

The Best Distraction Frequency for Optimizing Spine and Rod Length Gains with Magnetically Controlled Growing Rods

Jason Pui Yin Cheung, Karen Yiu, Kenneth MC Cheung,
Scott Luhmann, Charles Johnston, Peter Sturm, Jeff Pawelek, GSSG

Division of Spine Surgery
Department of Orthopaedics and Traumatology
The University of Hong Kong



Department of Orthopaedics and Traumatology, The University of Hong Kong
香港大學矯形及創傷外科學系



Disclosures

- Nil for **Jason Cheung, Karen Yiu and Kenneth Cheung**
- **Scott Luhlmann:** Nuvasive, Medtronic Sofamor Danek, Stryker, Orthopediatrics, Globus Medical, Wolters Kluwer
- **Charles Johnson:** Orthopedics journal of children's orthopaedics, POSNA, SRS, Medtronic Sofamor Danek, Saunders/Mosby-Elsevier
- **Peter Sturm:** Journal of Children's Orthopaedics, SRS, POSNA, Biomet, Nuvasive, Depuy Synthes, Medtronic, DePuy, Depuy Spine, DePuy, A Johnson & Johnson Company, Ellipse Technologies, Medtronic Sofamor Danek
- **Jeff Pawelek:** San Diego Spine Foundation, GSF, Nuvasive



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



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

Lancet 2012; 379: 1967-74



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Distraction frequency

- **Highly variable**

Spine (Phila Pa 1976). 2017 Jun 27. doi: 10.1097/BRS.0000000000002297. [Epub ahead of print]

Unplanned Reoperations in Magnetically Controlled Growing Rod Surgery for Early Onset Scoliosis with a Minimum of Two-Year Follow-Up.

Kwan KYH¹, Alanay A, Yazici M, Demirkiran G, Helenius I, Nnadi C, Ferguson J, Akbarnia BA, Cheung JPY, Cheung KMC.

- **1 week to 2 months 71% reoperation**
- **3-6 months 25% reoperation**
- **Length gain?**

Aim: To determine the distraction frequency that will achieve the most spine and rod lengthening



Methods

- Utilize the Growing Spine Study Group (GSSG) database
- Multicenter prospective data
- EOS patients with MCGR and at least 1yr FU

- Parameters
 - Coronal & Sagittal Cobb Angle
 - T1-12, T1-S1
 - Expected vs Achieved lengthening
 - Distraction frequency and amount

- Divided into 2 groups based on distraction frequency:
 - ≤ 3 times in 1 year
 - > 3 times in 1 year
 - (~36% of overall cohort for 3 or 4 months)



Results

- **119 patients (F: 57.1%)**
 - 65 reached 2 year FU
- **Mean**
 - **Age 7.1 ± 2.3 years**
 - **FU 18.4 ± 3.5 months**
- **Surgeries 1.3 ± 0.7**
- **Distraction 6.3 ± 2.8 times**
 - **Distraction 2.7 ± 0.5 times (distraction ≤ 3 times)**
 - **Distraction 4.8 ± 1.8 times (distraction >3 times)**



Post-op to Month 12

	≤ 3 times	> 3 times	P-value
Height	120.50 ± 18.22	119.57 ± 24.67	0.86
Cobb Angle	46.31 ± 17.92	44.55 ± 17.49	0.73
T1-12	196.82 ± 29.24	192.48 ± 30.63	0.65
T1-S1	314.91 ± 39.67	312.66 ± 44.96	0.87
Instrumental Length	295.17 ± 49.83	284.75 ± 52.33	0.52
Left Rod			
Expected Length	10.13 ± 3.12	11.36 ± 6.15	0.51
Achieved Length	4.63 ± 2.38	4.11 ± 4.35	0.39
Right Rod			
Expected Length	10.14 ± 3.11	11.25 ± 6.46	0.51
Achieved Length	4.77 ± 2.58	4.00 ± 4.48	0.39

