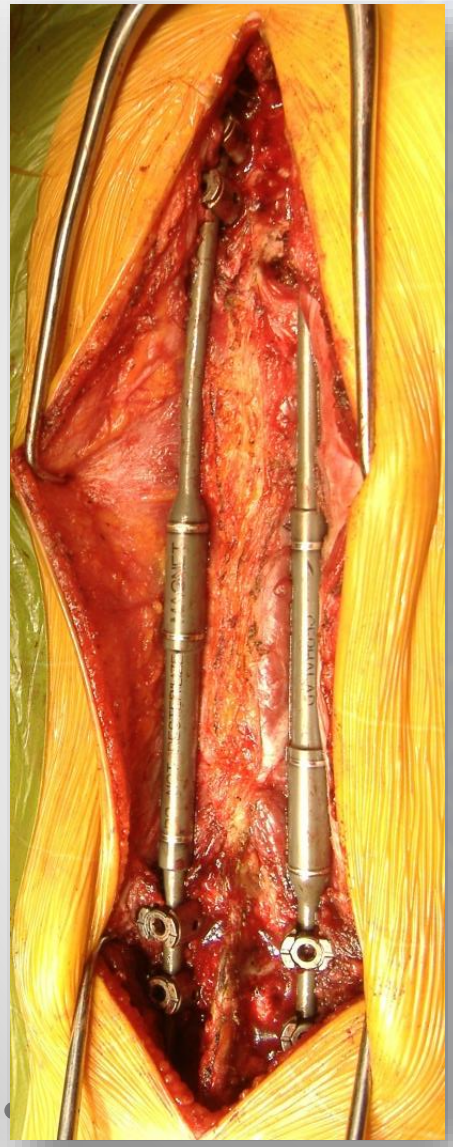
Cobb angle

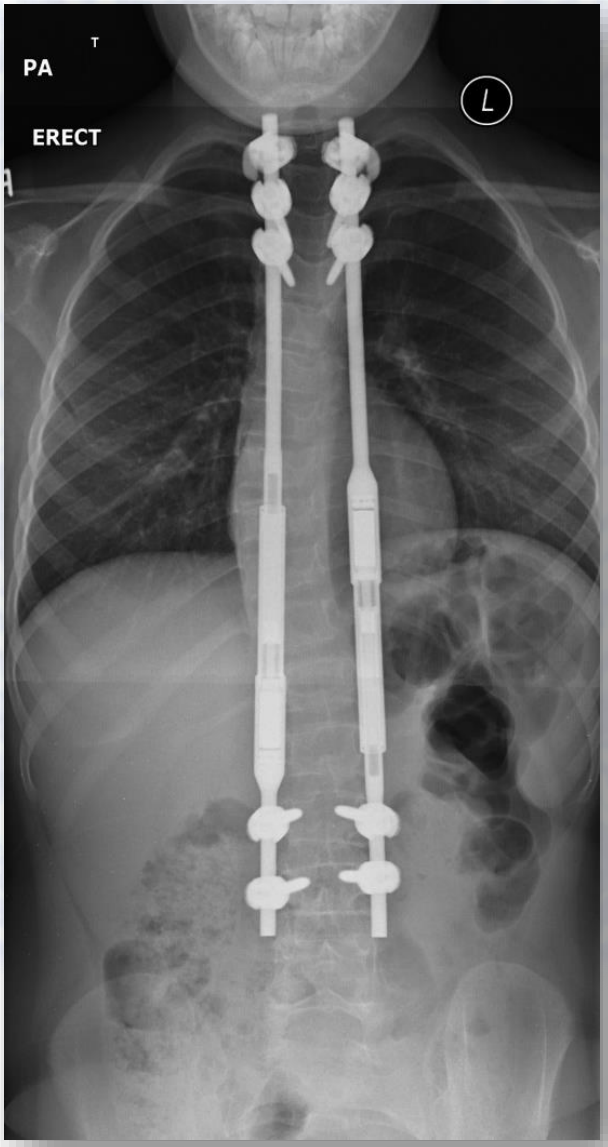
T1 S1

	Pre	Post	Final	Correction
< 6 mo	89.6	35.1	20	79%
> 6 mo				

	Elongation	Growth	Total	Gr / yr
< 6 mo	5.8	6.5	12.3	1.84
> 6 mo	4.01	4.7	8.78	1.02

