

# Are Magnetically Controlled Growing Rods a Good Option for Collapsing Spine Deformity in Spinal Muscular Atrophy Type-II Associated Early Onset Scoliosis?

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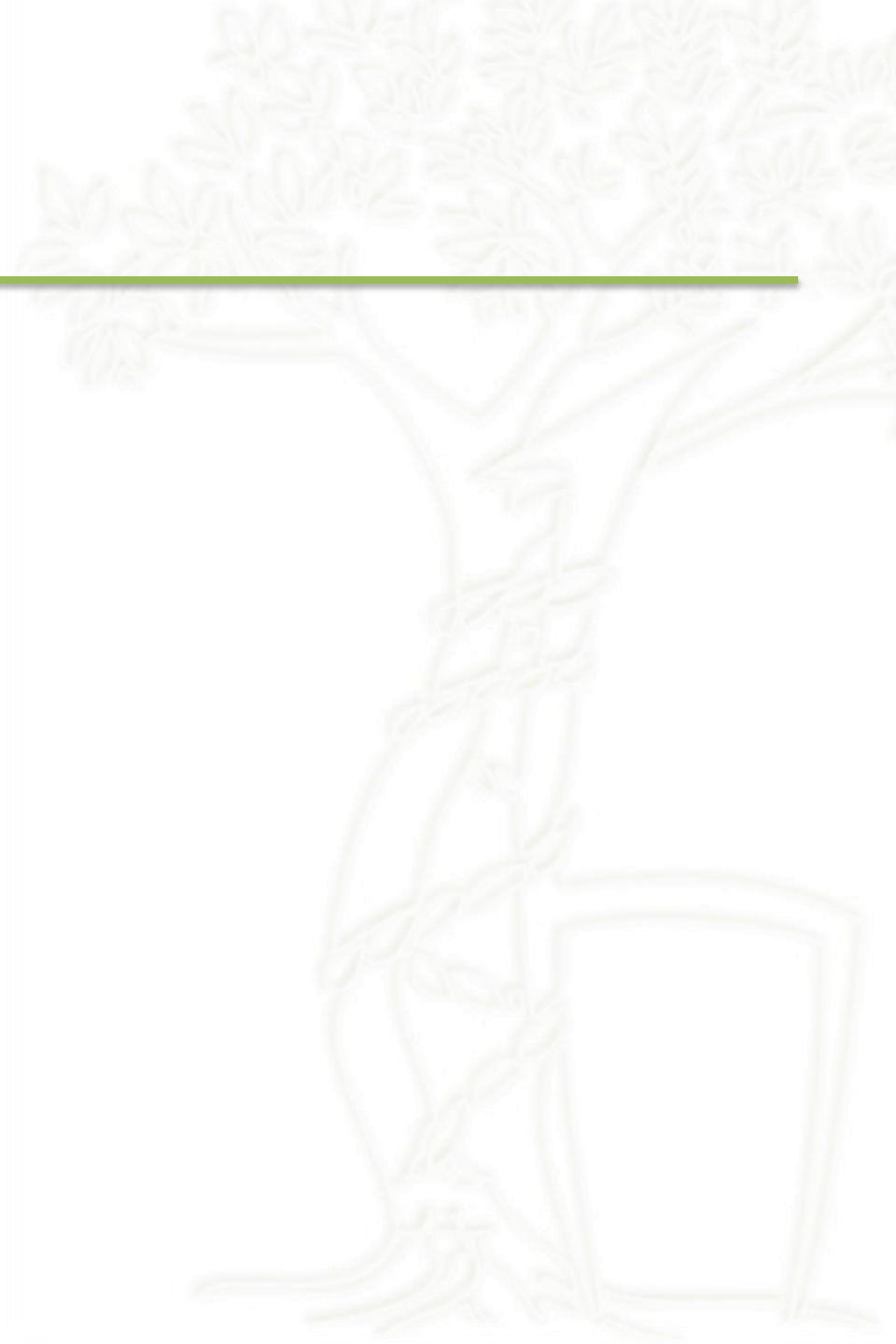
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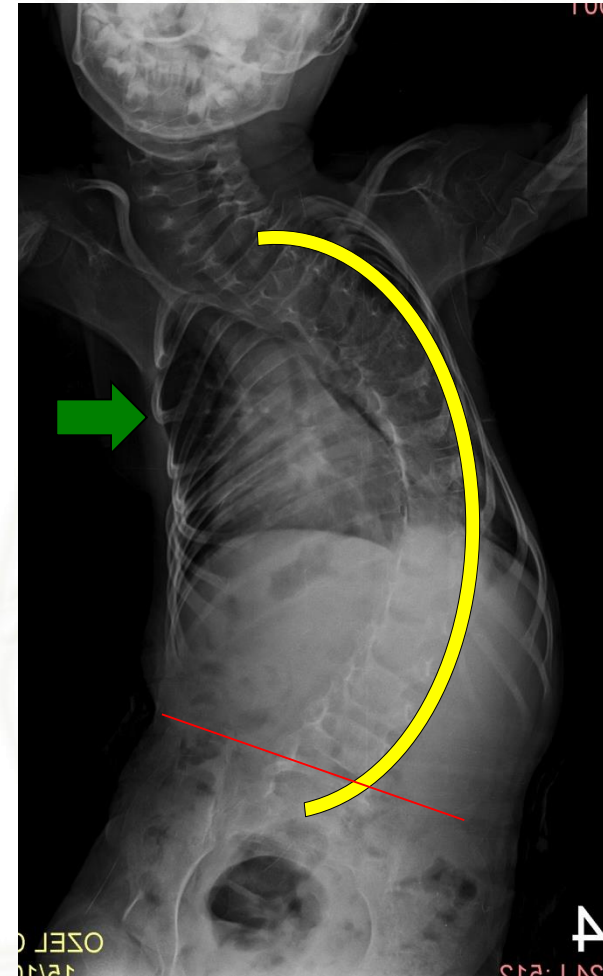
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- No disclosure!



