

What Have We Learned About Shilla Since it's Inception in 2004?

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COI

- No Conflicts of a financial nature

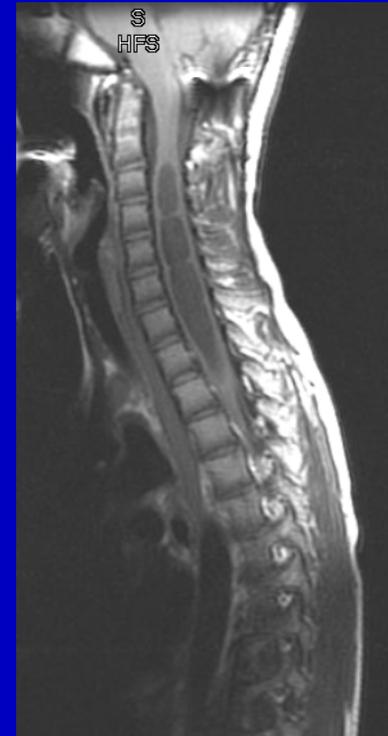
Surgery – tool to prevent thoracic insufficiency

- For curves greater than 50 degrees
- Remember : the most critical time for growth in thoracic cage is below 8 yrs of age (alveoli increasing in number)



Preoperative Preparation- essential

- Evaluation and workup
 - Assess child and family
 - Assess nutritional and pulmonary status
 - MRI
 - CT (3D)
 - Expectations

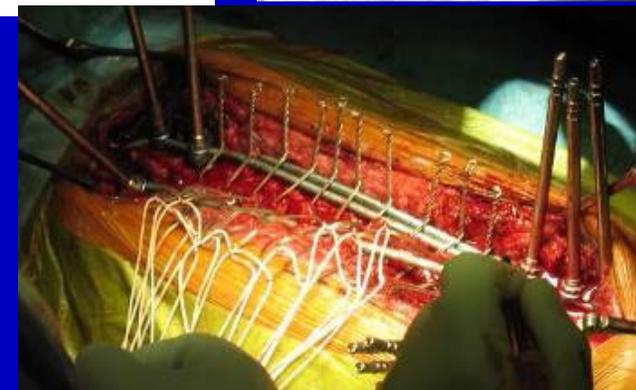
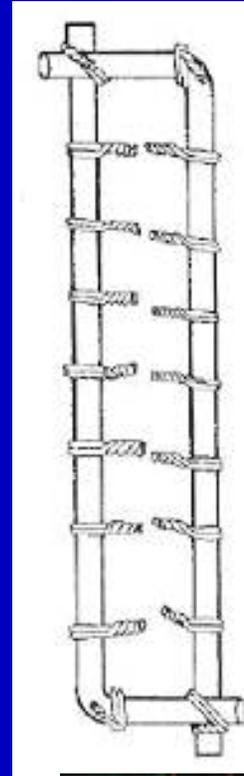


Growth Guidance

- Luque trolley

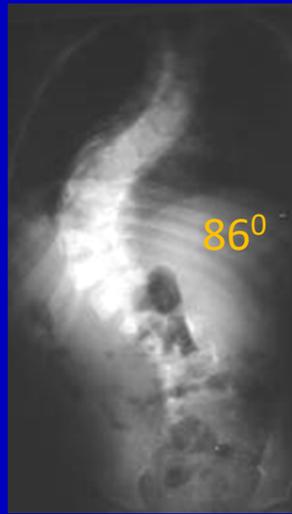
Problem:

Failed to consistently harness growth due to faulty anchor placement

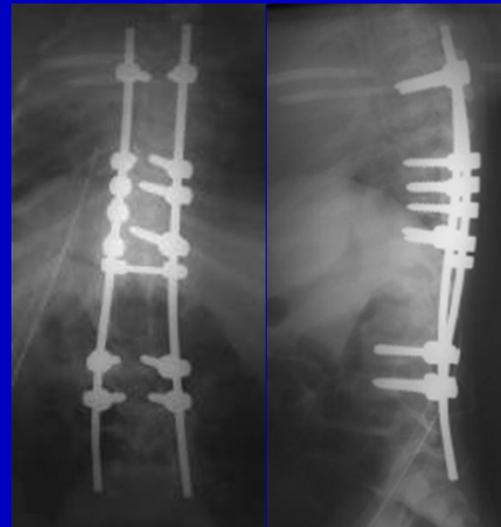


Growth Guidance Shilla

- Born out of a desire to:
 - Allow the EOS child maximum thoracic growth
 - Minimize trips to OR
 - Maximize the child's developmental years (no brace)



Preop

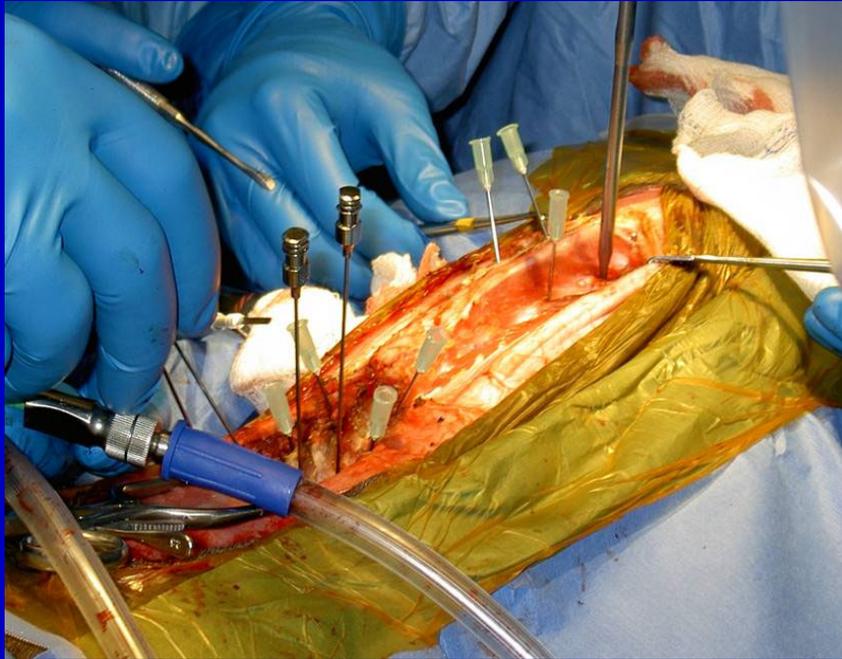
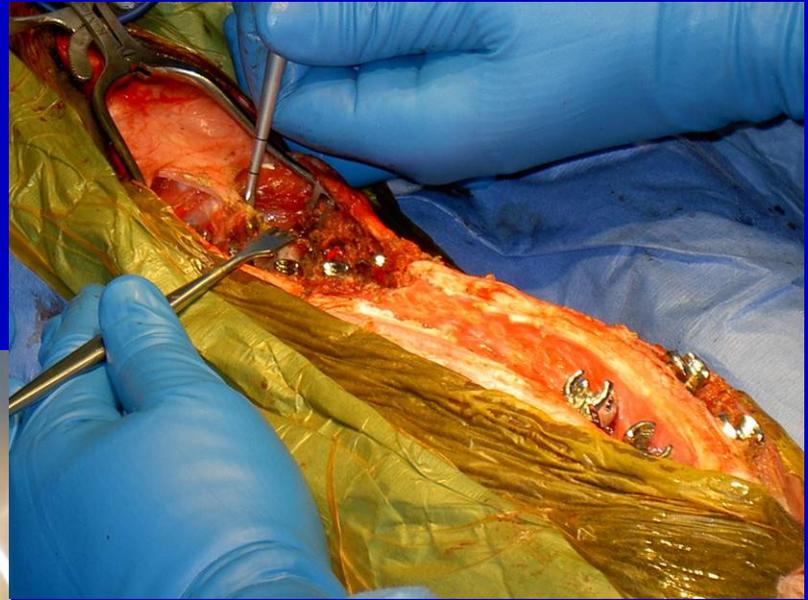