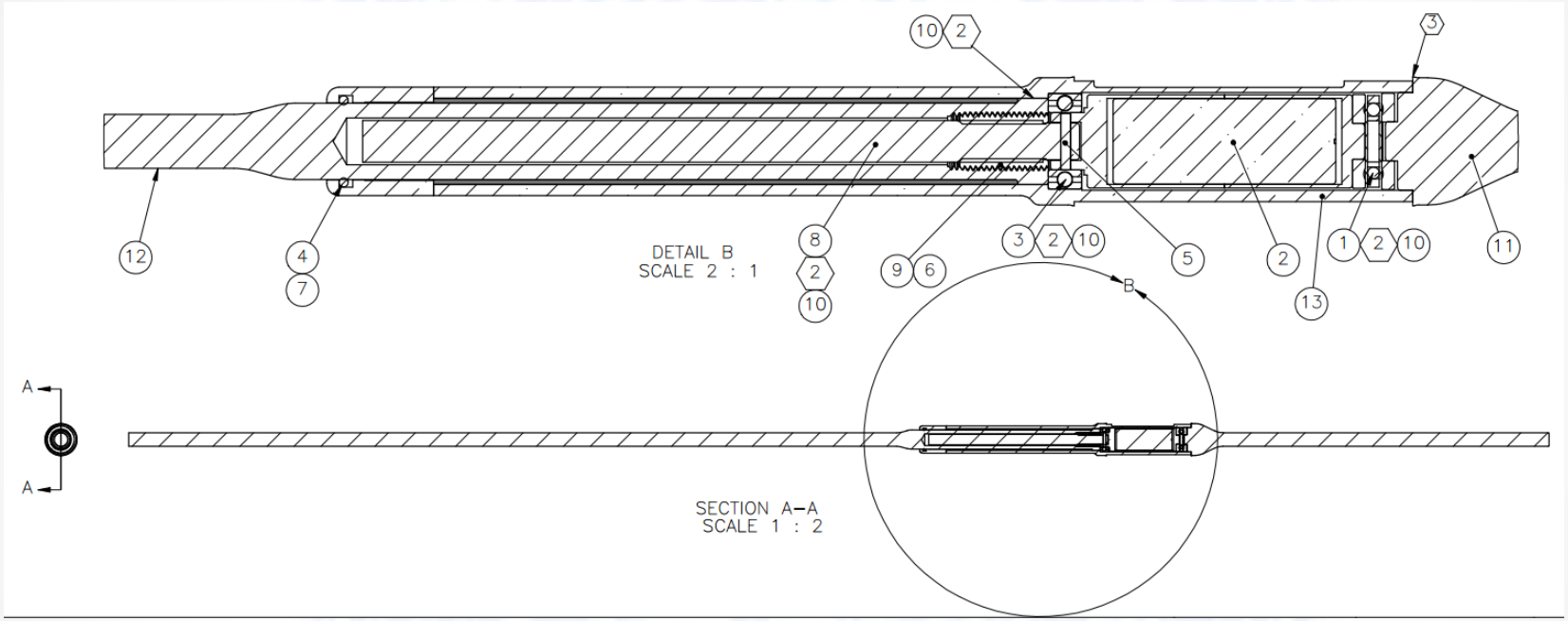
MCGR: Magnetically Controlled Growing Rods