# SMA & Spine Deformity

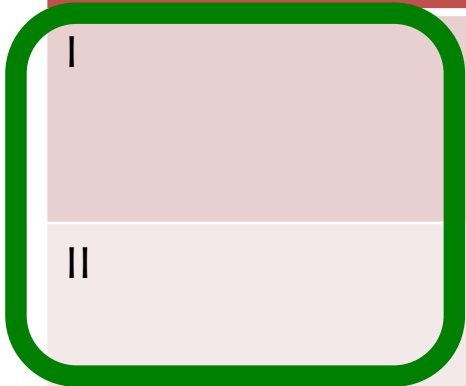
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- Collapsing spine deformity
  - C-shaped scoliosis / lack of compensation
  - Parasol rib deformity
  - Pelvic obliquity
  - Progression 5-15°/year
- Incidence is nearly 100%
  - Severe progression once patient becomes non-ambulatory
- Impairs functional status
  - Sitting imbalance
  - Unappealing cosmesis
  - Exacerbate pulmonary problems
- Conservative treatment fails
  - Bracing can not stop progression
  - Severe breathing impairment



# SMA & Spine Deformity

SMA Type	Age of Onset	Motor Milestones	Age of Death
I	< 6 months	Head lag	1-2 years
II	< 18 months	Stand and walk independently	3-10 years
III	> 18 months	Stand and walk independently	Normal life expectancy
IV	Adolescent or adult onset	Retain walking, muscle pain	Normal life expectancy



**Early onset scoliosis**

# GFT & SMA-related EOS

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- SMA&Traditional Growing Rods
  - McElroy et al, Spine 2011
    - Stabilizes the spine deformity, ↑spinal height
    - Does not halt rib collapse
    - Longer hospital stay but fewer major complications than idiopathic EOS
  - Chandran et al, J Pediatr Orthop 2011
    - Pulmonary functions maintained early after surgery (↑ FVC, 0.53 to 0.67 L)
  - Lenhart et al, J Pediatr Orthop 2016
    - ↑Spinal height, ↑Thoracic cavity size
    - ↑Absolute FVC
    - ↓Predicted FVC% over time

# GFT& SMA-related EOS

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- SMA & Eiffel tower MCGR
  - Lorenz HM, JBJS Open Access 2017
    - Bilateral rib to pelvis construct with a magnetically controlled implant
    - Good control in coronal plane (main curve&pelvic obliquity) and spinal height
    - Poor control in sagittal plane
    - Effects on pulmonary functions are unclear
    - ↓ complication rates
    - ↓ the burden of repetitive lengthening surgeries