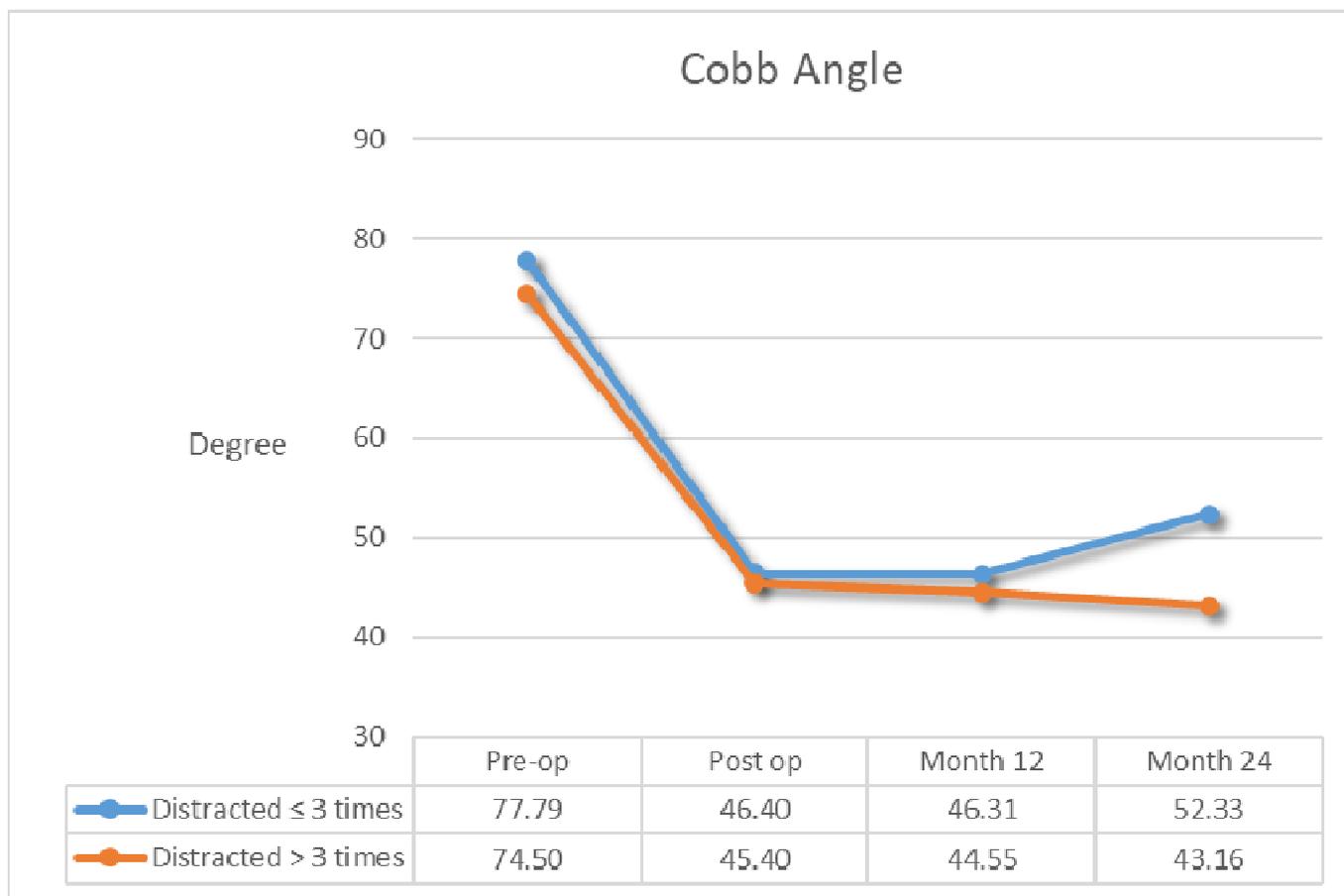


Month 12 to Month 24

	≤ 3 times	> 3 times	P-value
Height	119.58 ± 32.75	126.09 ± 22.34	0.45
Cobb Angle	52.33 ± 18.13	42.16 ± 16.30	0.31
T1-12	189.88 ± 26.12	201.13 ± 24.12	0.43
T1-S1	294.16 ± 33.10	321.84 ± 47.39	0.19
Instrumental Length	305.20 ± 27.81	284.87 ± 59.56	0.34
Left Rod			
Expected Length	7.42 ± 4.68	13.37 ± 6.03	0.004
Achieved Length	3.53 ± 1.12	3.66 ± 1.67	0.75
Right Rod			
Expected Length	6.60 ± 4.70	13.90 ± 6.56	0.008
Achieved Length	3.50 ± 1.47	3.62 ± 1.68	0.81



