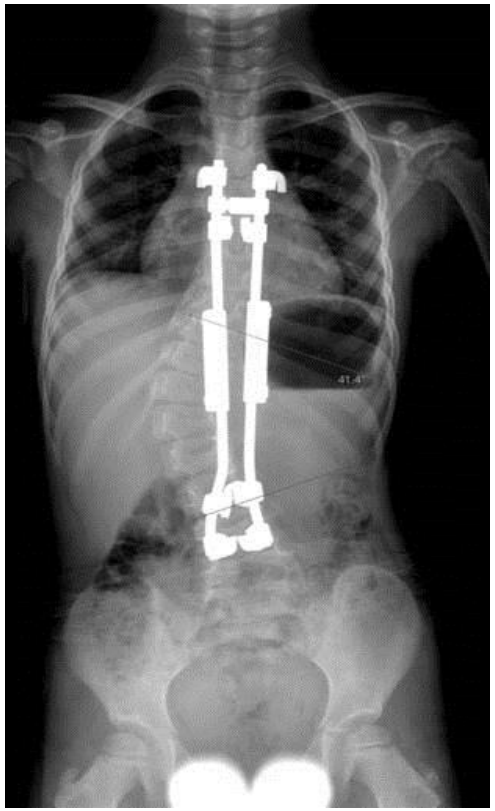
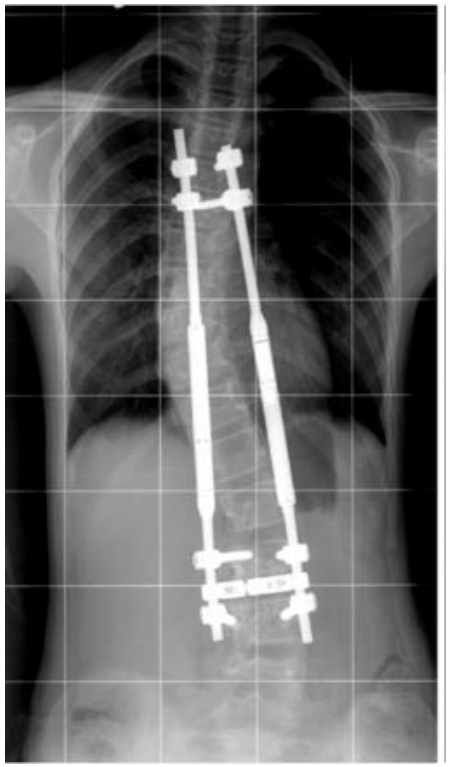
MCGR debate

Drive growth vs Match growth





Kenneth Cheung

Jessie Ho Professor in Spine Surgery

Chair Professor and Head

Disclosures

- Nuvasive (speaker and research support)
- AOSpine (speaker)

- *This talk is given in the spirit of a debate…..*

Definition

- Drive growth
  - Lenthening of rod(s) until “clunking occurs” at an interval of more that 4 months.

- Match growth
  - Lengthening by a pre-determined amount
    - Dimeglio growth charts
    - Tail-gating principle

Content

- Why match growth?
  - It makes sense
    - Physiological
  - It works!
    - Longest follow-up
  - Law of reducing length gains
- Why NOT drive growth?
  - Length gain never as much as expected
  - Damage leads to fusion?
  - Clunking and metallosis
  - Unpredictable

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Growing rods!
Why follow old ways when you can more closely mimic physiology?

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Articles

Lancet - *19 April 2012*

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

First surgery in 2009 at Age 7

Age 16 with 9 years of follow-up…

Mean 6-Year Follow-up of Magnetically Controlled Growing Rod Patients With Early Onset Scoliosis: A Glimpse of What Happens to Graduates

Jason Pui Yin Cheung, MBBS, MMedSc, MS, FHKCOS, FHKAM(Orth), FRCS(Edin)
Karen Yiu, MSc
Kenny Kwan, FHKCOS, FHKAM, FRCSEd
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Received, March 13, 2018.
Accepted, May 22, 2018.

BACKGROUND: There is no agreement on frequency of distractions of magnetically controlled growing rods (MCGRs) but more frequent and smaller amounts of distractions mimic physiological spine growth. The mid- to long-term follow-up and management at skeletal maturity is unknown.
OBJECTIVE: To analyze patients with mean 6 yr of follow-up and describe the fate of MCGR graduates.
METHODS: Early onset scoliosis (EOS) patients treated with MCGRs with minimum 4 yr of follow-up and/or at graduation were studied. Parameters under study included Cobb angle, spine and instrumented lengths, and rod distraction gains. Relationship between timing of rod exchanges with changes in rate of lengthening was studied.
RESULTS: Ten EOS patients with mean 6.1 yr of follow-up were studied. The greatest Cobb angle correction occurred at the initial implantation surgery and was stable thereafter. Consistent gains in T1-12, T1-S1, and instrumented segment were observed. Rate of
No clinically significant curve progression was observed for rod removal only. All postfinal surgery parameters remained similar at postoperative 2 yr.
CONCLUSION: This study provides an outlook of the end of MCGR treatment. Although this is a fusionless procedure, instrumented segments do experience stiffness limiting further correction and length gain during final surgery whether fusion or rod removal is performed.