Immediate postop

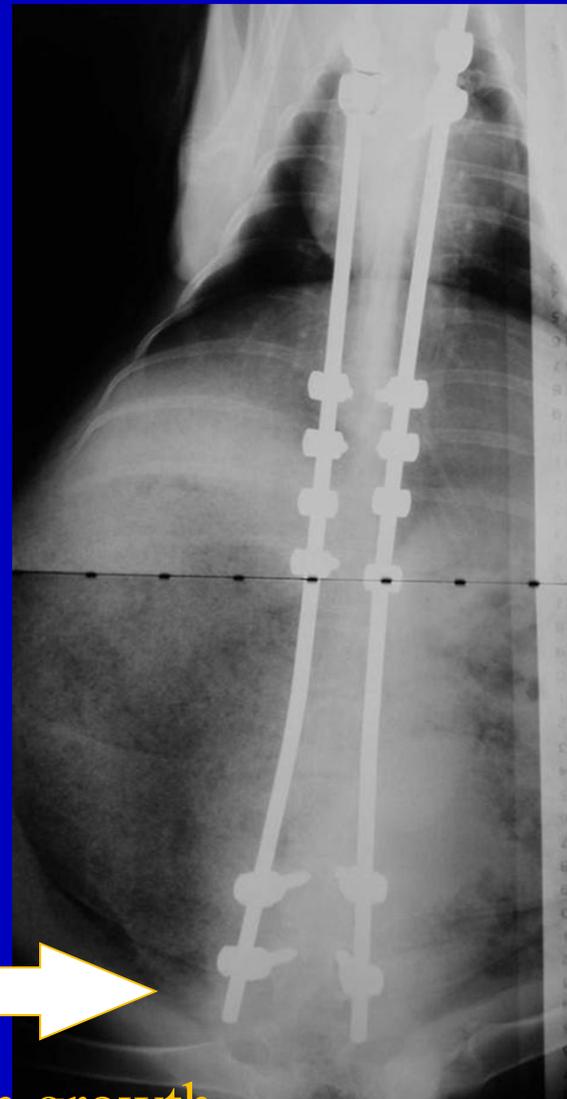
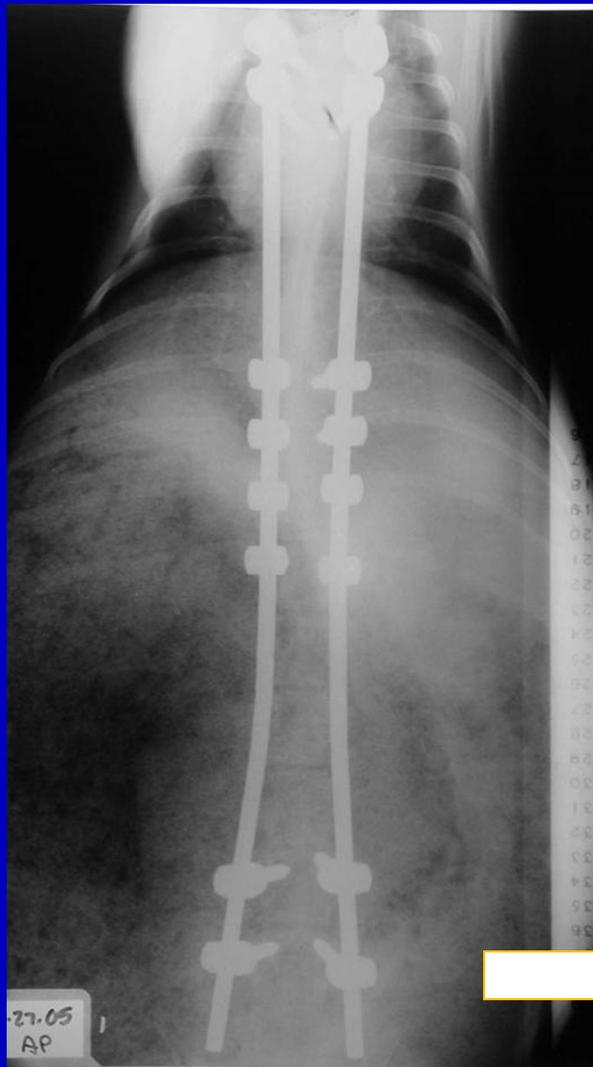
Options: Growth Guidance

- Anchors - screws or wires
 - Single curves
 - Grows with child
 - “normal” childhood allowed
- } Positive
- 7 year history (short follow-up)
 - Rods break
 - Technically demanding
 - Pedicle screws in small children
 - Non FDA approved
- } Negative





