12th International Congress on Early Onset Scoliosis

Contouring the Magnetically Controlled Growing Rod Impacts Its Expansion Capacity

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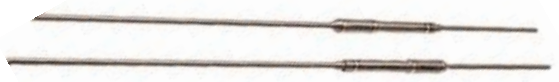
- ❑ No competing conflict of interest

Background

- Magnetically controlled growing rods (MCGR) reduced the need for repeated surgery while allowing spinal growth

  - less surgical procedures,
  - shorter hospital stays,
  - lower long-term cost relative to TGR



- The complication rate remains high:

  33% unplanned revision rate

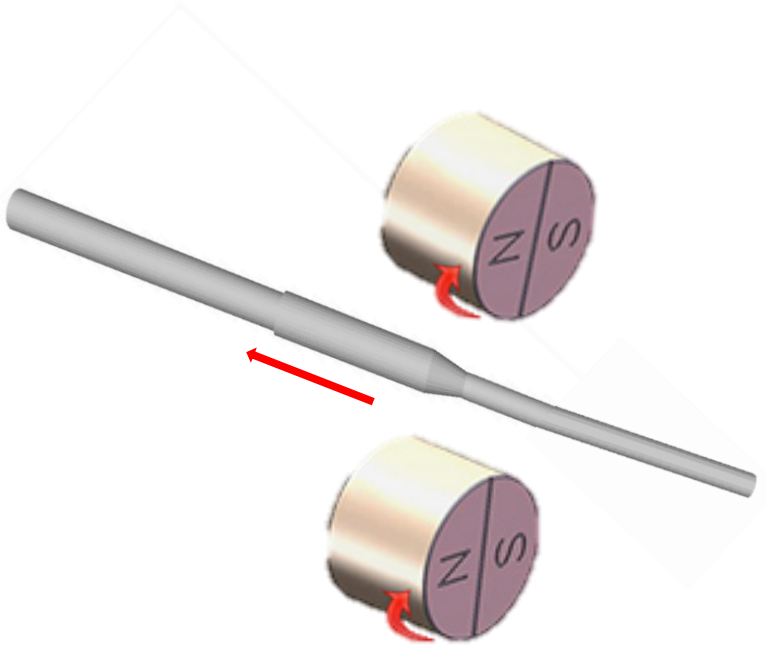
  44.5% average reported surgical-related complication

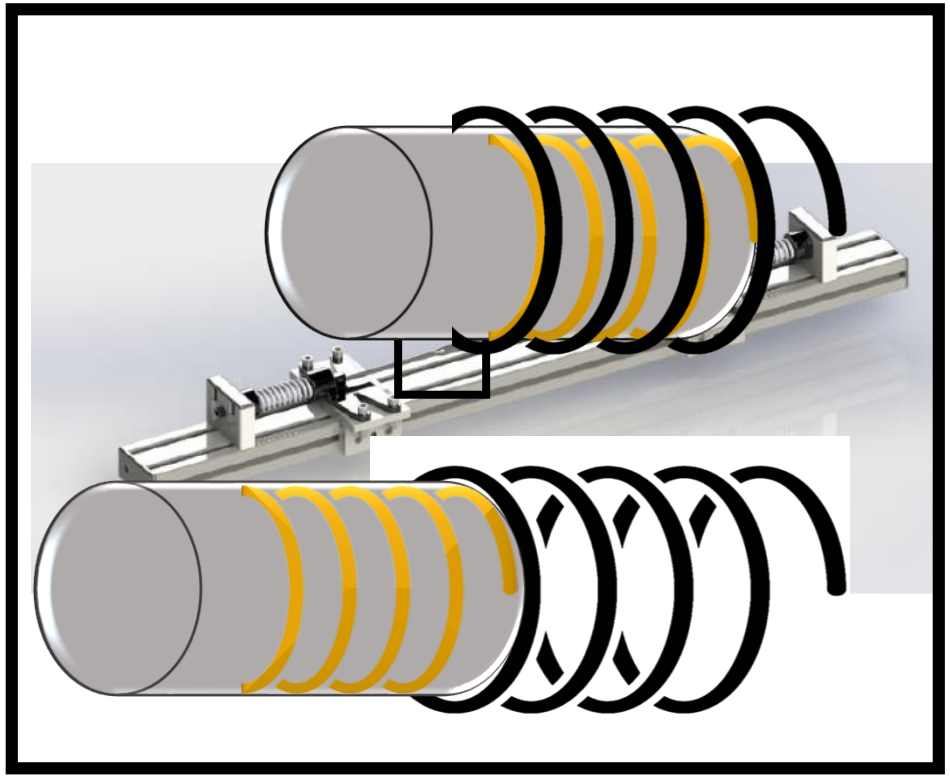
  - 11.8% screw hook pull-out,
  - 11.7% implant failure,
  - 10.6% rod or rod foundation breakage