Change in Cobb Angle – Pre-op to 24 Months Post-op

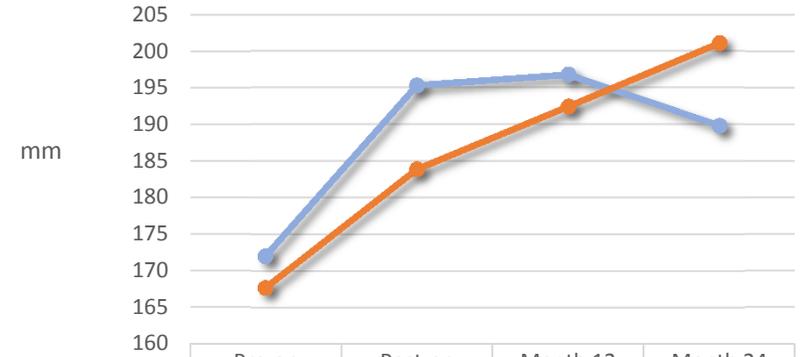


Body Height



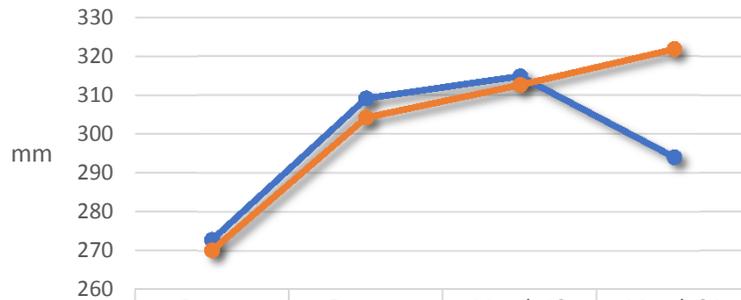
	Pre-op	Post-op	Month 12	Month 24
Height Distracted \leq 3 times	113.72	116.83	120.49	119.58
Height Distracted $>$ 3 times	115.48	118.50	119.57	126.09

Length of T1 - T12



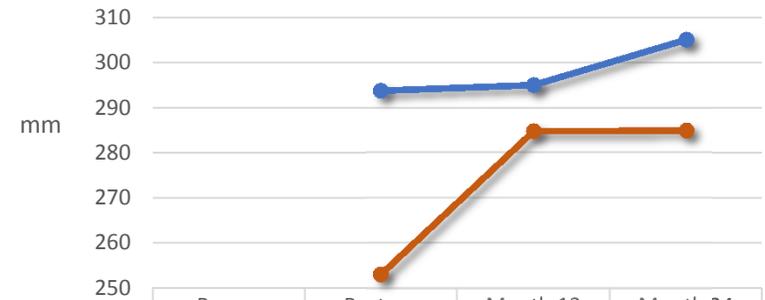
	Pre-op	Post-op	Month 12	Month 24
T1-12 Distracted \leq 3 times	172.09	195.37	196.82	189.88
T1-12 Distracted $>$ 3 times	167.77	183.92	192.48	201.13

Length of T1 - S1



	Pre-op	Post-op	Month 12	Month 24
T1-S1 Distracted \leq 3 times	272.93	309.27	314.91	294.16
T1-S1 Distracted $>$ 3 times	270.23	304.34	312.65	321.84

Instrumented Length



	Pre-op	Post-op	Month 12	Month 24
Instrumented length Distracted \leq 3 times		293.89	295.17	305.20
Instrumented length Distracted $>$ 3 times		253.08	284.75	284.87

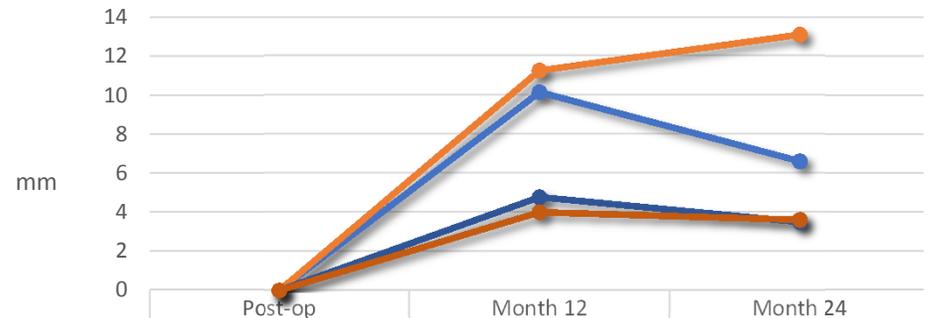


Left Rod - Expected vs Achieved



	Post-op	Month 12	Month 24
Expected Lengthening Distracted ≤ 3 times	0.00	10.13	7.42
Expected Lengthening Distracted > 3 times	0.00	11.36	13.37
Achieved Lengthening Distracted ≤ 3 times	0.00	4.63	3.53
Achieved Lengthening Distracted > 3 times	0.00	4.11	3.66

Right Rod- Expected vs Achieved



	Post-op	Month 12	Month 24
Expected Lengthening Distracted ≤ 3 times	0.00	10.14	6.60
Expected Lengthening Distracted > 3 times	0.00	11.25	13.09
Achieved Lengthening Distracted ≤ 3 times	0.00	4.77	3.50
Achieved Lengthening Distracted > 3 times	0.00	4.00	3.62



Discussion

- **Most significant Cobb angle correction occurs in the index operation and is stable regardless of distraction frequency**
- **Increased distractions tend to lead to more spine and rod lengthening**
- **Expected vs achieved distraction lengths do not match**