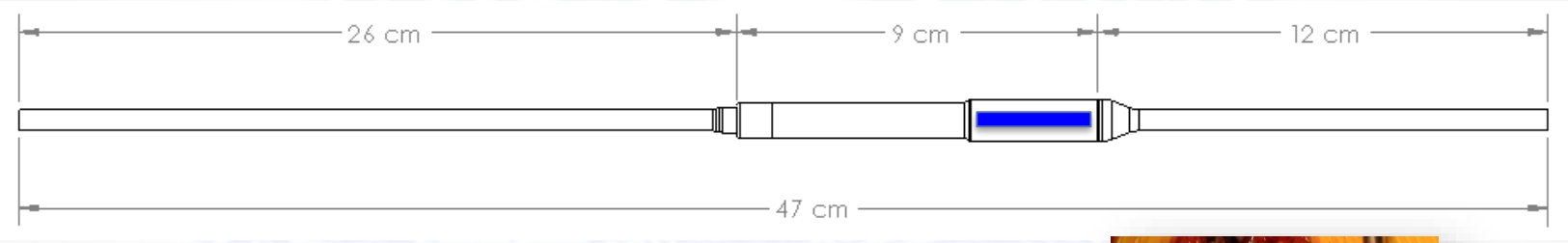


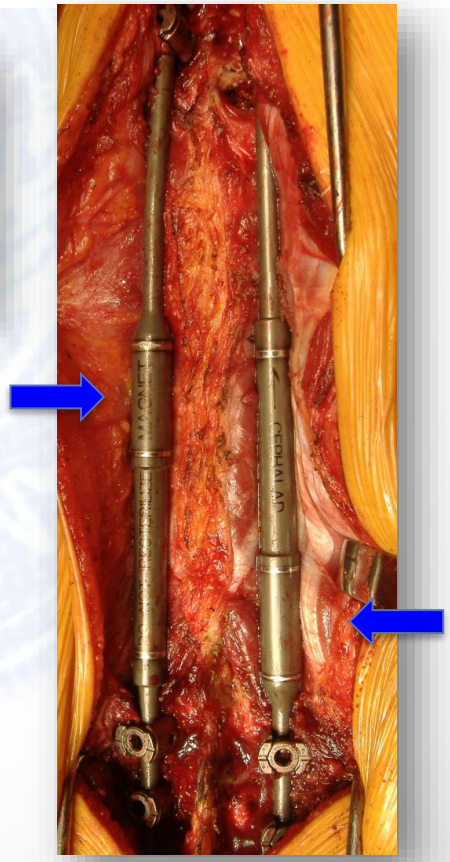
MAG netic Expansion Control

MAGEC



MAGEC™ rod dimensions





- **Actuator cannot be bent**
- **Shorter actuator option**
- **4.5**; *5.0* **and 5.5 rod diameters**
- **Standard and offset**