Clinical implications of the rods, specific to the rod mechanism, are not well-specified.

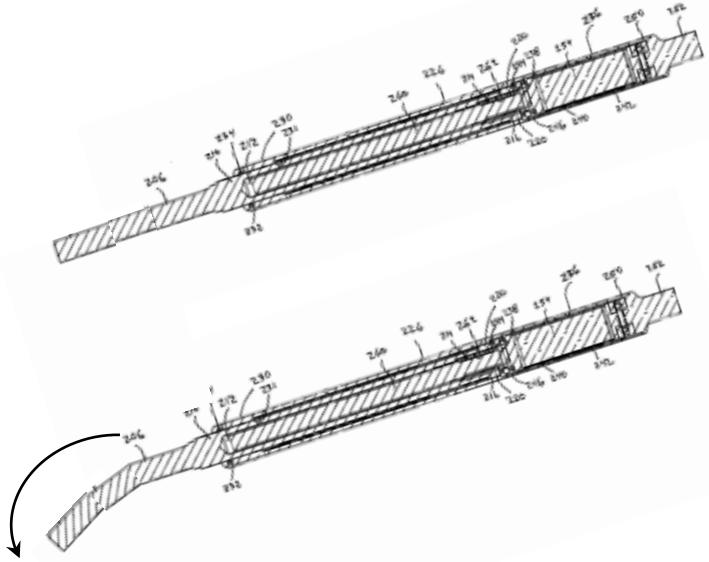
Research Question

Considering the mechanical structure of the rod, do changes in the expandable end of rod impact its expansion capacity?



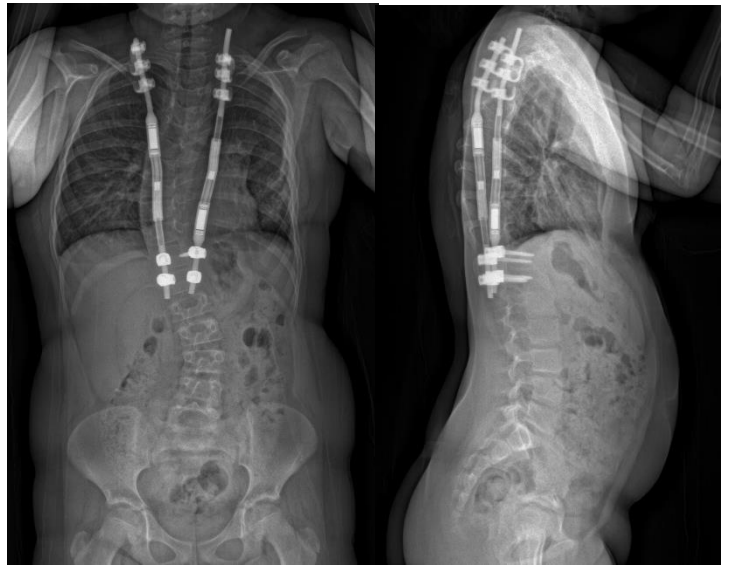


Rod Contouring



Changes in the alignment and length of contact of the *screw lead*, and the *threaded portion*