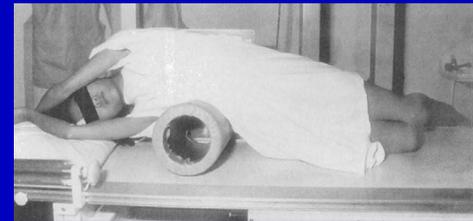
At 6mo follow-up all animals had grown



Average 4.8cm growth

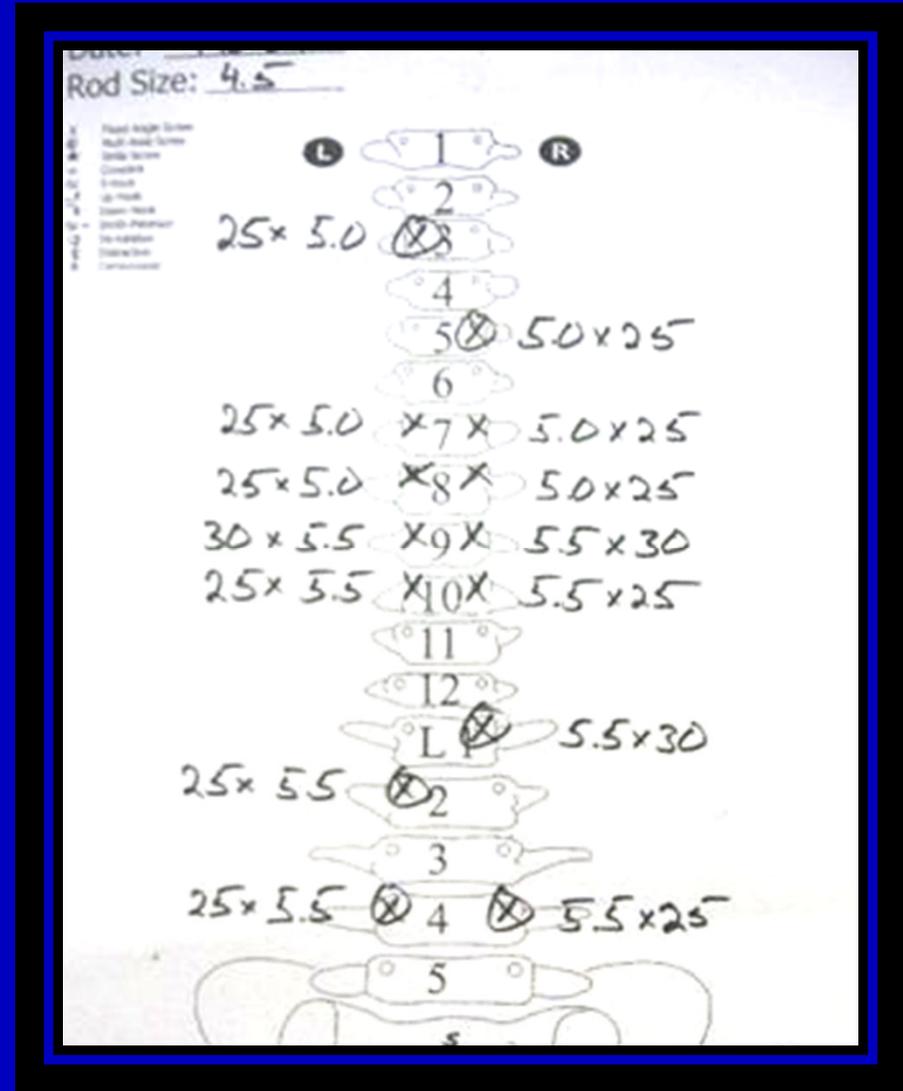
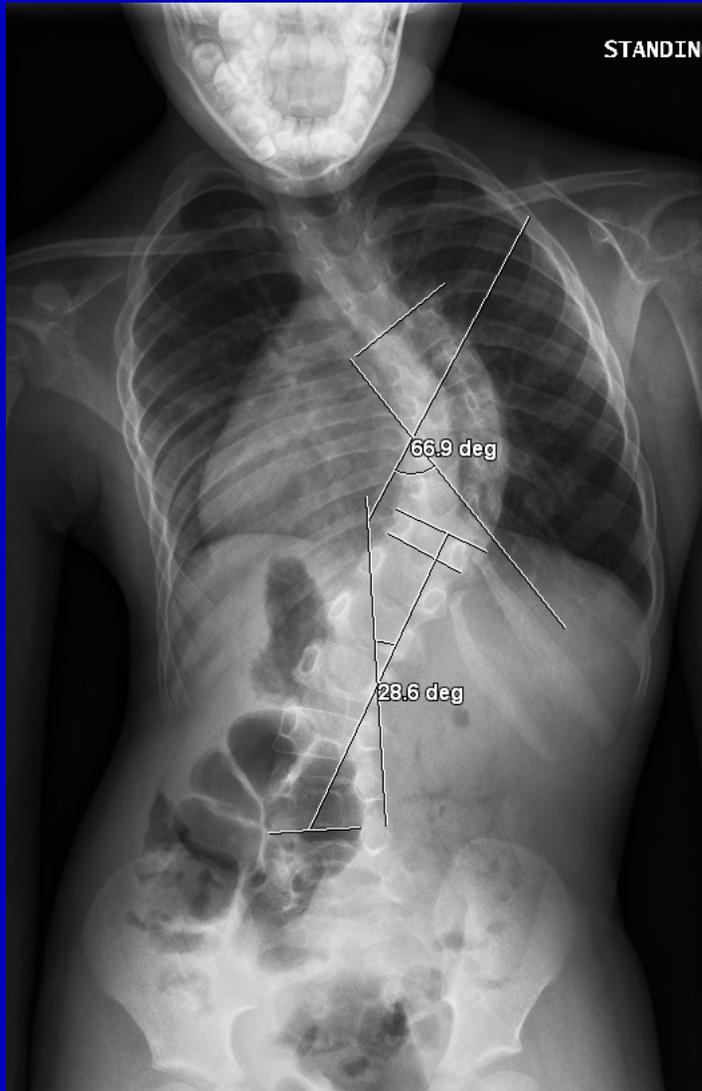
Assessment of Curve Flexibility

- Prone/supine push
- Traction
- Fulcrum bending



- *?additional procedures to enhance correction
i.e. osteotomies, release, traction*