Distraction Clinics

- Nurse-led
- 3 monthly distractions
- 6 monthly radiographs
- Compliance

Kobu the Cheetah

Locating the magnet

External Remote Controller: ERC

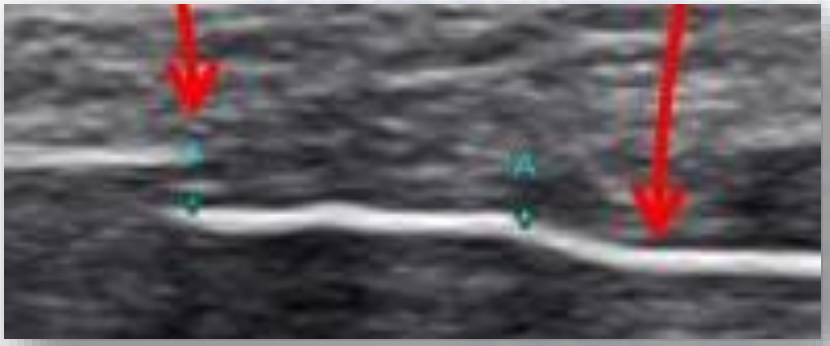
Tailgate

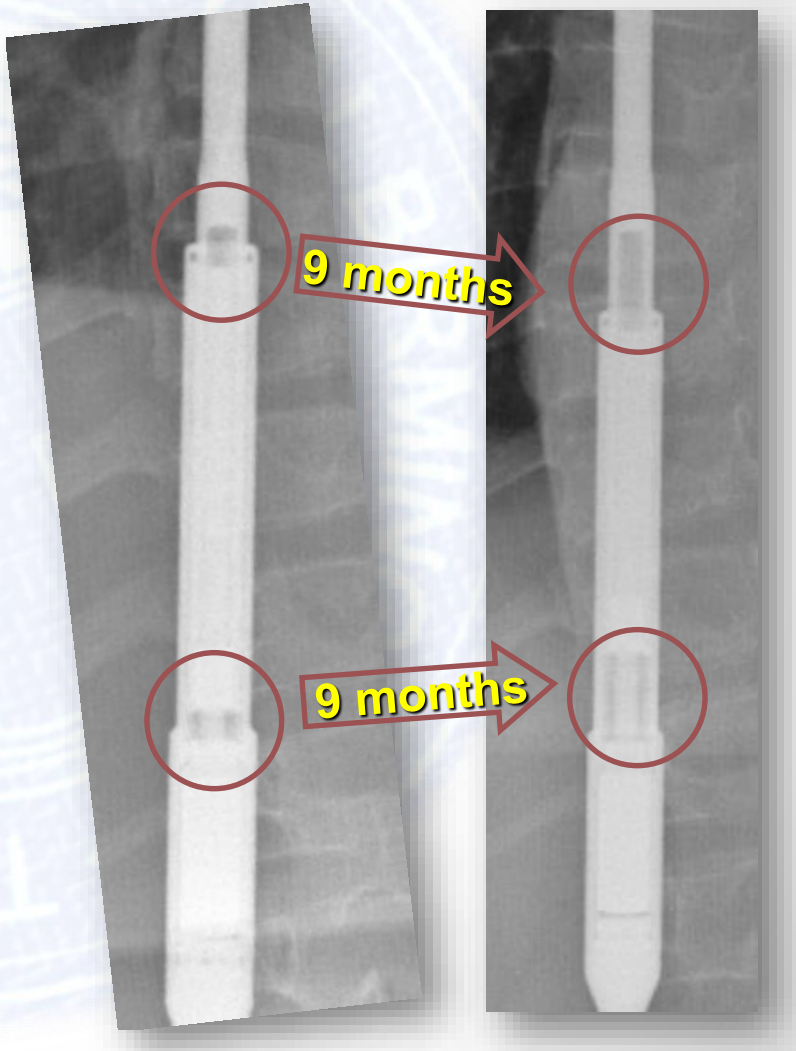
- Submaximal
- Normal T1/S1 1.62cm pa

Clunk

- Maximal distraction
- Torque at 230Nm
- Patient acceptance

Radiation exposure

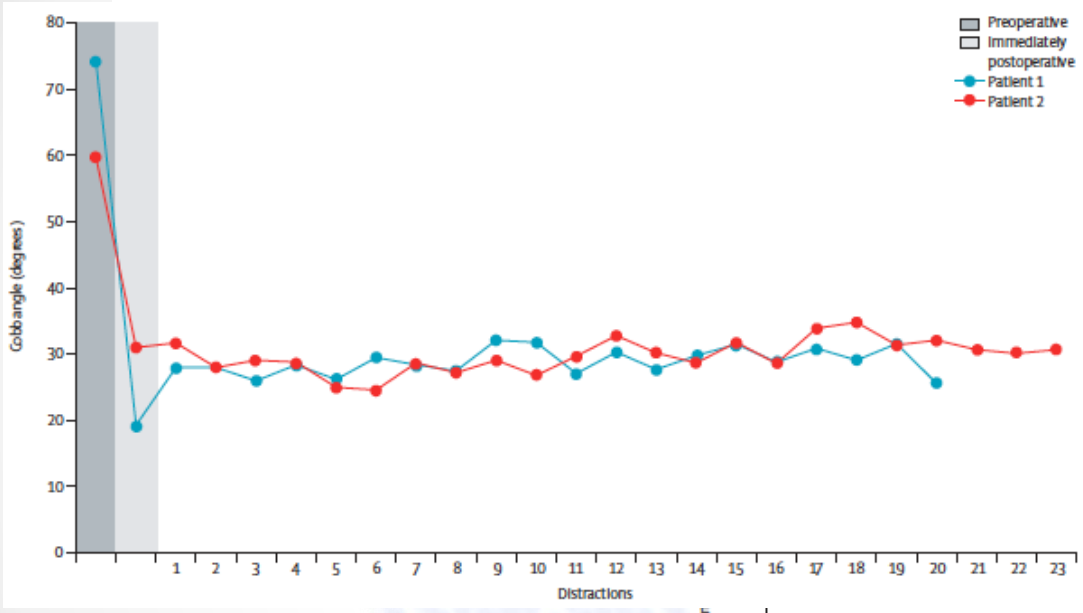




Magnetically controlled growing rods for severe spinal curvature in young children: a prospective case series

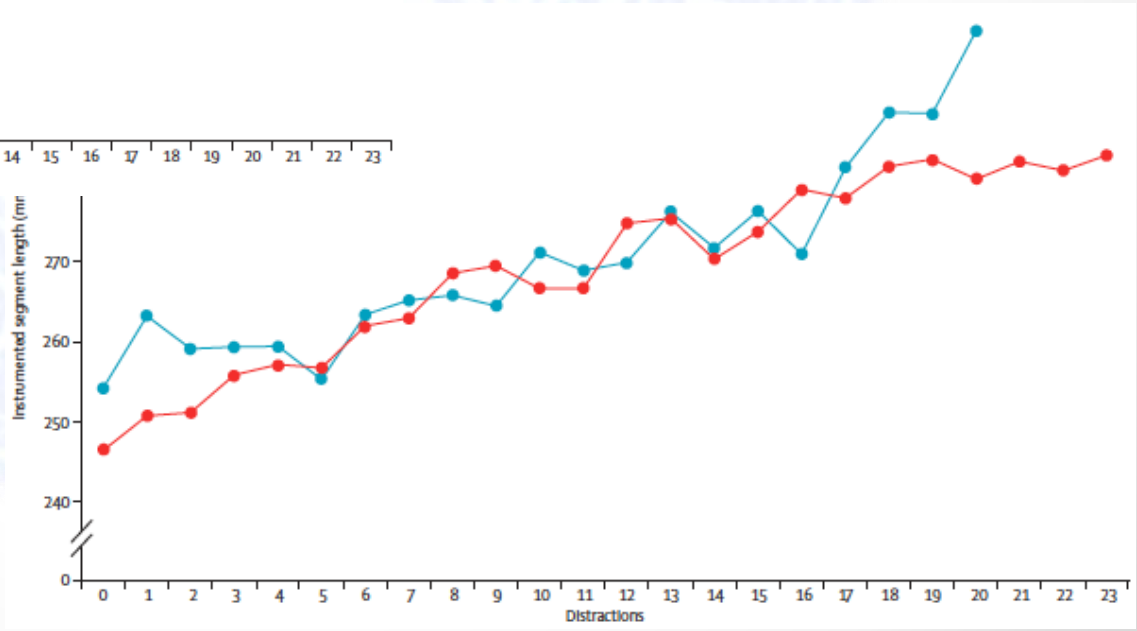
Kenneth Man-Chee Cheung, Jason Pui-Yin Cheung, Dino Samartzis, Kin-Cheung Mak, Yat-Wa Wong, Wai-Yuen Cheung, Behrooz A Akbarnia, Keith Dip-Kei Luk