Methods

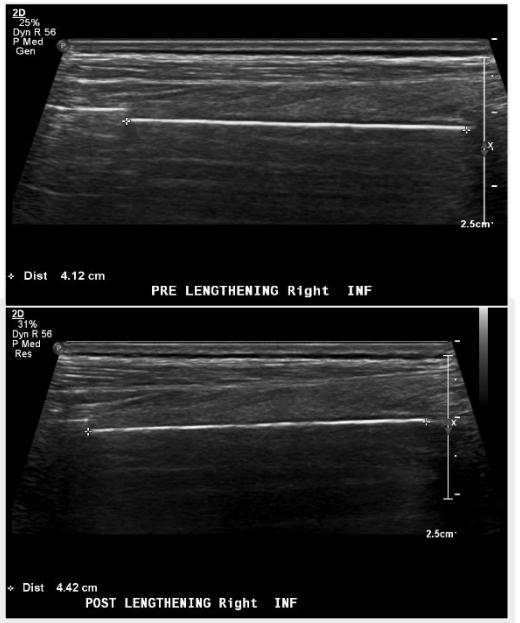


Retrospective radiographic analysis

45 MCGR: 23 early onset, juvenile, congenital scoliosis

Inclusion criterial

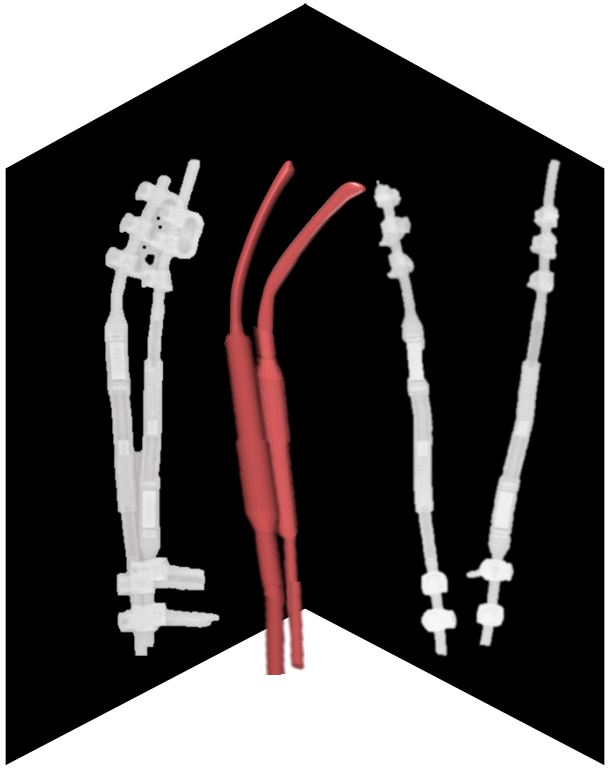
- At least three expansions
- Calibrated two view X-rays (Frontal and sagittal) after surgery
- Ultrasound before and after expansion



- Measured the rod expansion on the 2D ultrasounds (mm)
- Created the 3D model of the rods from the two-view images and calculated the 3D curve at the expandable end after insertion (degrees)

Methods

3D reconstruction of the rod and calculation of the 3D rod bent



Correlate the expansion to the 3D angle of the concave and convex rods

Results

Average expansion visits was 4.8, ranged [3-6]

Average 3D curve of the rods at the expandable end:

Convex side: 5.2±8.3°

Concave side: 11±10.9°

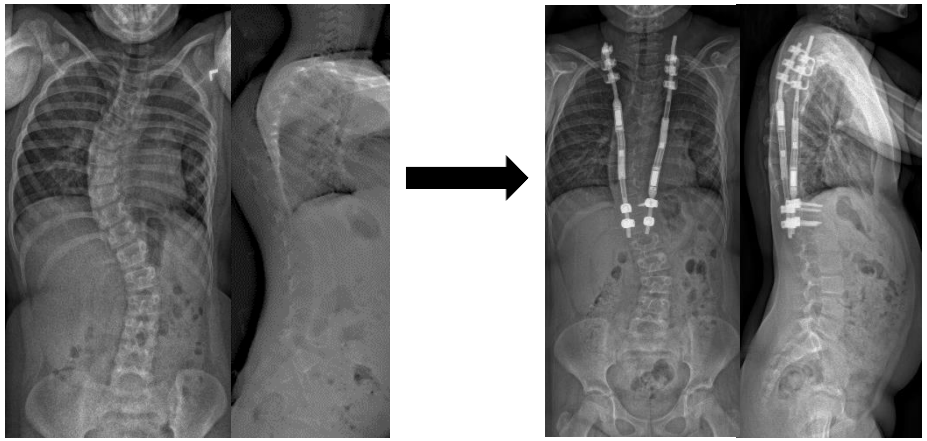
The correlation between the 3D rod curve (degrees) and expansion at each visit (mm):