KEY WORDS: Magnetically controlled growing rod, MCGR, early onset scoliosis, EOS, graduate

Neurosurgery 0:1–12, 2018 DOI:10.1093/neuros/nyy270 www.neurosurgery-online.com

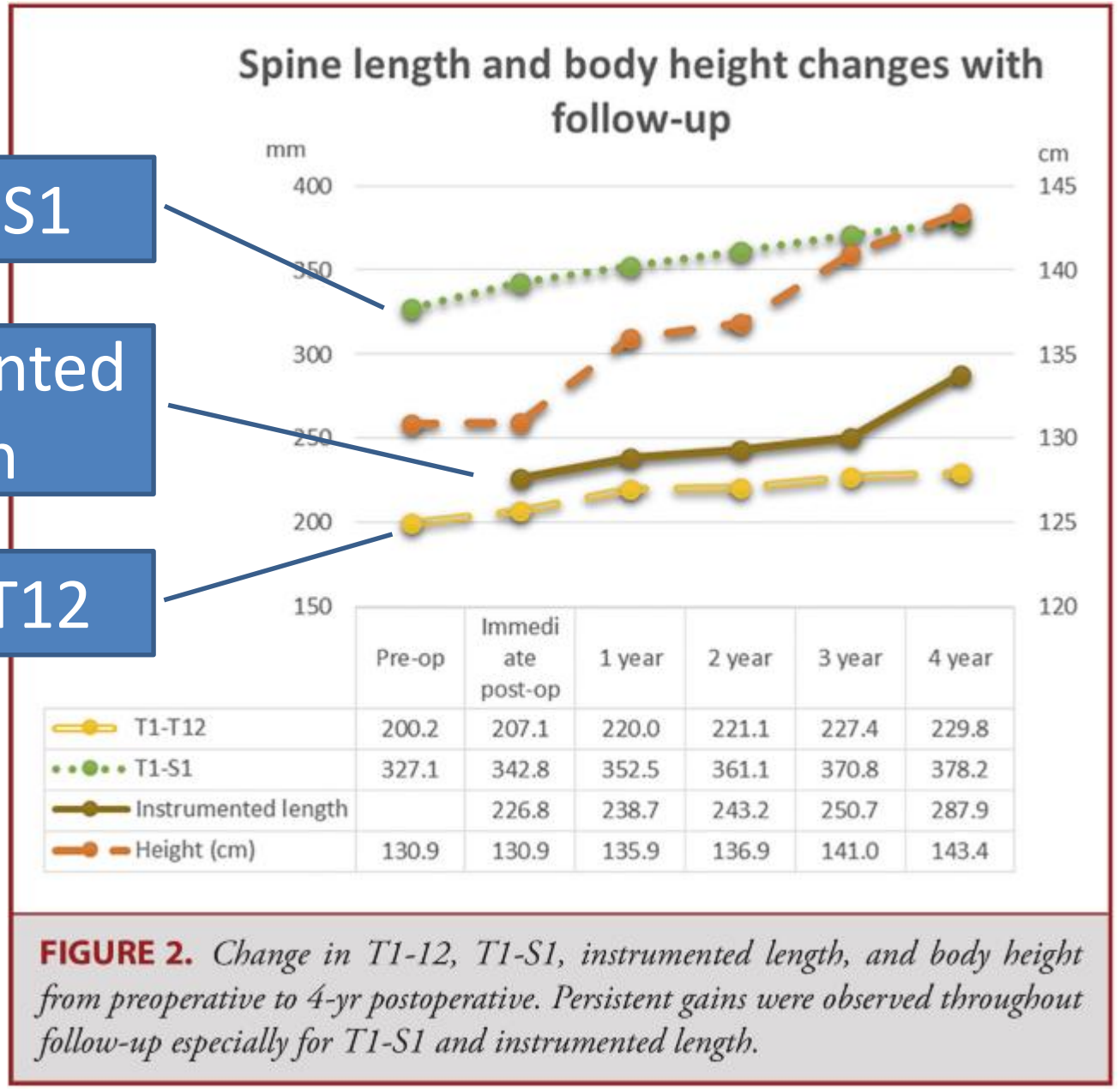
Ten EOS patients with mean 6.1 yr of follow-up