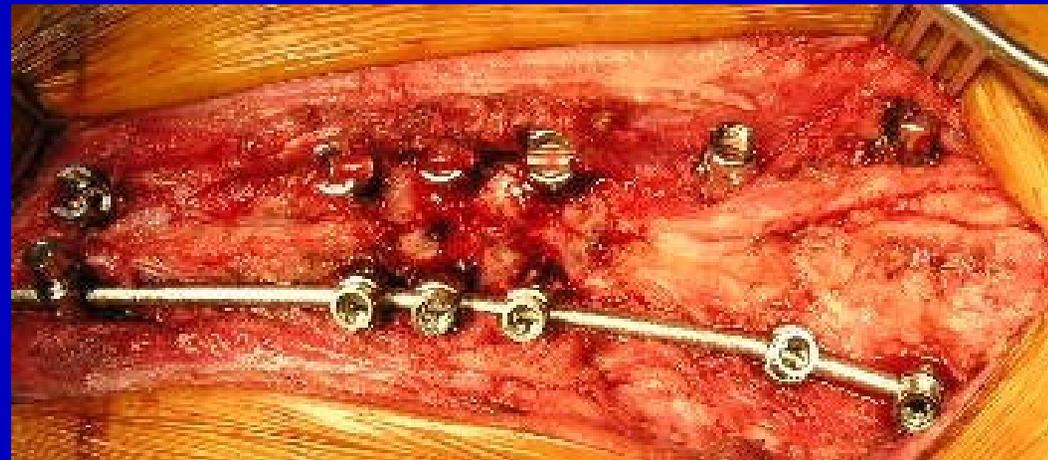
Blueprint



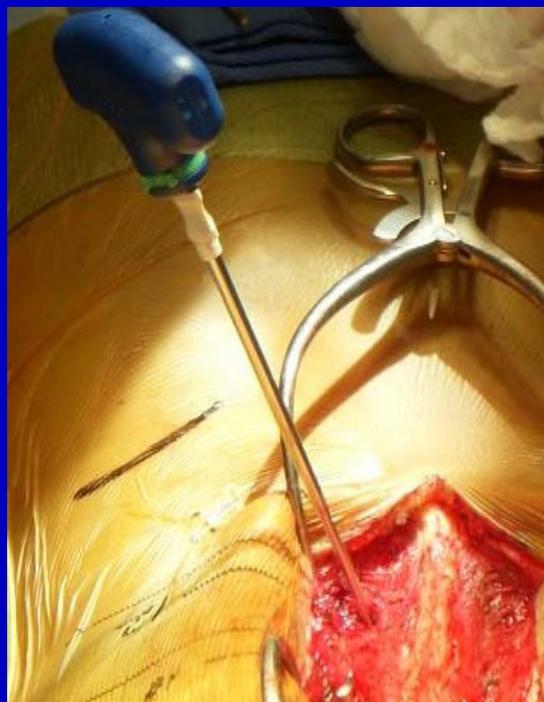
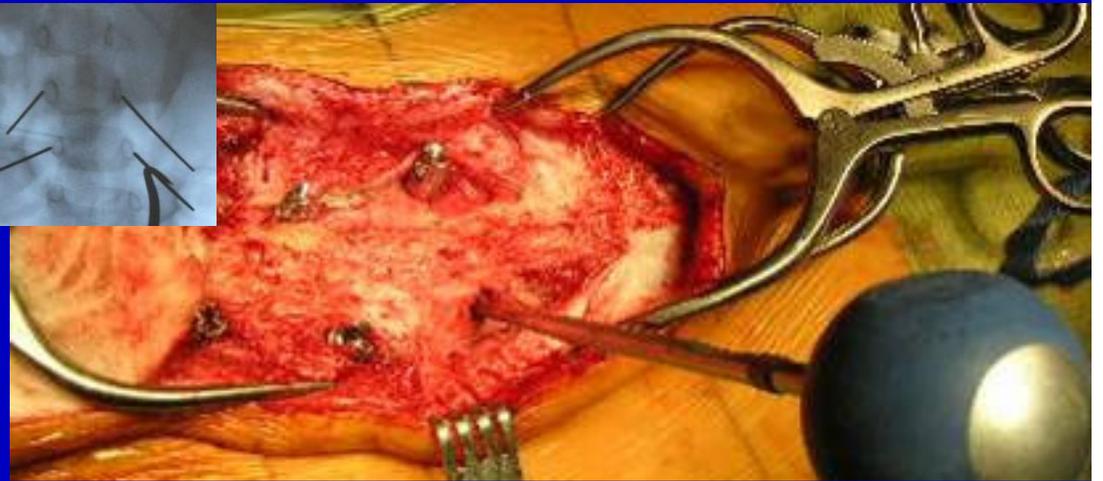
Keeps everyone in O.R. on the same page

Surgical Techniques

- Subperiosteal exposure of apex only



Subfascial exposure for Placement of Shilla Growing Screws



Growing Screws

- Allow for guided growth
- Motion at : rod/screw head and screw head/post



Fixed

Multiaxial



Gap for motion and sliding of rod



Growth Guidance Tips

- Multiaxial screws capture rods without binding to the rod allowing the rod to slide

Closed
polyaxial
screw



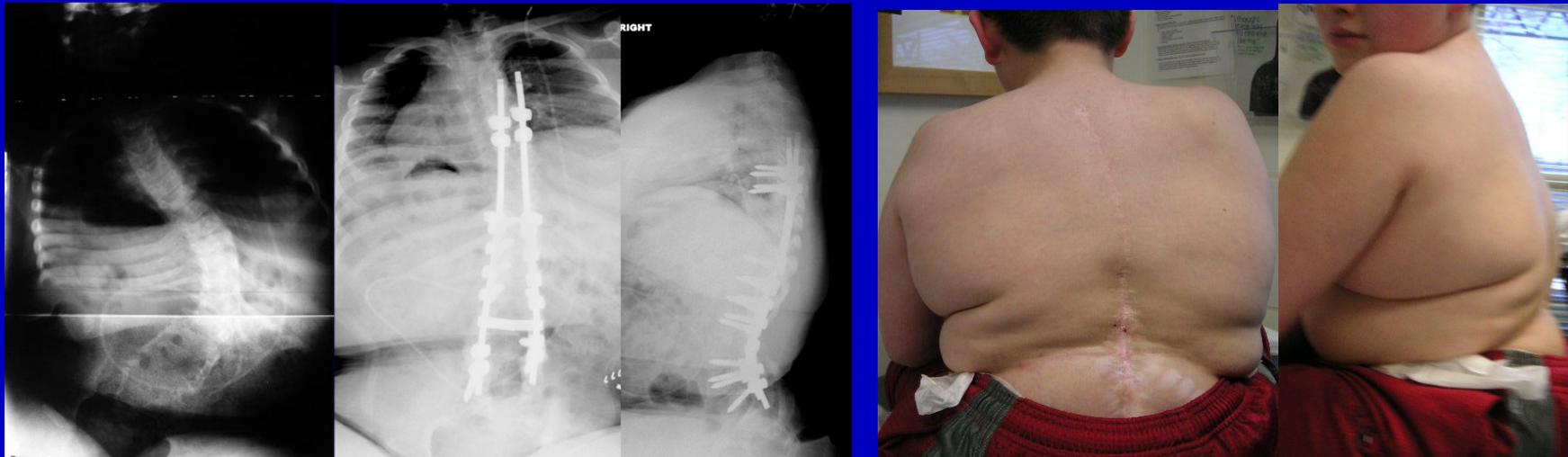
- Rod fixed at apex
- Use spinal cord monitoring



