Single Rod Constructs in Severe EOS Produce Similar Cobb Correction and Spinal Growth as Dual MCGR Constructs

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Comparison of Single and Dual Growing Rod Techniques Followed Through Definitive Surgery

A Preliminary Study

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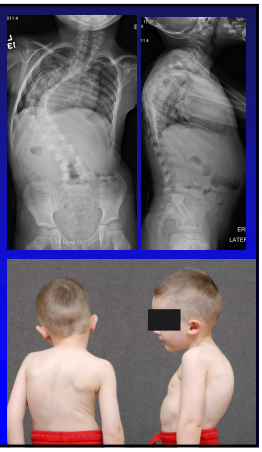
- The best overall results occurred in Dual TGR
- Established Dual TGR as Gold Standard in distraction constructs

- BUT, in patients with severe, progressive EOS, dual GR may not be desirable due to:
  - Patient height and weight
  - Type, location and severity of the spinal deformity.



Study Purpose

1. Describe the surgical cases treated with single-growing rod constructs since Thompson/Akbarnia study publication in 2005.
2. Report the radiographic and clinical outcomes of single-growing rods (2005-2016)

Methods

- Two prospective databases were queried
- Identify all patients with single TGR or MCGR with index surgery from 2005-2016
- VEPTRs excluded
- Inclusion criteria:
  - <10 years of age
  - Minimum 2 years of follow-up postoperatively
- No case matching to Dual GRs

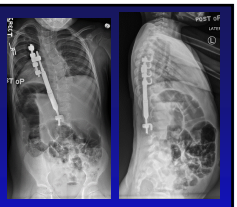
Methods

- 2005-2016 Single GR Cohort:
  - 25 patients (13 female, 12 male)
  - 10 TGR, 15 MCGR
- Dual-rod constructs (2005-2016)
  - GSSG: 590
  - CSSG: 367
  - } 957
- Single-rod constructs = **2.6% of GR cases**

Methods

- Age at index: median 4.3 yrs (1.3 to 9.3 yrs)
- F/u: median 3.0 yrs (2.0 to 10.6 yrs)
- Diagnoses
  - 11 congenital (all mixed-type): **44%**
  - 6 neuromuscular
  - 5 idiopathic
  - 3 syndromic

Results



- Proximal foundations:
  - Ribs **92%** (n=23)
  - Spine (PS) in 2 patients
- Distal foundations:
  - Spine in **84%** (n=21)
  - Pelvis (1 L5-S1 and 3 S-hooks)
- All single rods were on the concave side of the deformity.

Median	Preop	Postop
Height (cm)	94.5	99.0 NS
Weight (kg)	15.4	15.7 NS
Primary Cobb	81.0	54.0 (33%) (p<0.001)
T1-S1 (mm)	229.5	255.0 (p=0.030)
T1-T12 (mm)	142.6	154.0 NS
Maximal kyphosis	46.0	38.1 NS
T5-T12 kyphosis	18.0	13.9 NS

Median	Preop	Final
Height (cm)	94.5	122.5 (p<0.001)
Weight (kg)	15.4	25.0 (p<0.001)
Primary Cobb	81.0	62.0 (23.4%) (p<0.001)
T1-S1 (mm)	229.5	276.0 (p=0.009)
T1-T12 (mm)	142.6	167.0 (p=0.033)
Maximal kyphosis	46.0	50 NS
T5-T12 kyphosis	18.0	27.0 NS

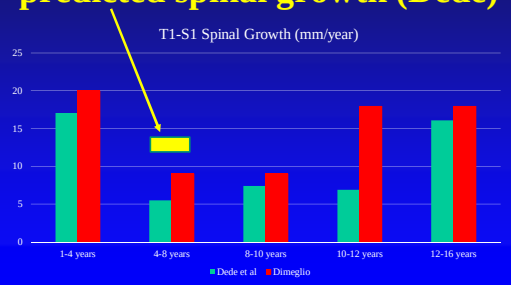
No differences between TGR and MCGR

Postoperative Spine Growth

Dual MCGR
Akbarnia/Pawelek
2014

- T1-T12 distance
  - Median: 13 mm = **4.3 mm/yr** 1.5-2.3
- T1-S1 distance
  - Median: 21 mm = **7 mm/yr** 8.1-9.7

Single rod cohort had 75% of predicted spinal growth (Dede)



- 72% (18/25) of cases dual growing rods would be difficult/suboptimal due to
  - Patient size (longitudinal a/o weight)
  - Kyphosis/kyphoscoliosis with severe rotation.

Reoperations

- TGR (n=10): 100
  - 66 lengthenings
  - 32 revisions
  - 2 unknown
- MCGR (n=15): 10 in 9 patients
  - 7 for maximized actuators
  - 3 for foundation migration

- At final follow-up:
  - 20 continued with lengthenings (5 TGR & 15 MCGR)
  - 4 underwent definitive fusions
  - 1 completed lengthening (implants retained).

Conclusion

	Literature
• Single rods demonstrated	
– 23.4% coronal correction	(28%-54%)
– T1-S1 growth of 7 mm/yr	(11.7-17.6)
– T1-T12 growth of 4.3 mm/yr	

- Single GRs in 4-8 y/o patients with severe, progressive EOS can provide acceptable outcomes when nonsurgical management is unable to control deformity.

Single-Rod Bridge Concept

- Permit initiation of treatment of patient with severe, progressive EOS
- Can avoid foundational fusions (iatrogenic shortening)