Cheung et al. Neurosurgery 2018

T1-S1

Instrumented length

T1-T12



	Pre-op	Immediate post-op	1 year	2 year	3 year	4 year
T1-T12	200.2	207.1	220.0	221.1	227.4	229.8
T1-S1	327.1	342.8	352.5	361.1	370.8	378.2
Instrumented length		226.8	238.7	243.2	250.7	287.9
Height (cm)	130.9	130.9	135.9	136.9	141.0	143.4

FIGURE 2. *Change in T1-12, T1-S1, instrumented length, and body height from preoperative to 4-yr postoperative. Persistent gains were observed throughout follow-up especially for T1-S1 and instrumented length.*

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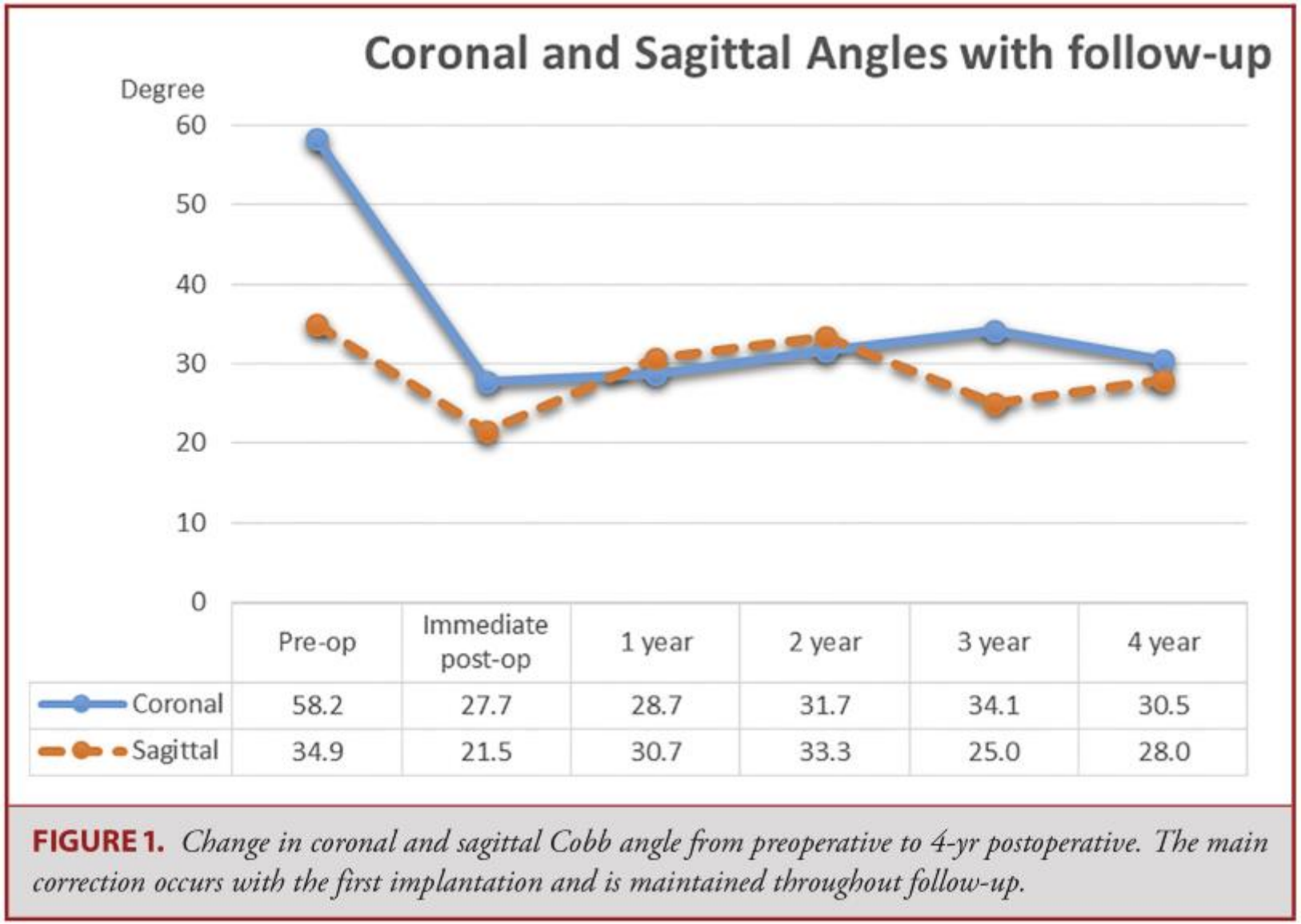

FIGURE 1. *Change in coronal and sagittal Cobb angle from preoperative to 4-yr postoperative. The main correction occurs with the first implantation and is maintained throughout follow-up.*