Paper presented at SRS, 2009

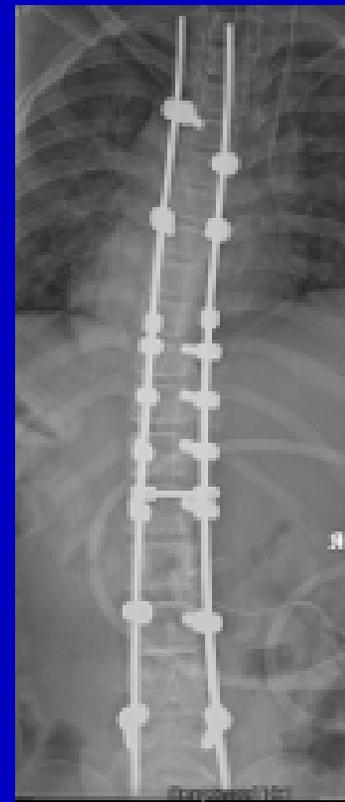
Number of Procedures

- 22 pts: 26 additional procedures
- If had scheduled (6 mo.) lengthenings:
additional **115** surgical procedures
plus Unplanned procedures



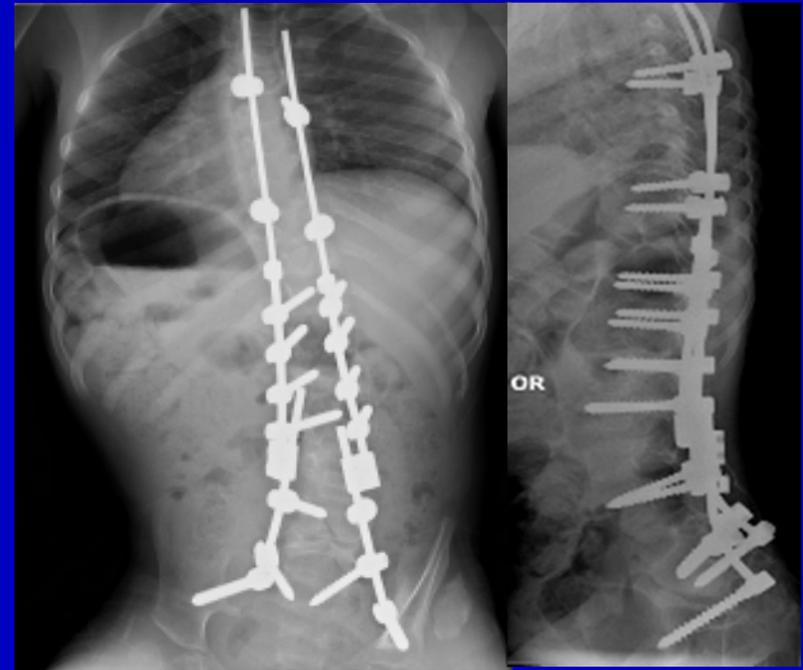
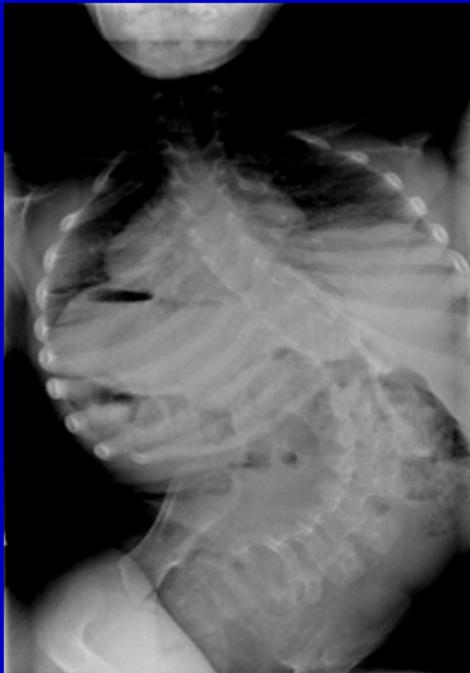
Pelvic Obliquity

- Mild (flexible) – instrument to L5



Pelvic Obliquity

- Severe (rigid) to pelvis

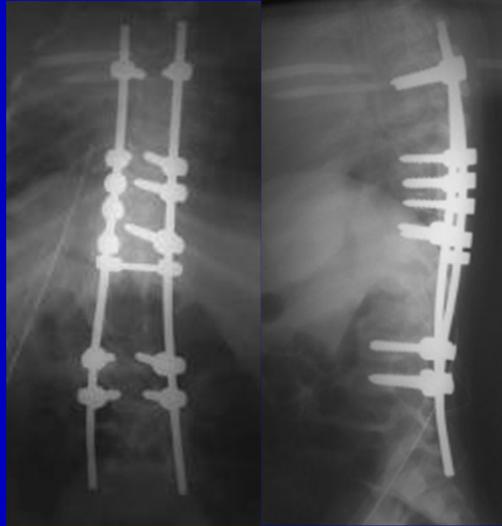


WHAT HAVE WE LEARNED ABOUT **SHILLA** ?

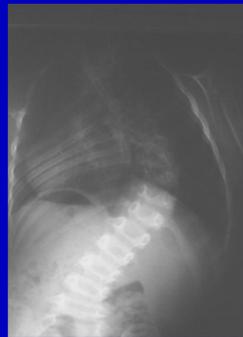
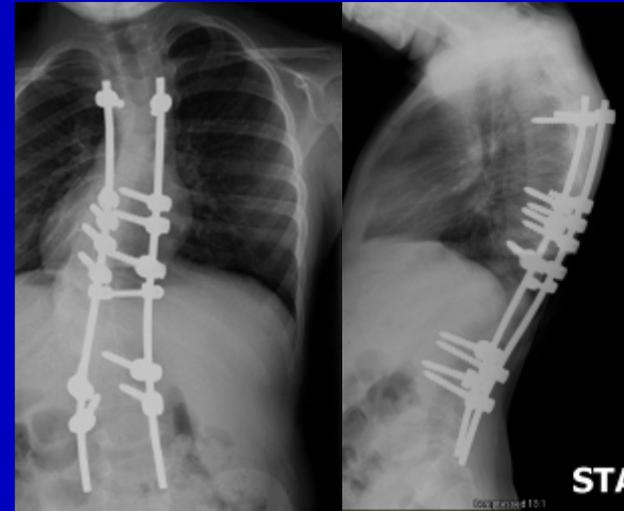
#1 Concept of Growth Guidance Works