Visit 1 (n=45): r= 0.10, $p>0.05$
Visit 2 (n=45): r= 0.18, $p>0.05$
Visit 3 (n=45): **r= 0.58**, $p<0.05$
Visit 4 (n=31): **r= 0.38**, $p<0.05$
Visit 5 (n=22): r= -0.17, $p>0.05$*
Visit 6 (n=10): r= -0.10, $p>0.05$*

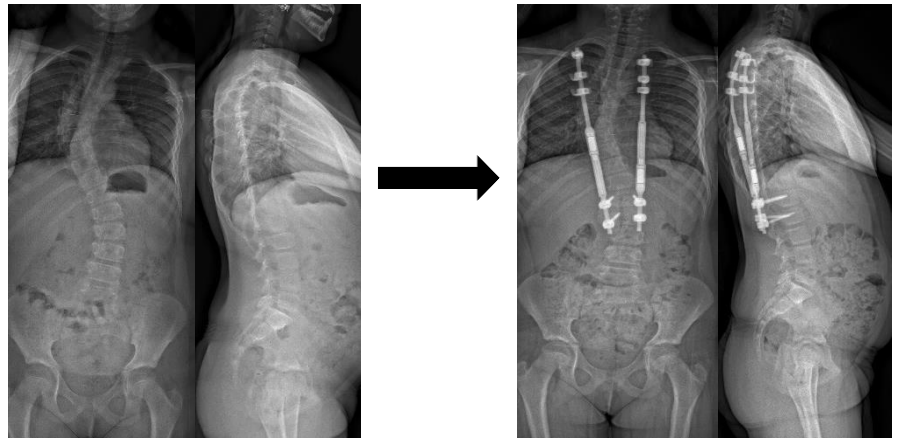
*underpowered

Results

Changes in the frontal and sagittal curves:



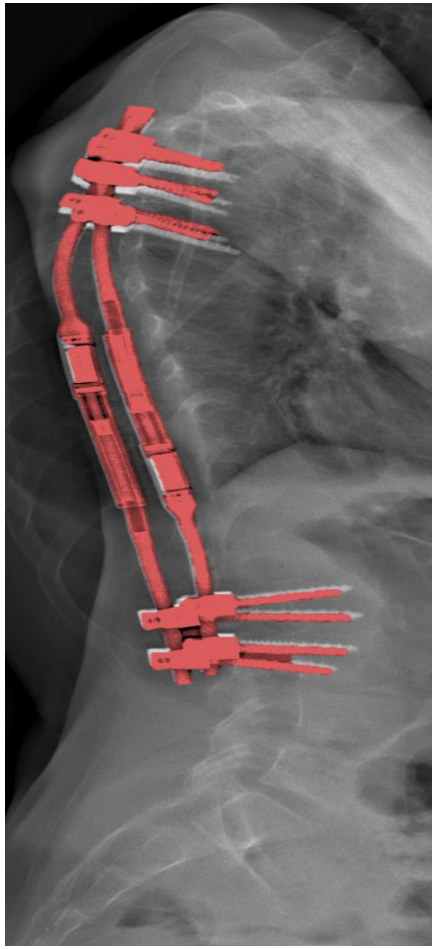
Bent

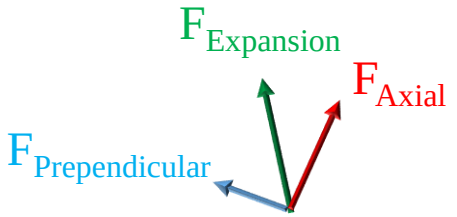


Straight

- The rate of changes in **kyphosis** between the first and third expansion was significantly related to the rod 3D curve angle, $r= 0.41$, $p<0.05$
- The rate of changes in **frontal Cobb** between the first and third expansion was not significantly related to the rod 3D curve angle, $r= 0.23$, $p>0.05$