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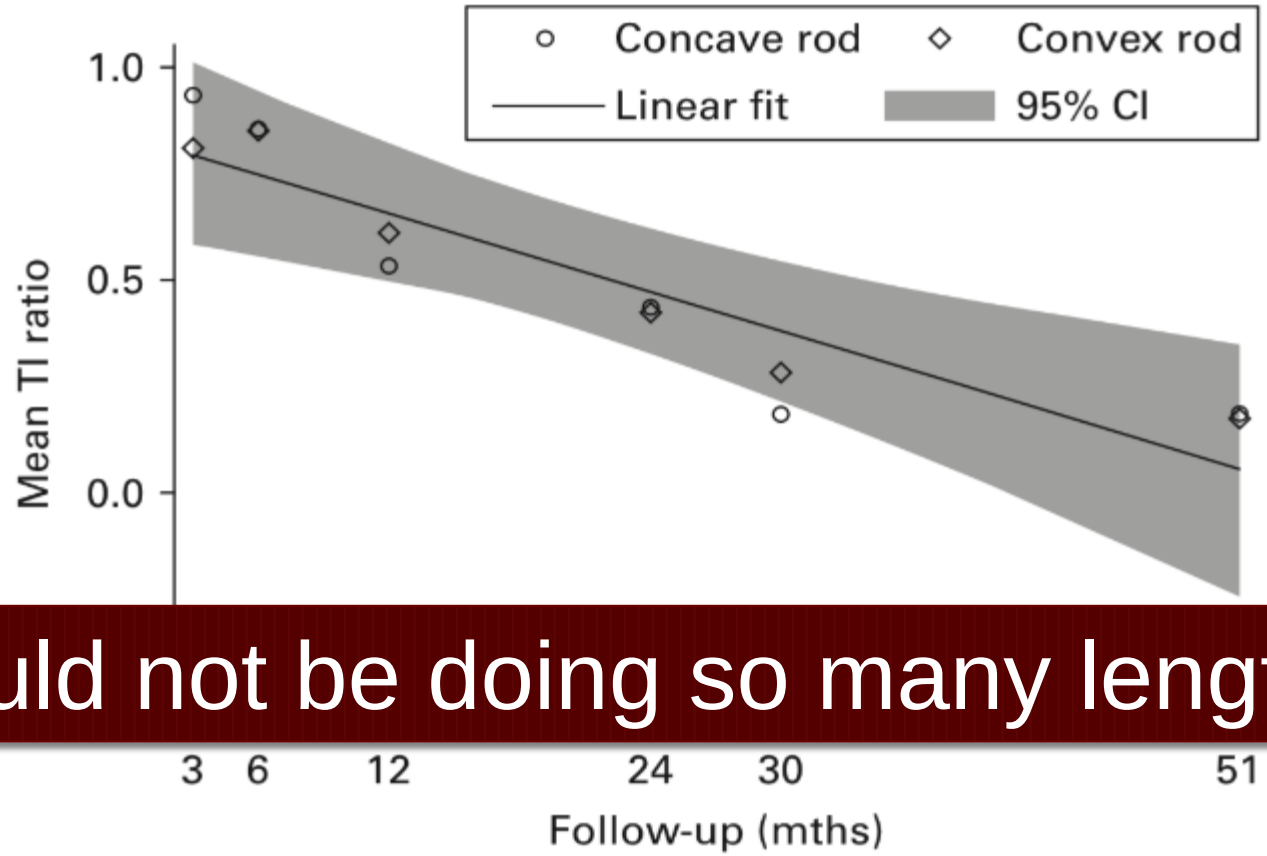
■ SPINE

Quantifying the 'law of diminishing returns' in magnetically controlled growing rods