www.thelancet.com Published online April 19, 2012



T1 S1

Cobb



Early experiences

	N	Curve correction	T1 S1 growth	FU
Cheung 2012	2	57%	46 mm	2 yr
Dannawi 2013	34	41%	44 mm	1 yr
Akbarnia 2013	14	48%	9 (single) 20 (dual)	10 mo
Hickey 2014	8	43%	6 mm / yr	23 mo

Jenks M, Craig J, Higgins J, et al. The MAGEC system for spinal lengthening in children with scoliosis: **A NICE Medical Technology Guidance.** *App Health Econ Health Policy 2014; 12: 587 - 99*

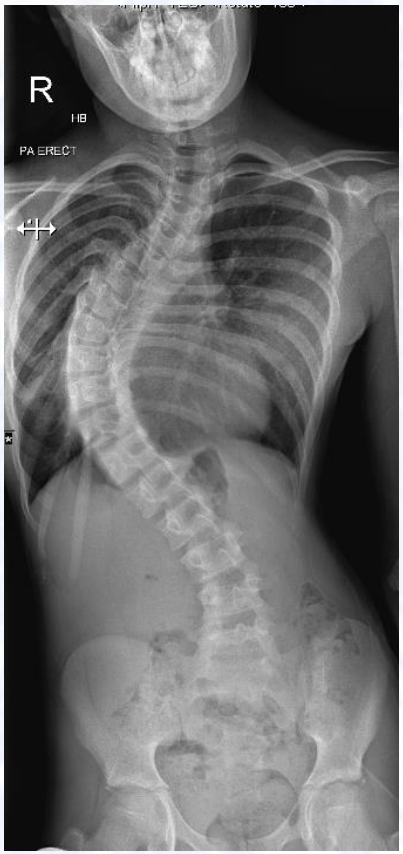
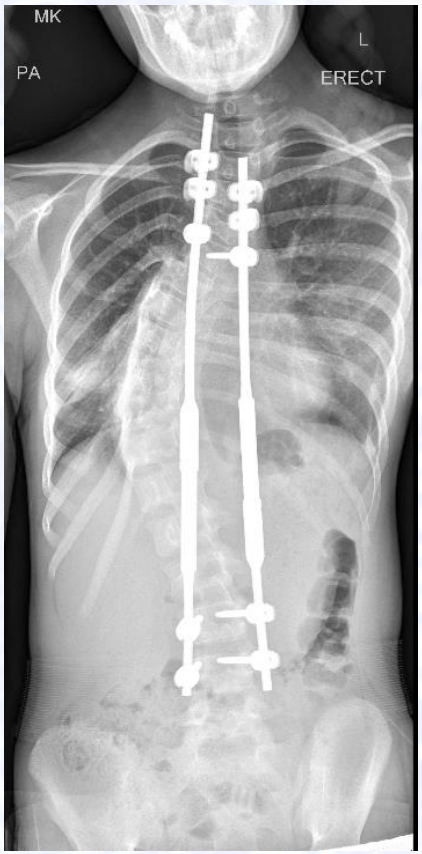
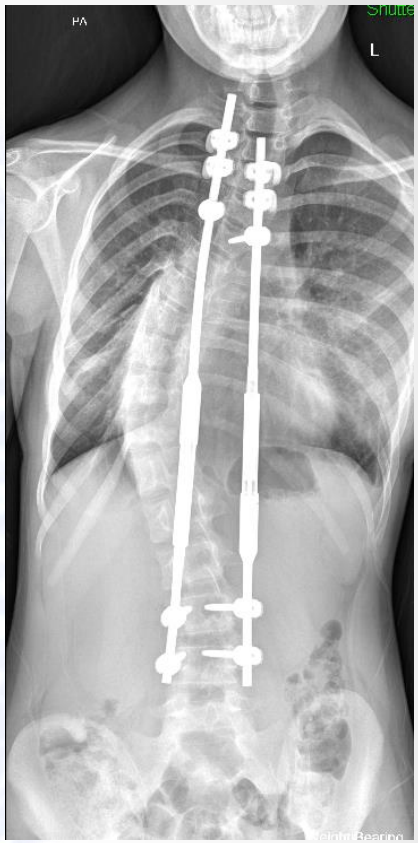
Usage			Complications [by % of Rods Implanted]			
Year	Patients Treated	Rods Implanted	Infection	Actuator Break	Rod Break	Failure to Distract
2012	39	74	0.0%	1.3%	0.0%	1.3%
2013	79	150	0.0%	1.3%	1.3%	0.0%
2014[#]	87	165	0.6%	0.0%	1.2%	1.2%
2015[#]	145	276	0.4%	0.0%	0.4%	4.7%