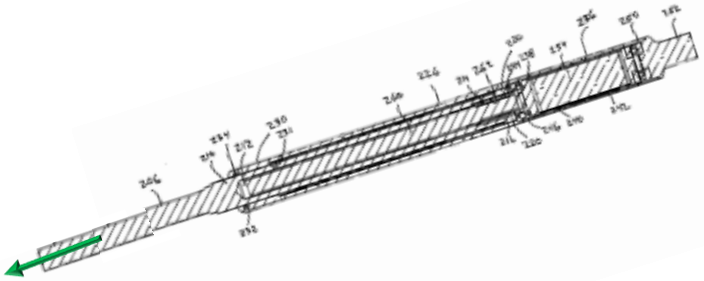
Interpretation



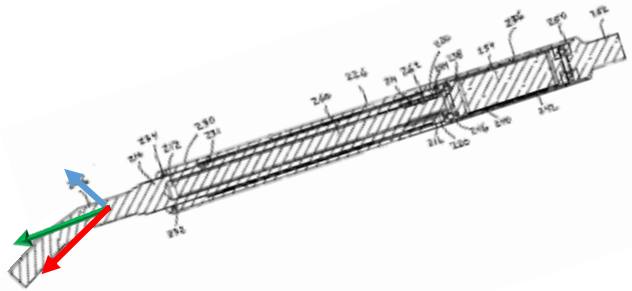


$F_{Expnasion}$: Imparted from fixation and spine
F_{Axial}: resisting the expansion
$F_{Prependicular}$ kyphosing force

PJK



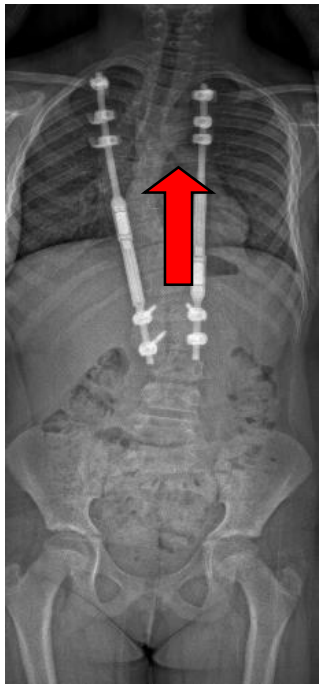
Corrects the curve

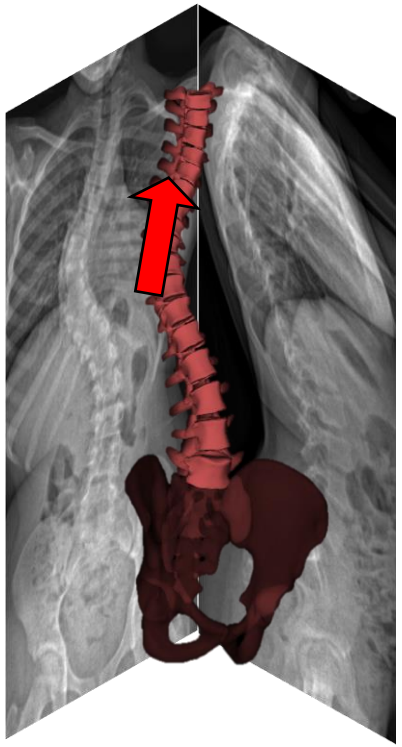


Less axial resistance ~ larger expansion

Discussion

- Contouring of the MCGR impacts the expansion capacity of the rod.
- The 3D curve of the expandable end of the rod can increase its lengthening capacity.
- An increased rod expansion does not necessary impacts the curve correction.
- Direction of the applied force (Rod curve) can increase the kyphosis without frontal correction of the curve.





Relationship between expansion and 3D Trajectory of the UIV

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