A. Ahmad,
T. Subramanian,
P. Panteliadis,
J. Wilson-Macdonald,
D A. Rothenfluh,
C. Nnadi

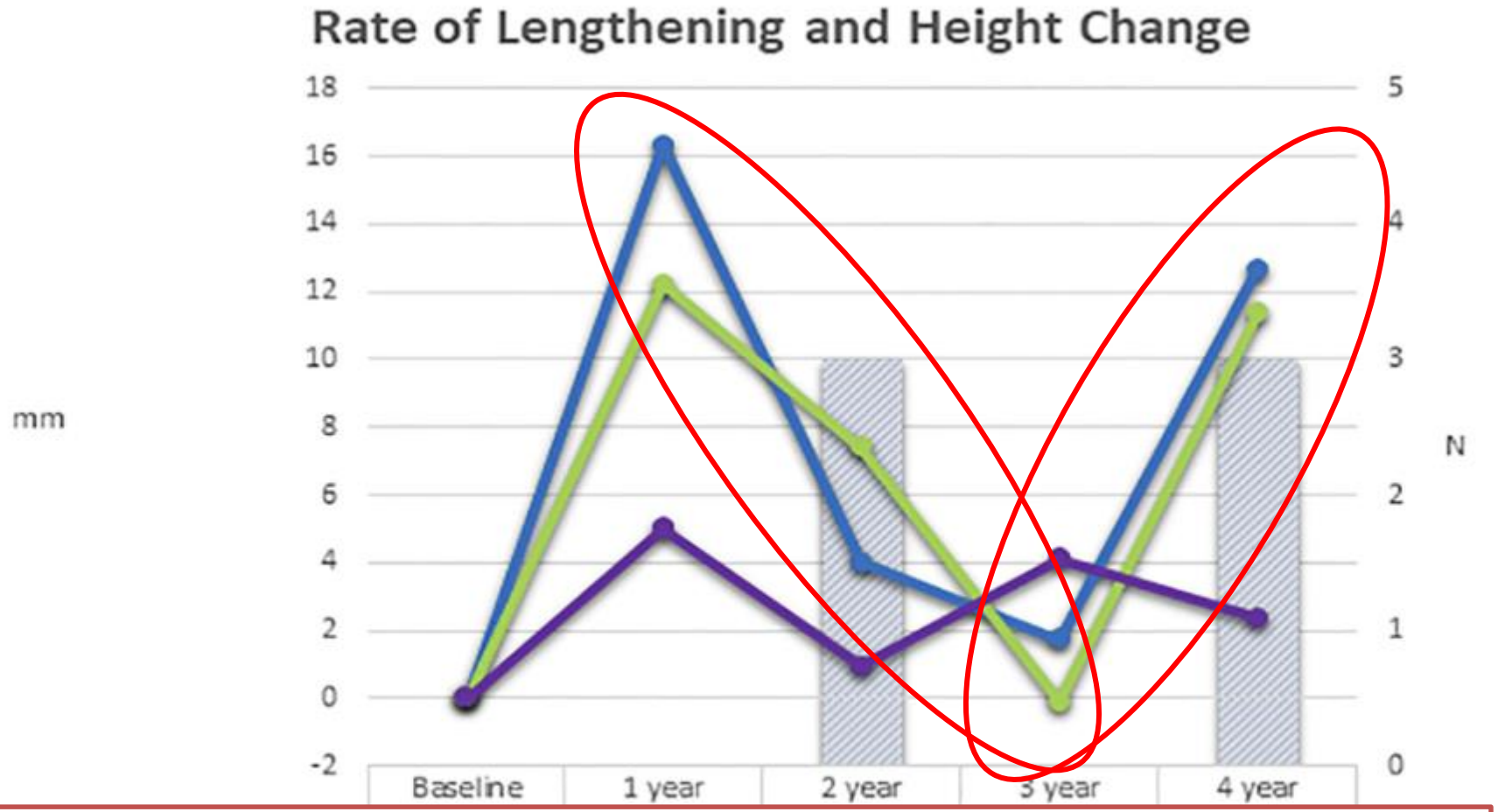
From Oxford University Hospitals NHS Trust, Oxford, United Kingdom



We should not be doing so many lengthenings?

Ahmad et al.
BJJ 2018

C



Diminished rate of lengthening over time due to rod factors and not patient factors

Cheung et al. Neurosurgery 2018

Spine Deformity
www.spine-deformity.org

Spine Deformity 6 (2018) 787–790

Maximal Force Generated by Magnetically Controlled Growing Rods Decreases With Rod Lengthening

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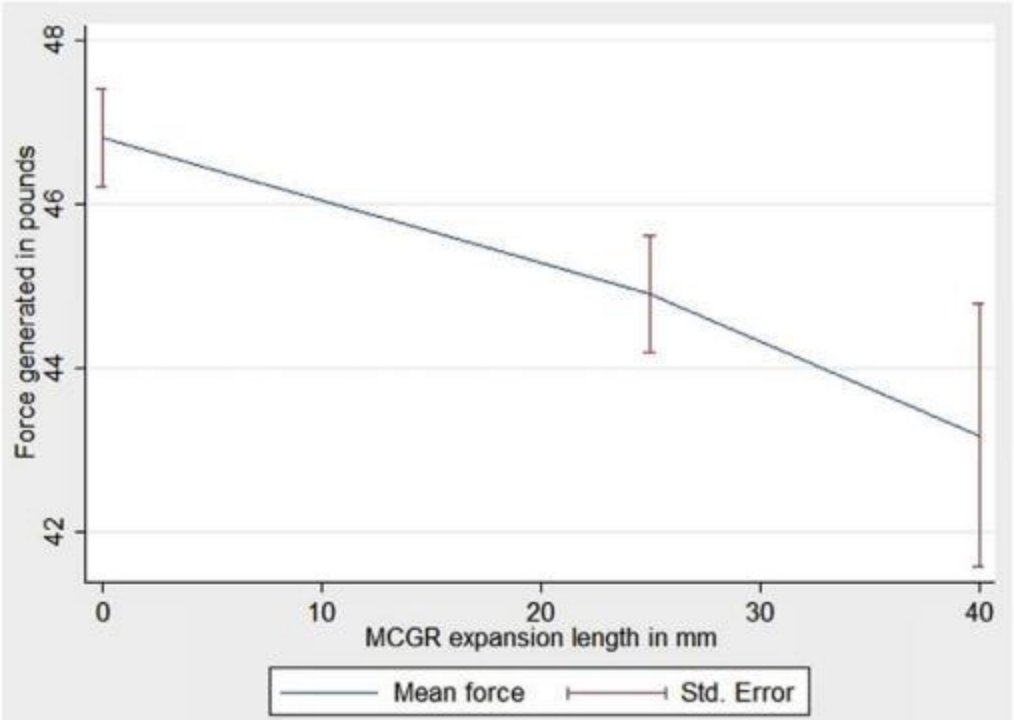

