Technique Session 1: Challenges in Management
Thoracic Kyphosis with Growth Friendly Implants
Magnetically Controlled Growing Rods

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• Grants / Research Support
  • Depuy-Synthes Spine
  • Medtronic Canada
  • Joint Solutions
  • EOS Imaging

• Consultant
  • Depuy-Synthes Spine
  • Medtronic Canada
  • Apifix Ltd.
  • Wishbone Medical
  • Globus Medical
8 yo girl with Cerebral Palsy (2015)
8 yo girl with CP (2015 to 2018)

Pre-Implant

Immediate Post-Op

Most Recent

“Growth” from Insertion

True Growth Phase
How Does Kyphosis Affect Outcomes?

• Proximal Junctional Kyphosis

• Rod Breakage
General Definition of PJK

• Non-physiologic, sagittal plane angulation that occurs cephalad to an instrumented spine.

Yagi et al., Spine, 2011
What is the Risk of Developing Proximal Junctional Kyphosis During Growth Friendly Treatments for Early-onset Scoliosis?

Ron El-Hawary, MD, MSc, FRCSC,* Peter Sturm, MD,† Patrick Cahill, MD,‡ Amer Samdani, MD,‡ Michael Vitale, MD, MPH,§ Peter Gabos, MD,∥ Nathan Bodin, MD,¶ Charles d’Amato, MD,# Colin Harris, MD,** Anmar Al Khudairy, MBChB, MRCSI, MCh,* and John T. Smith, MD††

• Maintain Sagittal Alignment
  • Spine vs. Rib Based Sagittal Alignment
  • 27.5 % risk of PJK (31% vs. 25%)
  
  • Older kids
  • Higher pre-op thoracic kyphosis (45 vs 29 degrees; p<0.05)
  • Higher pre-op pelvic incidence
  • Higher post-op positive sagittal balance
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- Subjects with PJK (Pre-Insertion)
  - Older Age
  - Higher Thoracic Kyphosis
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• Subjects with PJK (Post-Insertion)
  • Increased Cervical Lordosis
  • Normal Thoracic Kyphosis
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• Subjects with PJK (Final Follow Up)
  • Increased Cervical Lordosis / Increased PJA
  • Normal Thoracic Kyphosis / Increase +SVA
Pre-Operative Hyperkyphosis

- Subjects with PJK
Rib-based Distraction Surgery Maintains Total Spine Growth

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[Graph showing data on kyphosis and lengthening interval]
Traditional Growth Friendly

- Radius of Curvature
  - 220mm
  - 500mm*
    *designed to address Kyphosis found with 220mm implants
Magnetically Controlled Growing Rods: Sagittal Plane Analysis and the Risk of Proximal Junctional Kyphosis

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Introduction/Methods

• Hypothesis:
  • MCGR insertion may have increased risk of proximal junctional kyphosis (PJK) due to actuator geometry

• Methods:
  • Multi-center, retrospective, CSSG registry data
  • Radiographic analysis pre-op, immediate post-op and 24 month follow up
Results

Data:
- N=67
- 34 (51%) male, 33 (49%) female
- 2-13 years of age
  - Idiopathic (n=28)
  - Neuromuscular (n=23)
  - Syndromic (n=10)
  - Congenital (n=6)
- M=7.4 (±2.7) years at initial implantation
- Pre-op curves: (M= 70.5±18.7 degrees)
- 443 lengthenings (M = 6.6/patient)
Results

Sagittal analysis data:

• Thoracic kyphosis (not significant)
  • Pre-op to Post-op (28.9 vs. 25.8, p=.289)
  • Pre-op to 24 months (28.9 vs. 32.1, p=.278)
• At 24-month evaluation, PJK developed in 4 of 33 (12%) patients
Results

• 3 of 4 (75%) with PJK had pre-op max kyphosis > 50º (vs. 36% in those without PJK)

• 2 of 4 (50%) had a pre-op PI-LL mismatch >30 (vs. 19% in those without PJK)

• Patients with PJK had a higher average pre-op SVA than those who did not develop PJK (62mm. vs. 13mm.)

• Centroid of actuator slightly higher in those with PJK
What is Unique about MCGR?

• Actuator Geometry – Cannot Contour
  • By default, will decrease kyphosis
Pre-Operative Hyperkyphosis

- Subjects with PJK
8 yo boy with SMA II (2016 to 2019)

Pre-Implant | Immediate Post-Op | Most Recent

“Growth” from Insertion | True Growth Phase
Strategies for Managing Hyperkyphosis

• Avoid acutely correcting the hyperkyphosis
  • Contour the rods into kyphosis
  • Take advantage of the straight actuator

• Anchors
  • Number of anchors
  • Shorten the working length
Strategies for Managing Hyperkyphosis

- Avoid acutely correcting the hyperkyphosis
  - Contour the rods into kyphosis
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8 yo Girl with Cerebral Palsy
8 yo girl with CP (2015 to 2018)

Pre-Implant → Immediate Post-Op → Most Recent

“Growth” from Insertion → True Growth Phase
Strategies for Managing Hyperkyphosis

- Anchor Strategy
  - Number of anchors
  - Shorten the working length
Increase the Number of Proximal Anchors
Shorten the Working Length

• Working length: Unsupported spine
8 yo boy with SMA II (2016)
8 yo boy with SMA II (2016 to 2019)

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Conclusions

• Hyperkyphosis can be managed effectively with MCGR

• Avoid acutely correcting the hyperkyphosis
  • Contour the rods into kyphosis
  • Take advantage of the straight actuator

• Anchors to increase rigidity of construct
  • Number of anchors
  • Shorten the working length
Thank You
3 yo girl with Fibrous Dysplasia (2016)
3 yo girl with FD (2016 to 2019)

Pre-Implant  Immediate Post-Op  Most Recent

“Growth” from Insertion  True Growth Phase