Indications

- EOS
- Skeletally immature
- Progression despite bracing

Contra-indication

- MRI requirements
- Approaching maturity

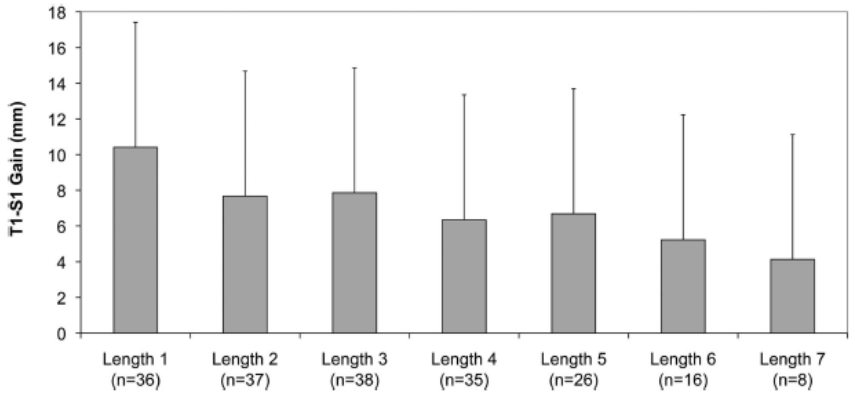
9 yr F	10 yr pre	10 yr post	6 mo, 2L
			
T1S1 *320*	**T1S1** *338*	**T1S1** *370*	**T1S1** *376*
Cobb 54	**Cobb** 66	**Cobb** 43	**Cobb** 43

MCGR: Benefits

- Non- invasive lengthening
- No anaesthesia
- Out-patient setting
- Better compliance
- Variable frequency

Law of diminishing returns

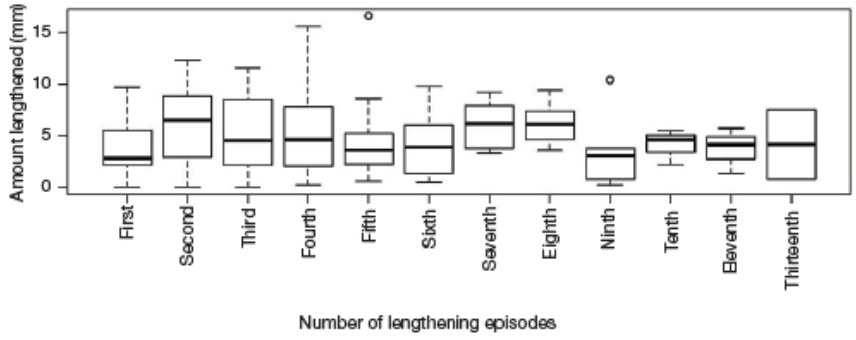
amount of length achieved decreases on repeated lengthening episodes



