

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

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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, Alanav 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

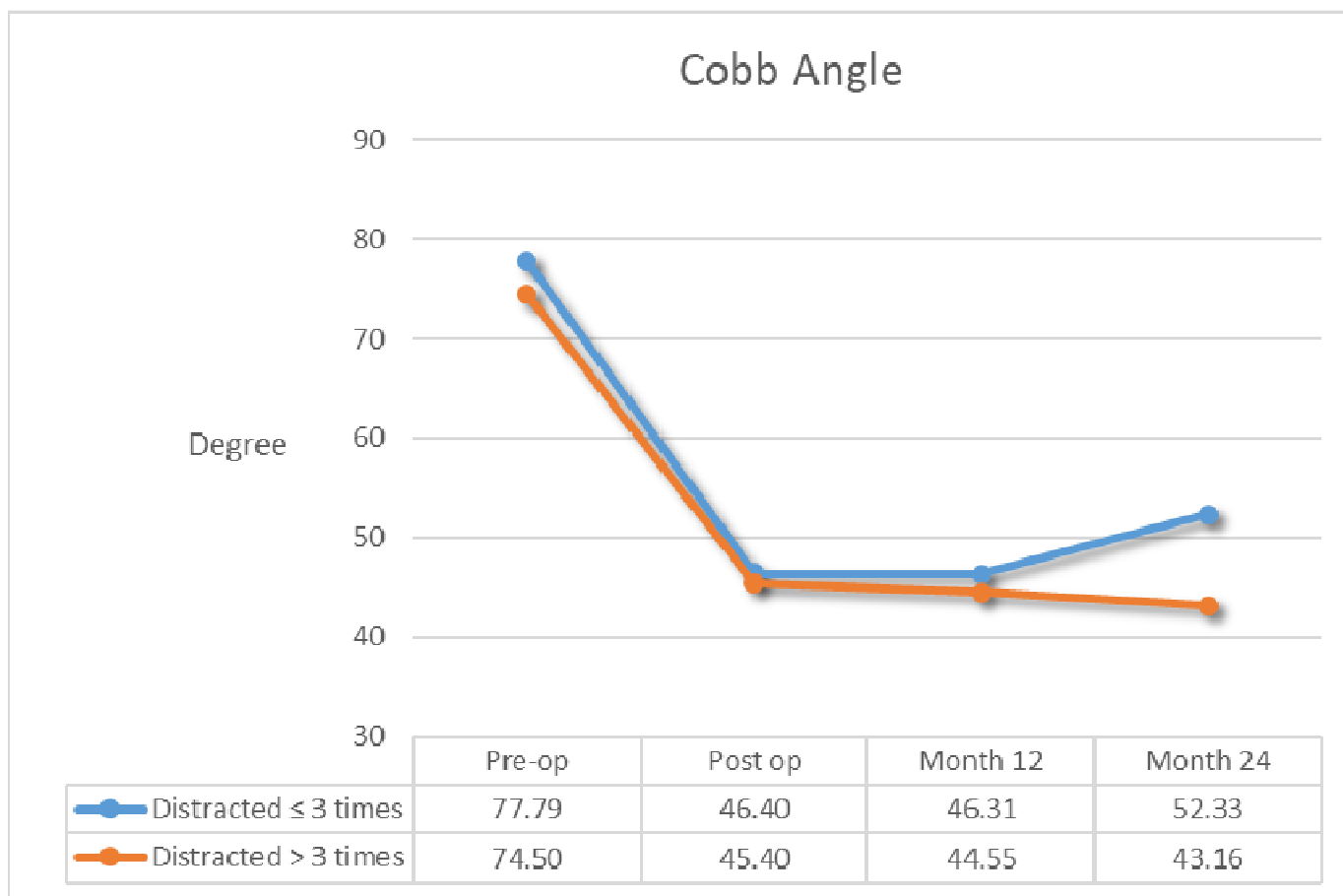


Month 12 to Month 24

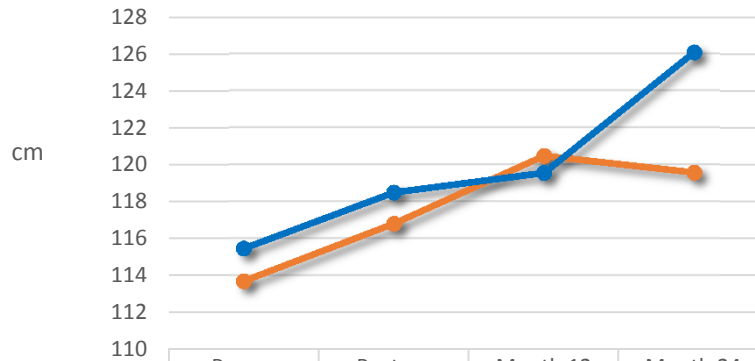
	≤ 3 times	> 3 times	P-value
Height	119.58 ± 32.75	126.09 ± 22.34	0.45
Cobb Angle	52.33 ± 18.13	42.16 ± 16.30	0.31
T1-12	189.88 ± 26.12	201.13 ± 24.12	0.43
T1-S1	294.16 ± 33.10	321.84 ± 47.39	0.19
Instrumental Length	305.20 ± 27.81	284.87 ± 59.56	0.34
Left Rod			
Expected Length	7.42 ± 4.68	13.37 ± 6.03	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