# Aim

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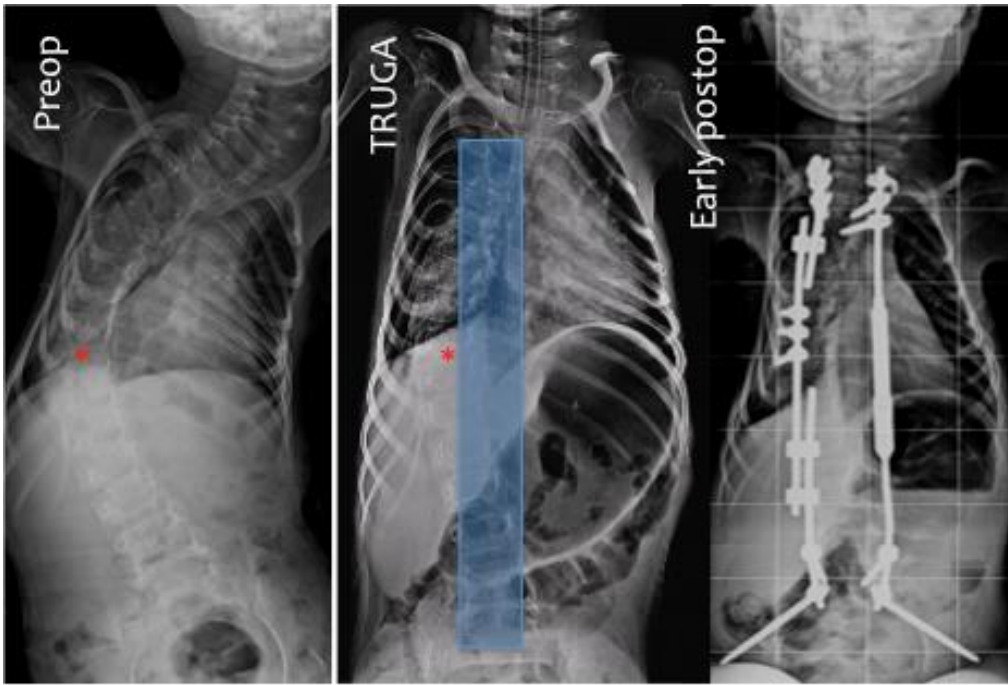
- A new treatment algorithm
  - SMA type 2 EOS
  - Spine based MCGR
- Does this algorithm work?

# Methods

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- Prospective study
- Single institution
- Inclusion criteria
  - SMA type-II
  - EOS (<10 years)
  - Collapsing spine deformity
  - Growing rods treatment with MCGR
  - >1 year follow-up
- Demographic, clinical, radiological information, surgical details and final status of the patients