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

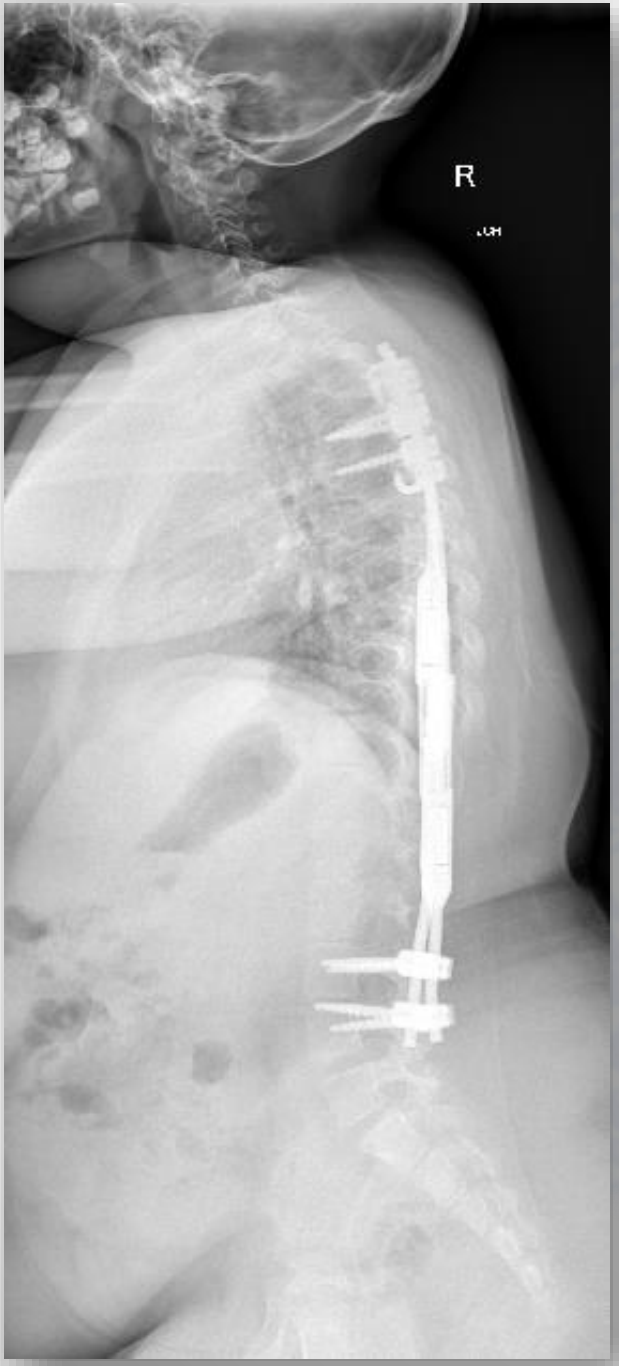
SPINE Volume 36, Number 10, pp 806–809



Does the law of diminishing returns apply to the lengthening of the MCGR rod in early onset scoliosis with reference to growth velocity?

Adrian Gardner, Alistair Beaven, David Marks, Jonathan Spilsbury, Jwalant Mehta, Matthew Newton Ede

J Spine Surg 2017;3(4):525-530



MCGR: Problems

- Very small & very large patients
- Sagittal profile
- Jammed rod (pin fracture)
- Metallosis
- MRI compatibility

Magnetically controlled growing rods: our experience of mechanical failure

- 2012 – 15 2 y follow up age 6 yr 10 mo
- 235 lengthening episodes
- Mechanical failures in 14 / 28
  - 6 final fusion
  - 8 more length
- True failures 8 / 28 (29%)

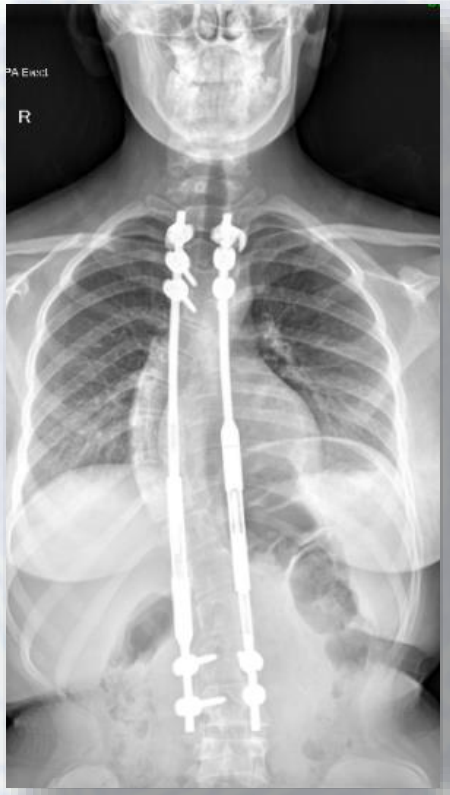
Definitive fusion

7 yrs

Thoracic 46º
Lumbar 40º
T1 S1 27.7 cm

12 yrs

Thoracic 25º
Lumbar 12º
T1 S1 31.2 cm



14 yrs

Thoracic 42º
Lumbar 11º
T1 S1 38.9 cm

15 yrs

Thoracic 21º
Lumbar 09º
T1 S1 38.6 cm

Multi-Center Assessment of Neurological Events in Distraction-Based Surgery for Early-Onset Scoliosis

- 748 TGR 5793 procedures
- Neurologic events 0.41% (24 / 5793)
- Permanent deficit 0.14% (8 / 5793)