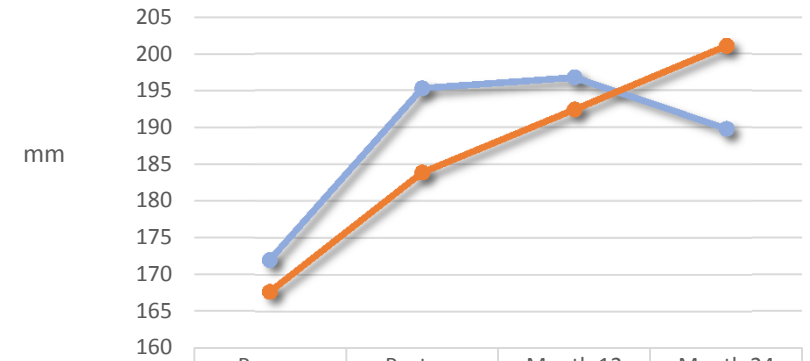


Body Height



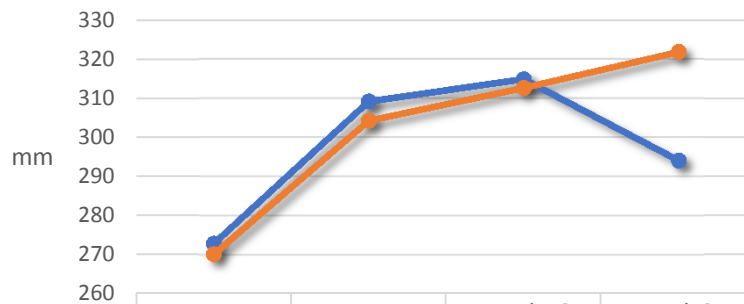
Height Distracted ≤ 3 times	Pre-op	Post-op	Month 12	Month 24
	113.72	116.83	120.49	119.58
Height Distracted > 3 times	Pre-op	Post-op	Month 12	Month 24
	115.48	118.50	119.57	126.09

Length of T1 - T12



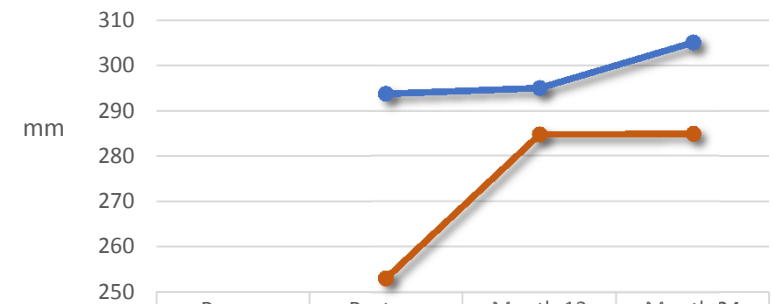
T1-12 Distracted ≤ 3 times	Pre-op	Post-op	Month 12	Month 24
	172.09	195.37	196.82	189.88
T1-12 Distracted > 3 times	Pre-op	Post-op	Month 12	Month 24
	167.77	183.92	192.48	201.13

Length of T1 - S1



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

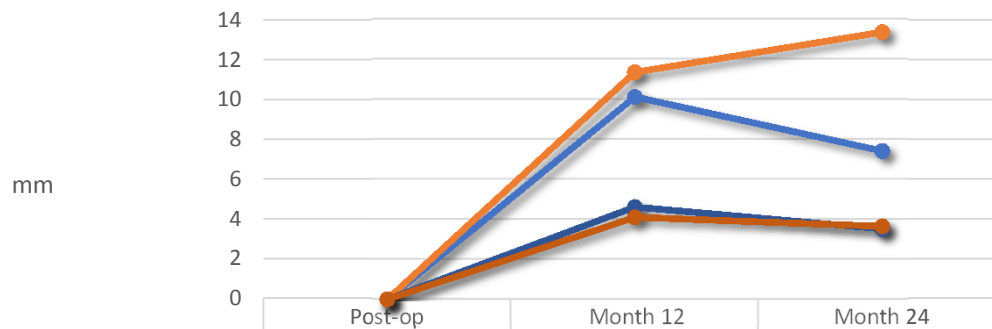
Instrumented Length



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

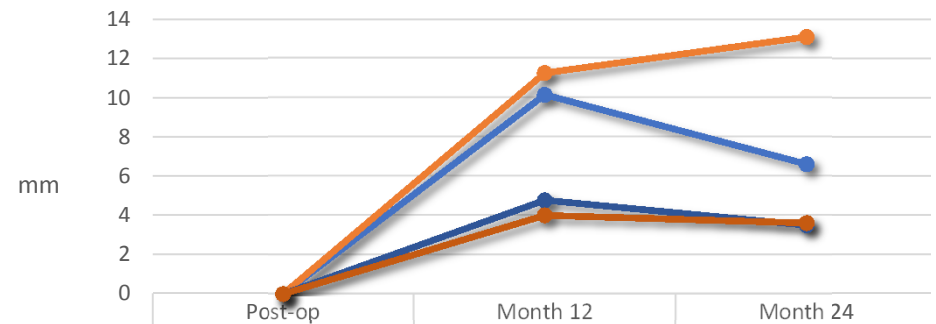


Left Rod - Expected vs Achieved



	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**