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  - Length gain never as much as expected
  - Damage leads to fusion?
  - Clunking and metallosis
  - Unpredictable

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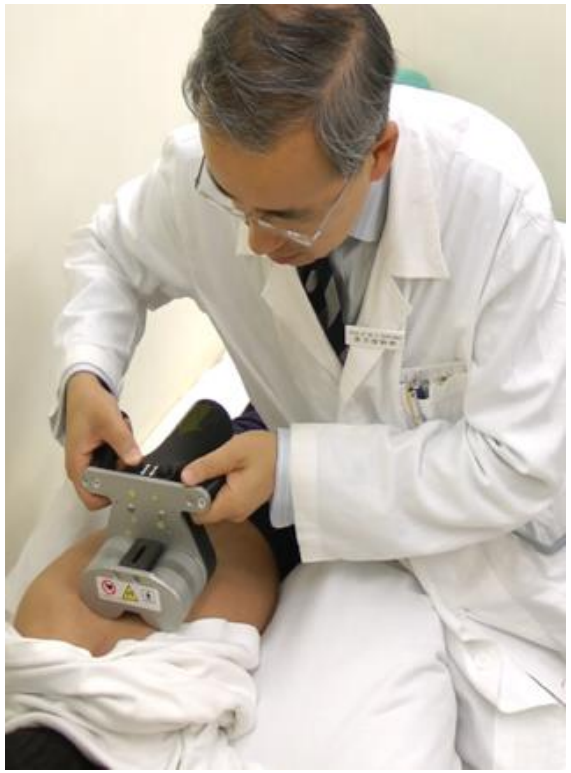
J Pediatr Orthop • Volume 38, Number 3, March 2018

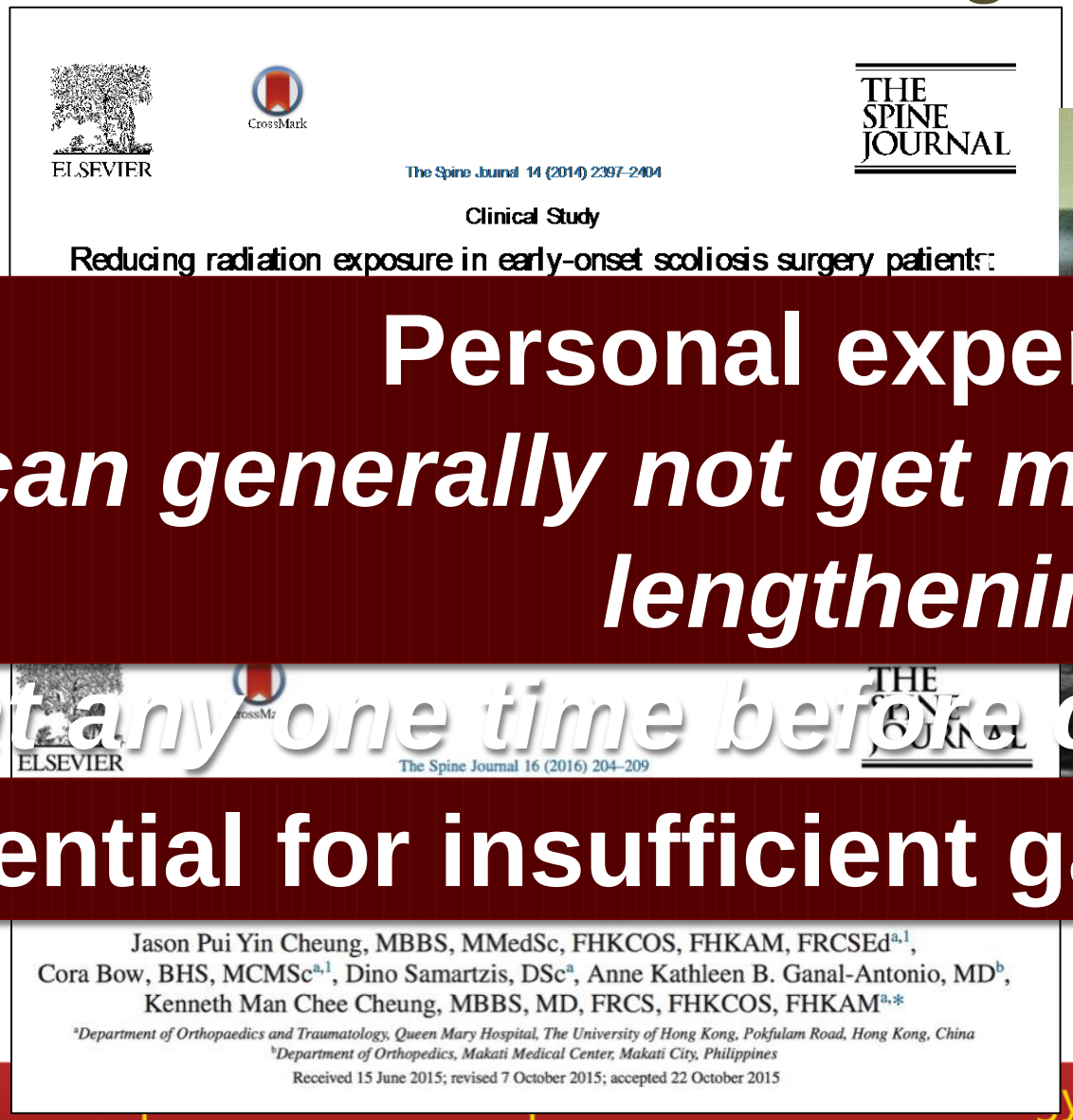
Observed Length Increases of Magnetically Controlled Growing Rods are Lower Than Programmed