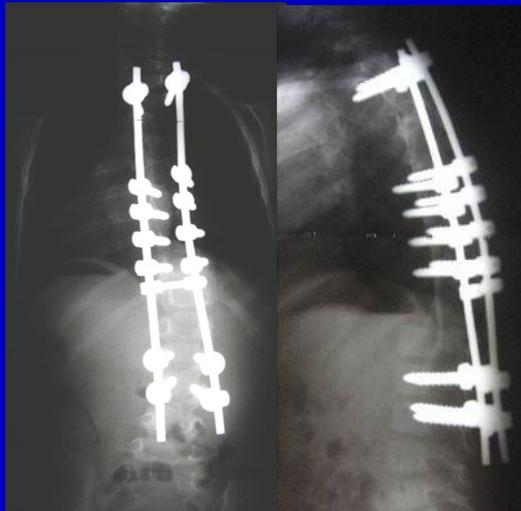
2 ½ yrs old



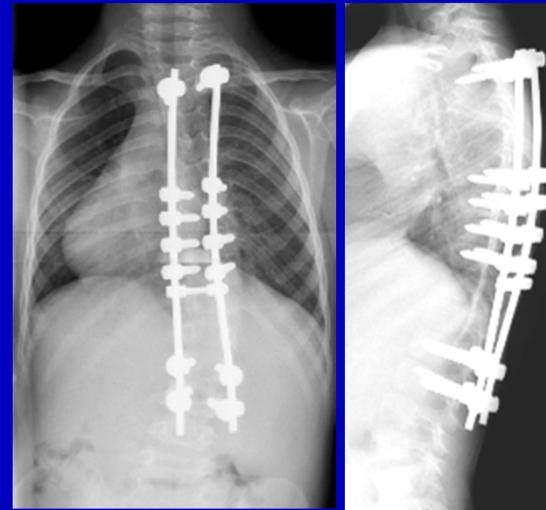
→
7 yrs
postop



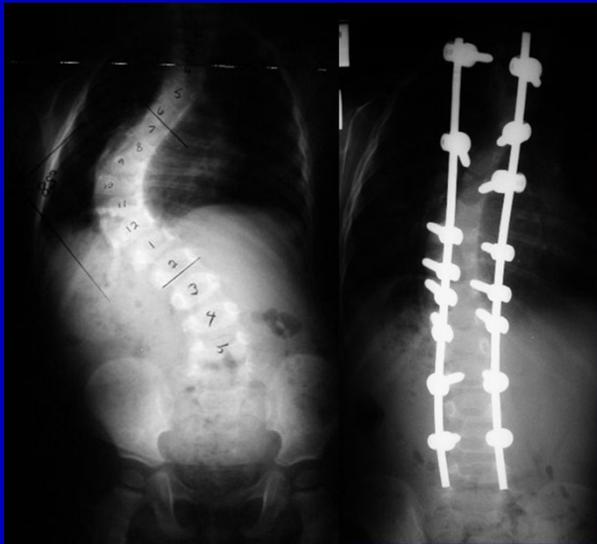
3 yrs old



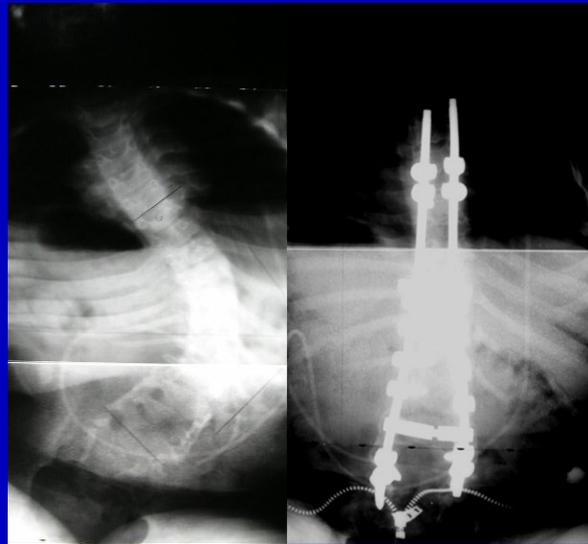
→
3 yrs
postop



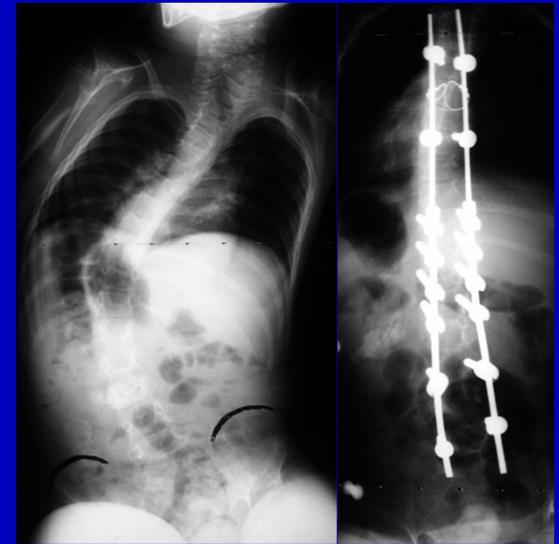
- Can be used for multiple diagnoses



Idiopathic



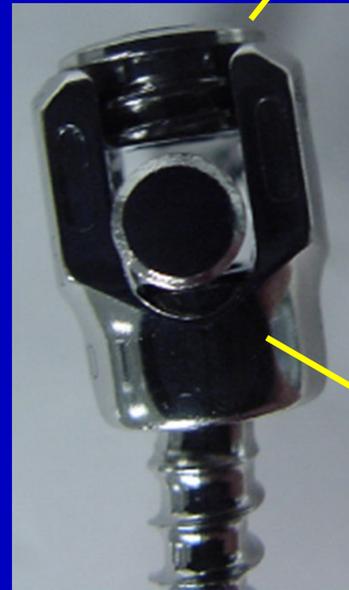
Spina bifida



Cerebral Palsy

Technique

- Multiaxial screws capture rods without binding to the rod allowing the rod to slide