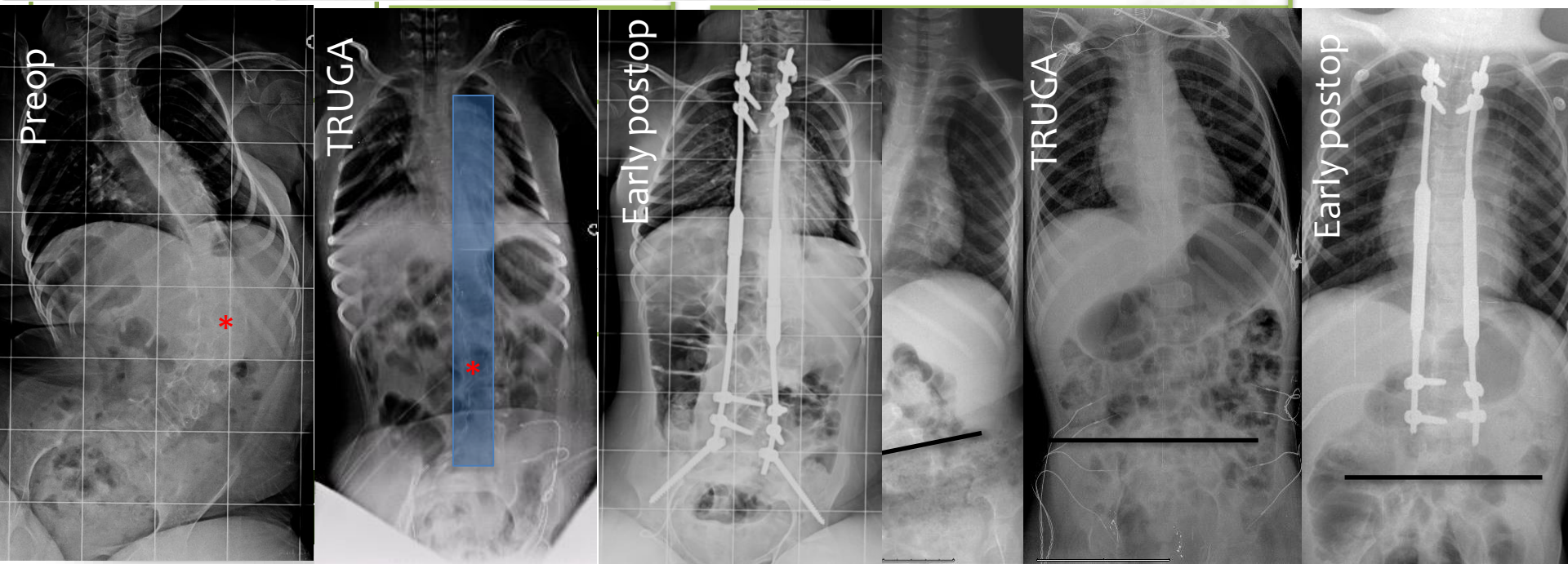




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Apical vertebra inside  
the stable zone  
(n:6)  
\* Dual MCGR



# Results

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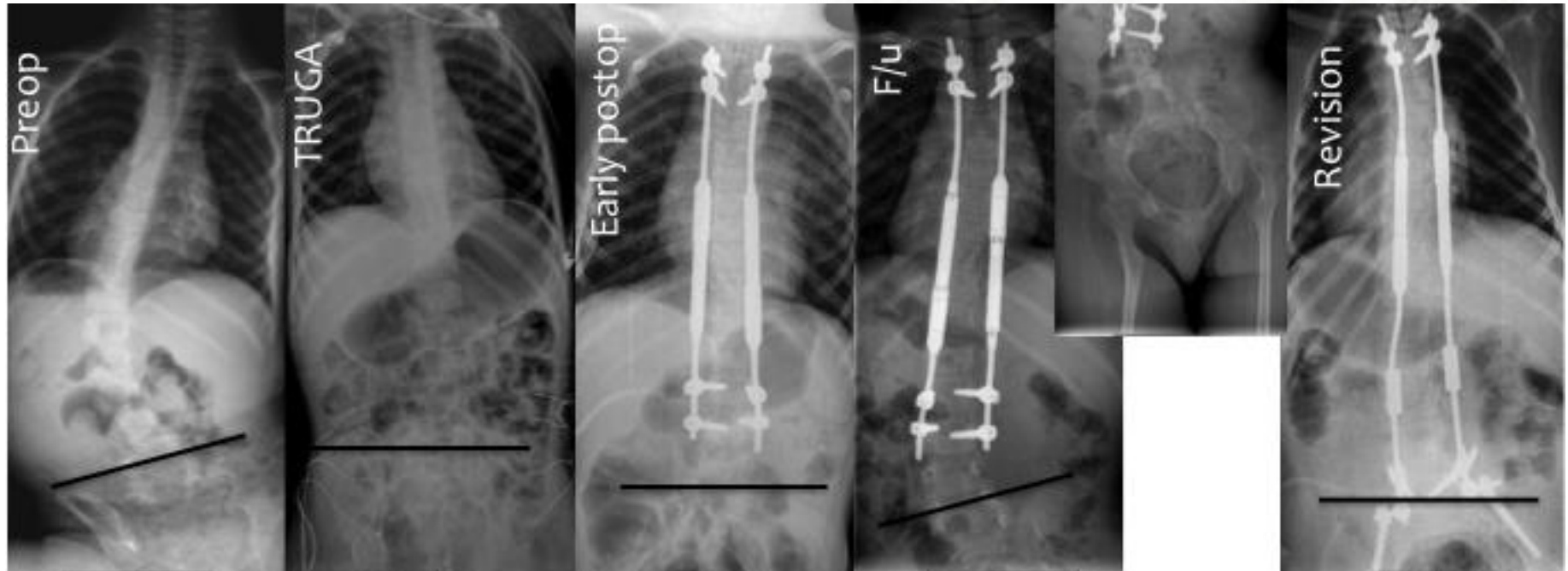
- Mean f/u
  - 29.9 months (12-50)
- # Outpatient lengthening
  - 6.7
- Deformity
  - Cobb angle
    - $81.8^{\circ}$  (66-115)  $\rightarrow$   $29^{\circ}$  (11-57)  $\rightarrow$   $23.6^{\circ}$  (12-50)
  - Pelvic Obliquity
    - $21.9^{\circ}$  (8-30)  $\rightarrow$   $5.1^{\circ}$  (2-8)  $\rightarrow$   $4.4^{\circ}$  (2-7)

