# Early Onset Scoliosis Treated by Magnetically Controlled Growing Rods: Mid to Long-term Follow-up including 5 Graduates

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# Disclosures

• Nil





### Introduction

### Magnetically-controlled growing rods (MCGR)

- Non-invasive distractions done at out-patient clinic
- No anaesthesia needed for distractions
- More frequent distractions to mimic normal spinal growth
- Potential cost-saving benefit at 4yrs
  - Wong JOS 2017



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



Lancet 2012; 379: 1967-74

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





### Objective

- Most of the literature is based on short-term follow-up
- Behavior at mid to long-term FU not clarified

#### <u>Aim</u>:

 Minimum 4 years follow-up of EOS patients with MCGR treatment
Outcomes of MCGR graduates





# Methods

- Prospective EOS study
- Single and dual MCGRs since December 2009
- At least 4 years post-implantation FU
- Intended 2 mm distraction length monthly
- Parameters
- Coronal & Sagittal Cobb Angle
- T1-12, T1-S1, instrumented length
- Expected vs Achieved lengthening
- Statistical Analysis
- Wilcoxon Signed Rank Test
- *P*-value of < 0.05 considered significant





# Results

- 10 patients (M:3 and F:7)
  - Idiopathic: 4
  - Congenital: 1 (conversion from TGR)
  - Syndromal: 3
  - Neurofibromatosis: 2
- Mean
  - Age at diagnosis: 6.3 ± 4.7 yrs
  - Age at rod implantation: 10.1 ± 3.5 yrs
  - FU 6.1 ± 1.3 yrs
  - Distractions: 40.1 ± 20.7





	Preoperative	Immediate post- operative	1-year	2-year	3-year	4-year	<i>P</i> -value
Age (years)	10.1±3.5		11.1±3.4	12.1±3.4	13.1±3.4	14.1±3.4	
Height (cm)	130.9±12.3		135.9±15.2	136.9±12.1	141.0±18.4	143.4±9.9	0.002
Coronal Cobb angle (°)	58.2±9.2	27.7±7.2	28.7±7.8	31.7±11.3	34.1±12.3	30.5±10.5	<0.001
Sagittal Cobb angle (°)	34.9±22.1	21.5±11.0	30.7±31.3	33.3±21.0	25.0±15.6	28.0±15.2	0.20
T1-12 length (mm)	200.2±24.4	207.1±24.9	220.0±25.2	221.1±30.5	227.4±28.7	229.8±21.3	0.001
T1-S1 length (mm)	327.1±35.4	342.8±44.7	352.5±41.5	361.1±44.1	370.8±38.0	378.2±40.0	<0.001
Instrumented length (mm)		226.8±43.4	238.7±40.4	243.2±45.3	250.7±36.1	287.9±55.9	0.005
Left rod expected lengthening (mm)		2.2±0.8	20.5±3.1	35.0±21.1	30.1±14.3	45.5±16.7	0.001
Right rod expected lengthening (mm)		2.1±0.7	20.5±4.3	31.2±18.8	40.0±15.8	55.4±16.7	<0.001
Left rod achieved lengthening (mm)		1.9±0.7	18.2±6.5	22.2±12.1	23.9±7.6	36.6±10.8	<0.001
Right rod achieved lengthening (mm)		2.3±0.9	14.5±7.1	22.0±7.9	21.9±7.9	33.2±9.5	<0.001

Change in Coronal and Sagittal Cobb Angle – Pre-op to 4 years Post-op



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Subgroup analyses

- Younger 5.8 ±1.2yrs vs older 12.0 ±2.1yrs
- Younger group had more length gain before first rod exchange
  - 34.1 ± 4.2mm vs 28.8 ±15mm
- Duration of distraction
  - 31.6 ±13.7mths vs 25.7 ±16.3mths





# Revision/complications

- 7 patients had one rod exchange
- Complication rate (40% of patients)
  - PJK (n=2)
  - Distraction failure (n=3)
  - Infection (n=1)
  - Nonunion of proximal foundation (n=1)
  - Metallosis (n=6)





### Pre- and Post-final Surgery Parameters for MCGR Graduates

	Coronal Cobl angle (°)	b Sagittal Cobb angle (°)	T1-12 spine length (mm)	e T1-S1 spine length (mm)						
Final fusion (n=4)										
Pre-final fusion	37.1±11.1	30.6±21.9	244.4±37.6	385.7±56.0						
Post-final fusion	30.0±8.9	31.1±20.8	251.2±40.7	405.7±40.4						
2-year post-final fusion	34.0±11.4	29.4±25.1	253.8±26.8	405.9±49.0						
<i>p</i> -value	0.273	0.068	0.273	0.715						
Rod explant without fusion (n=1)										
Pre-explant	52.2	49.6	200.6	328.1						
Post-explant	58.6	44.6	191.1	332.7						
2-year post-explant	58.4	40.9	199.7	336.8						
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### Discussion

- Consistent rod and spine length gains are observed
  - Do not expect full 4.8cm lengthening
- Diminishing returns after certain rod usage
- Complications and re-operation rates are high due to rod distraction failure and proximal functional problems
- MCGR graduates have limited correction during final surgery
- Possible rod explant without fusion





# Thank You