- Rod fixed at apex

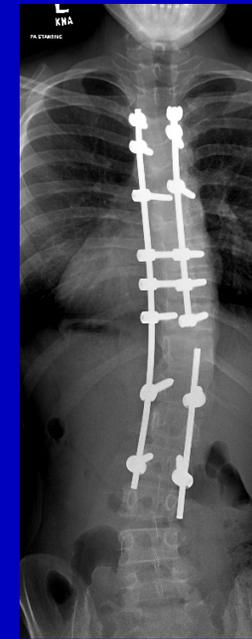
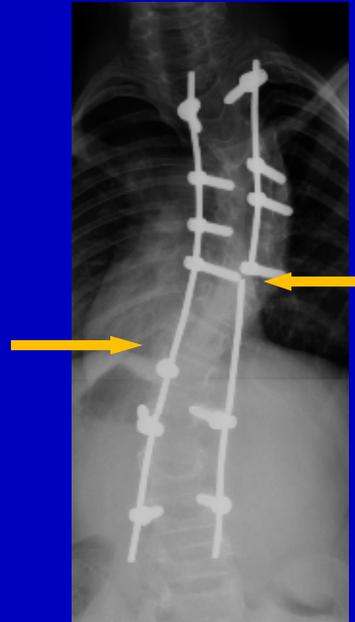
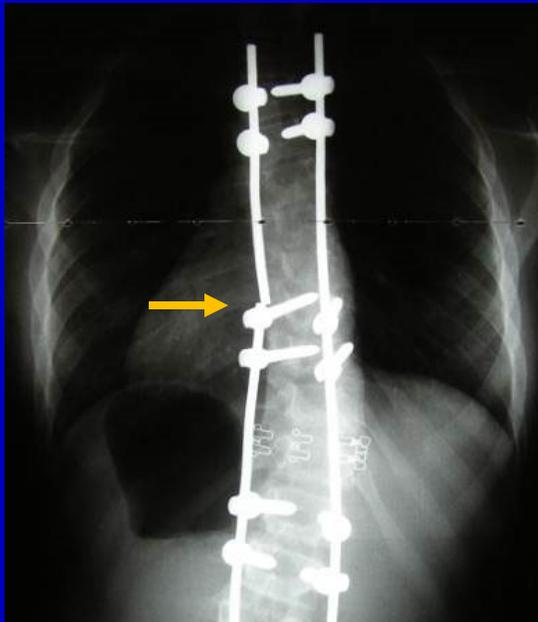
#2 Scheduled returns to O.R. are unnecessary but a third (?) of patients will require another O.R. visit for:

- Prominent implant
- Implant pull-out
- Broken rods
- Infection
- (rarely) growth off rods

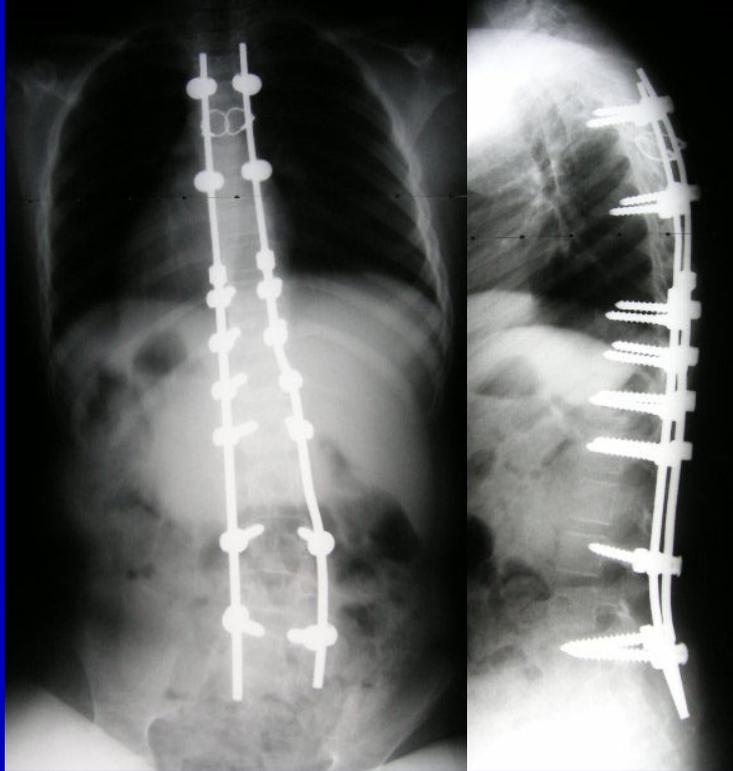


#3 Fixed rods in a mobile child eventually break

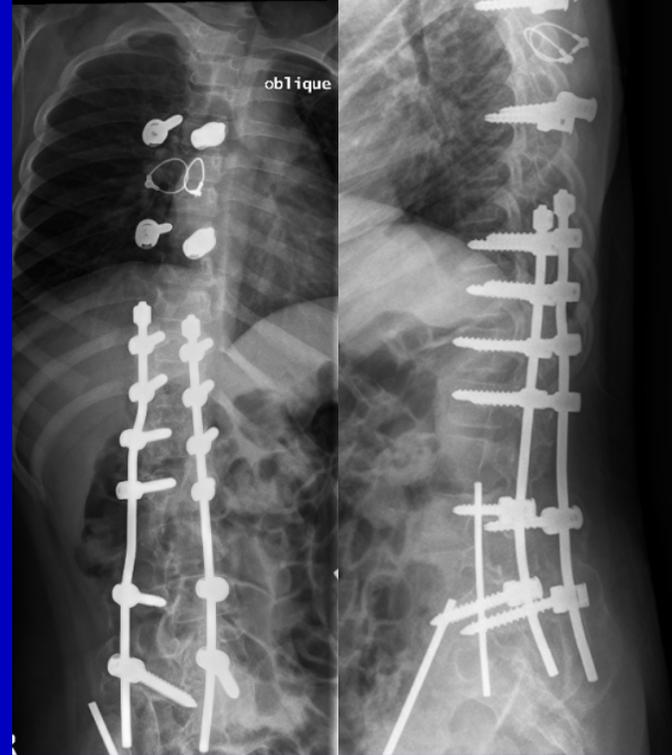
- 3.5 mm \longrightarrow 2-3 yrs
- 4.5 mm \longrightarrow 4-5 yrs
- 5.5 mm \longrightarrow 6 yrs or more