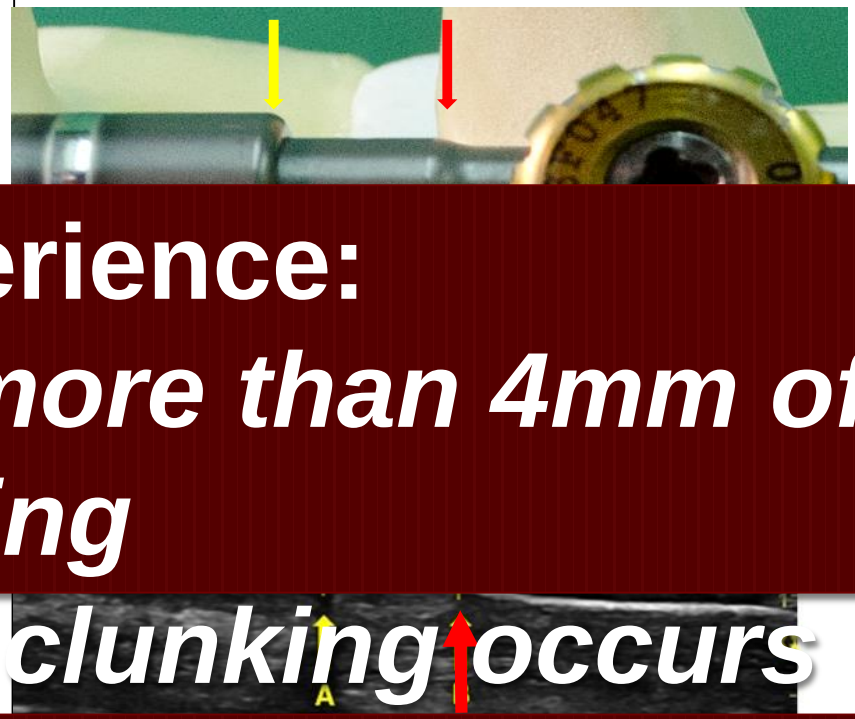
Sarah E. Gilday, MS, PA-C, Mark S. Schwartz, DO,† Donita I. Bylski-Austrow, PhD,*
David L. Glos, BSE,* Lindsay Schultz, BS, CCRP,* Sara O'Hara, MD,*
Viral V. Jain, MD,* and Peter F. Sturm, MD, MBA**

Monitoring of lengthenings is important



Non-invasive monitoring of lengthenings





Personal experience:

I can generally not get more than 4mm of lengthening

at any one time before clunking occurs

Potential for insufficient gain in spine length

Content

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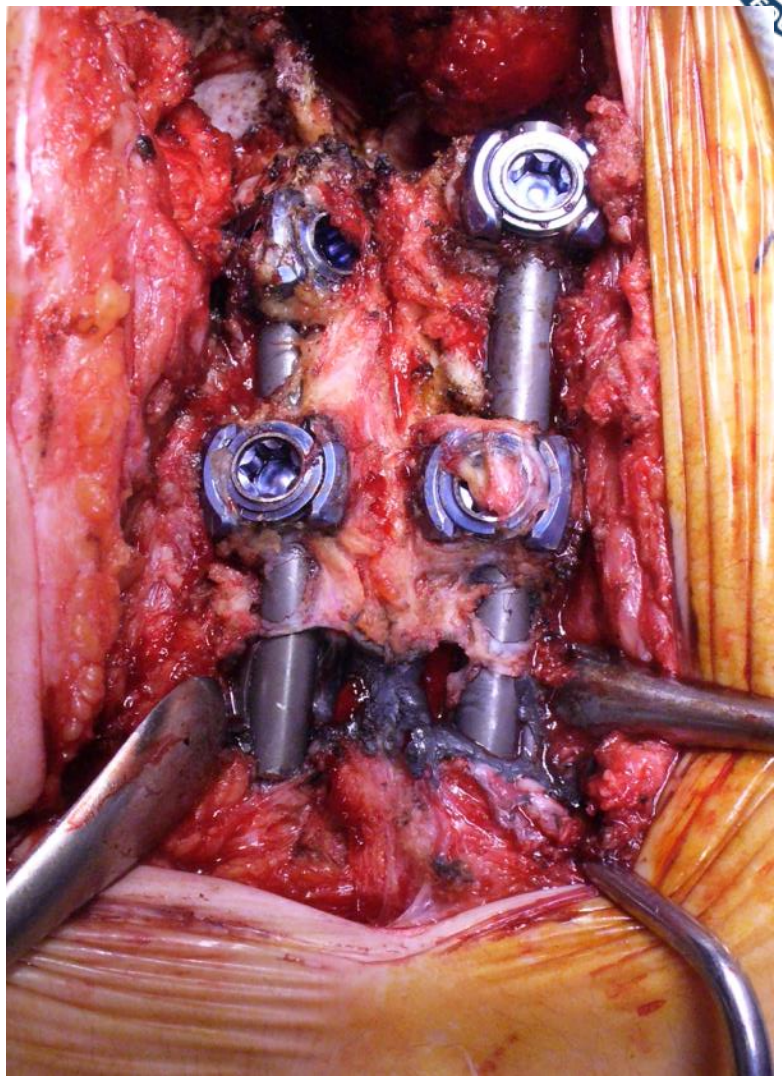
  - Length gain never as much as expected
  - Damage leads to fusion?
  - Clunking and metallosis?
  - Unpredictable
  - No law of diminishing return

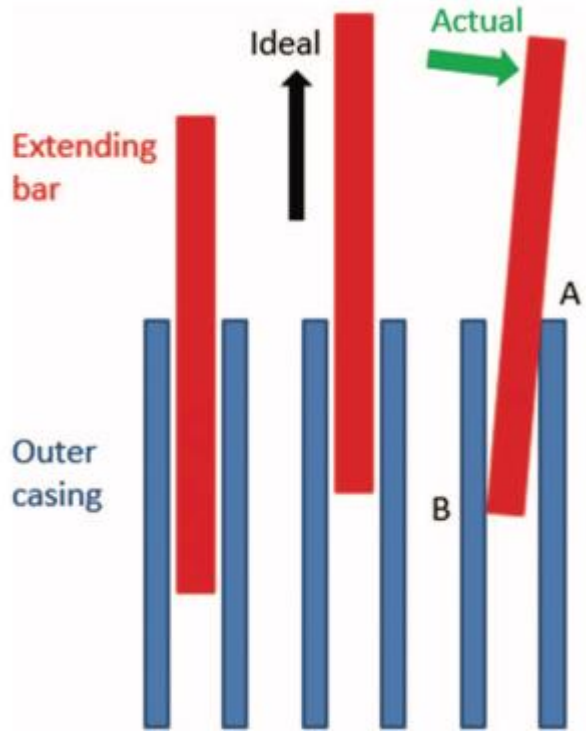


Spine
BIOMECHANICS
SPINE Volume 43, Number 1, pp E16–E22

Analysis of Explanted Magnetically Controlled Growing Rods From Seven UK Spinal Centers

Thomas J. Joyce, PhD,* Simon L. Smith, PhD,* Paul R. P. Rushton, MRCSEd,†
Andrew J. Bowey, FRCS(Tr&Orth),† and Michael J. Gibson, FRCS†

- failure of the O-ring seal
- eccentric loading
- leading to wear



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Take home messages

- For matching growth:
  - Makes physiological sense
  - Supported by long term follow-up
  - *Law of reducing length gains* related to rod factors
  - Does driving growth get sufficient length gain?
  - Could driving till clunk be related to metallosis?

The University of Hong Kong