Routine use of IOM for all GA procedures

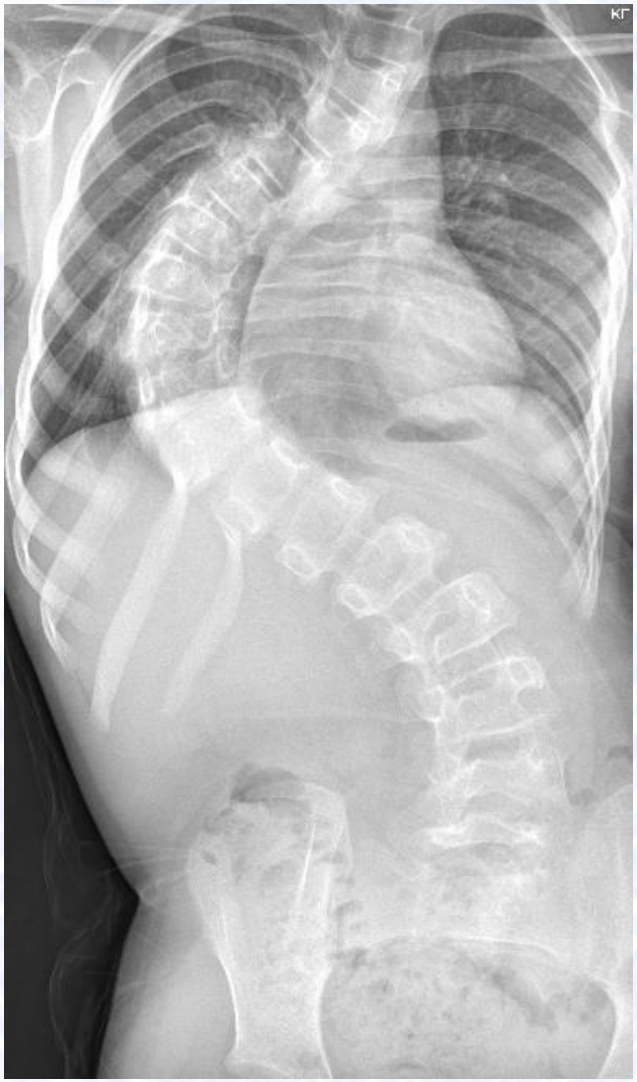
Matthew P. Newton Ede, Jeff B. Pawelek, David L. Skaggs, John B. Emans, Suken A. Shah, George H. Thompson, Adrian Gardner, Jwalant Mehta, David Marks
Growing Spine Study Group

4 / F

T1S1 252

Cobb 60

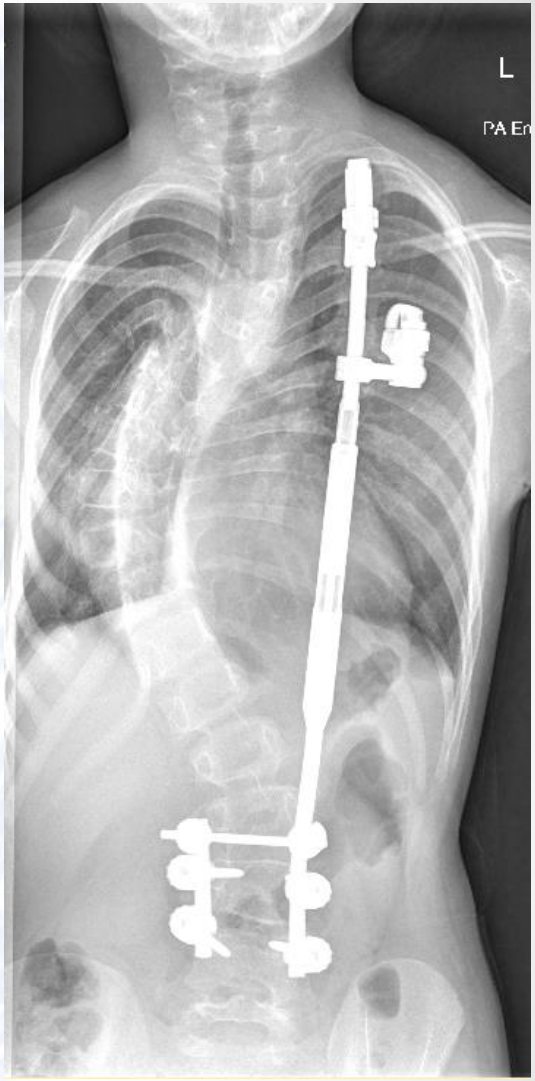
Pre



T1S1 269

Cobb 99

10 mo 3 L



T1S1 228

Cobb 65

New frontier today…….