# Results

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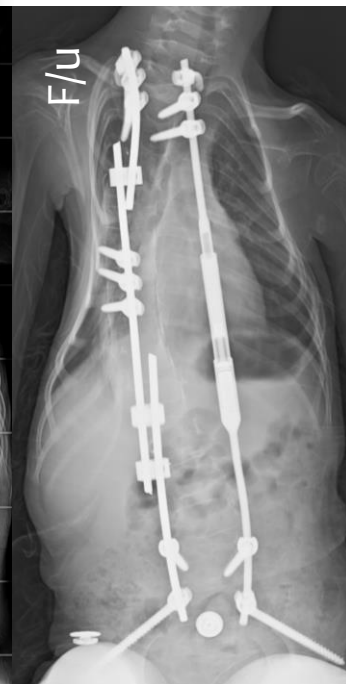
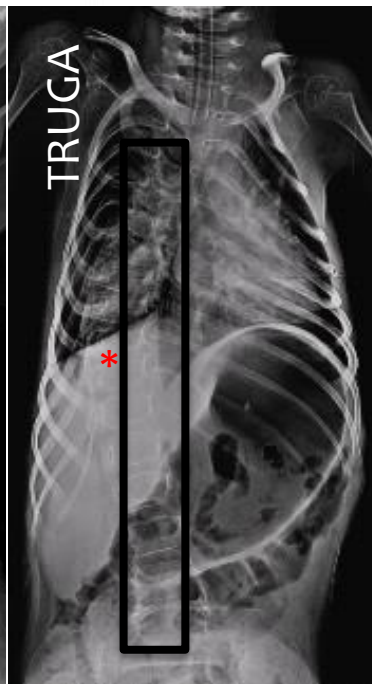
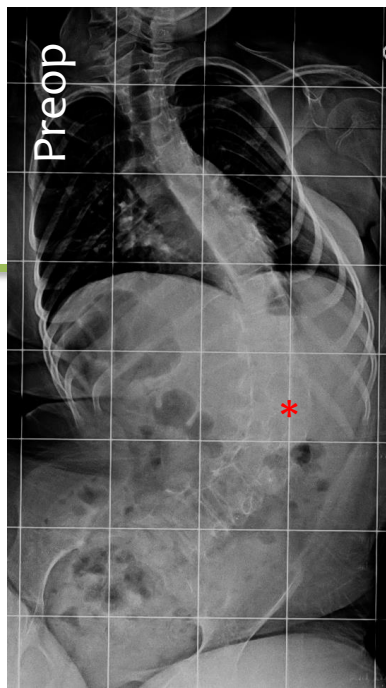
- T1-S1 height (mm)
  - 329 (280-376) → 356 (310-386)
  - 10.8 mm/year
- Thoracic kyphosis
  - 46.6 (28-66) (early postop) → 54.2 (35-71) (last f/u)
- Lumbar lordosis
  - 43.5 (25- 62) (early postop) → 46.1 (27-65) (last f/u)

# Results



- Distal adding-on in 2 pts. w/o initial pelvic fixation
  - Revised with extending the inst. to pelvis

# Results



# Conclusion

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- MCGR is a good option in SMA-related EOS
  - Reduce the burden of repetitive lengthening surgeries
  - Good coronal/sagittal plane deformity correction/maintenance
  - Low complication rates
- Algorithm does work!
  - Except stopping @ lumbar spine
  - Natural course of underlying disease!