#3b Rods can migrate

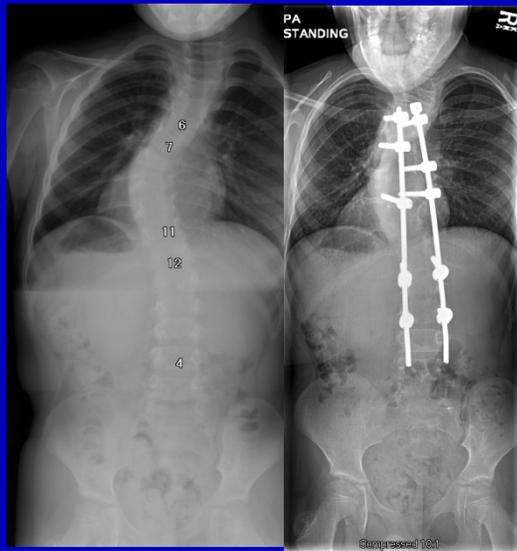


Spinal Cord Injury
8 1/2 yrs old



1 1/2 yrs postop

#4 Metallosis is a reality in growing rods

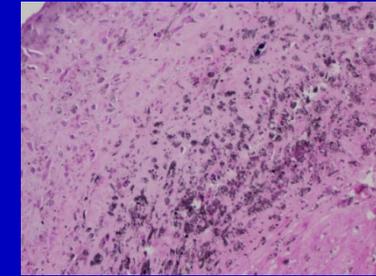
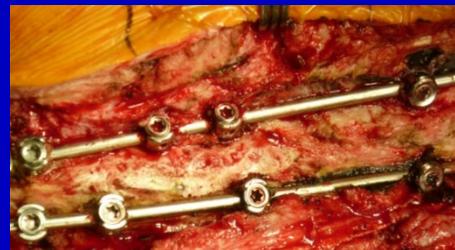


Preop
7 yrs old

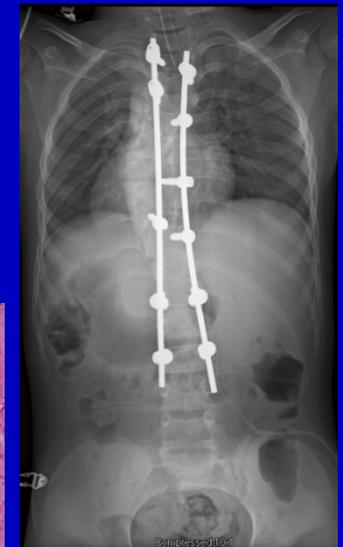
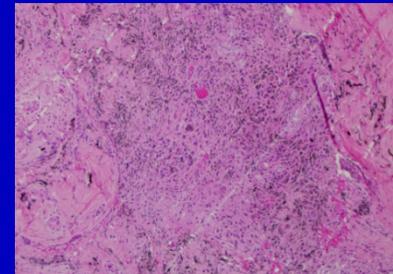
3 yrs Postop



Intra-op

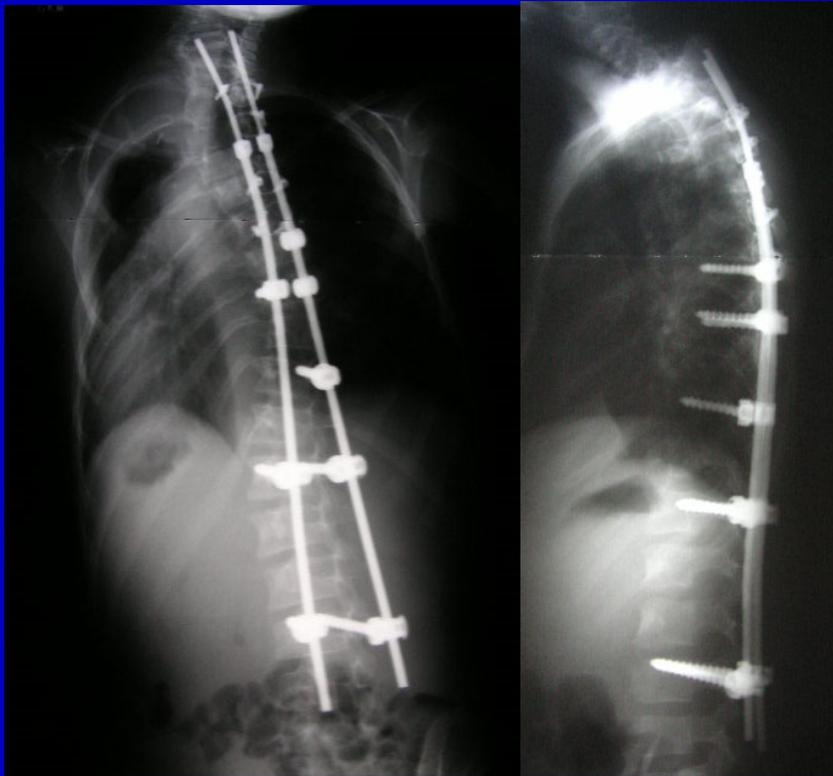


Micro

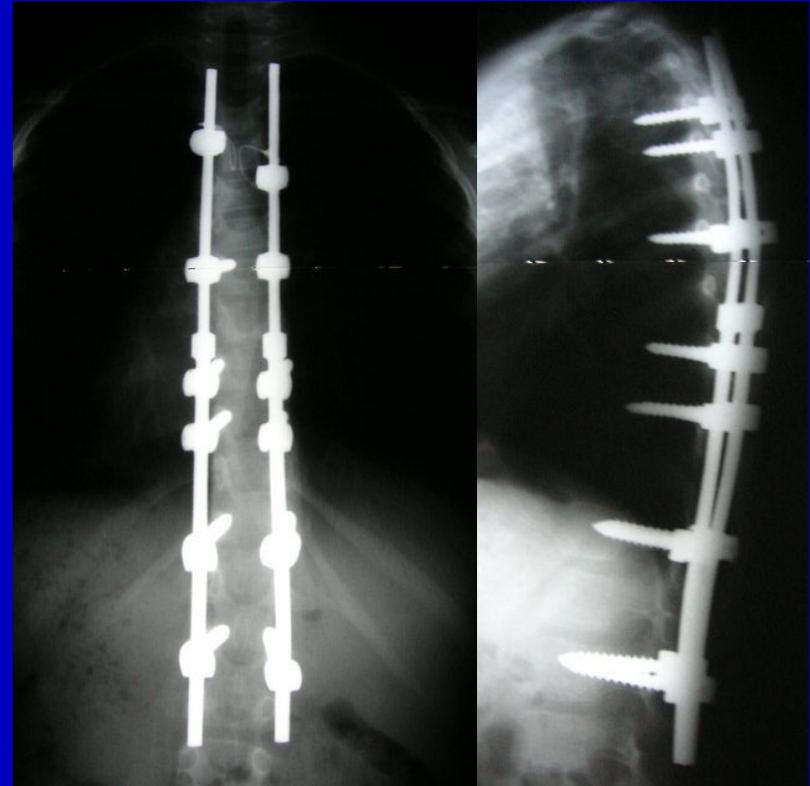


Post
revision

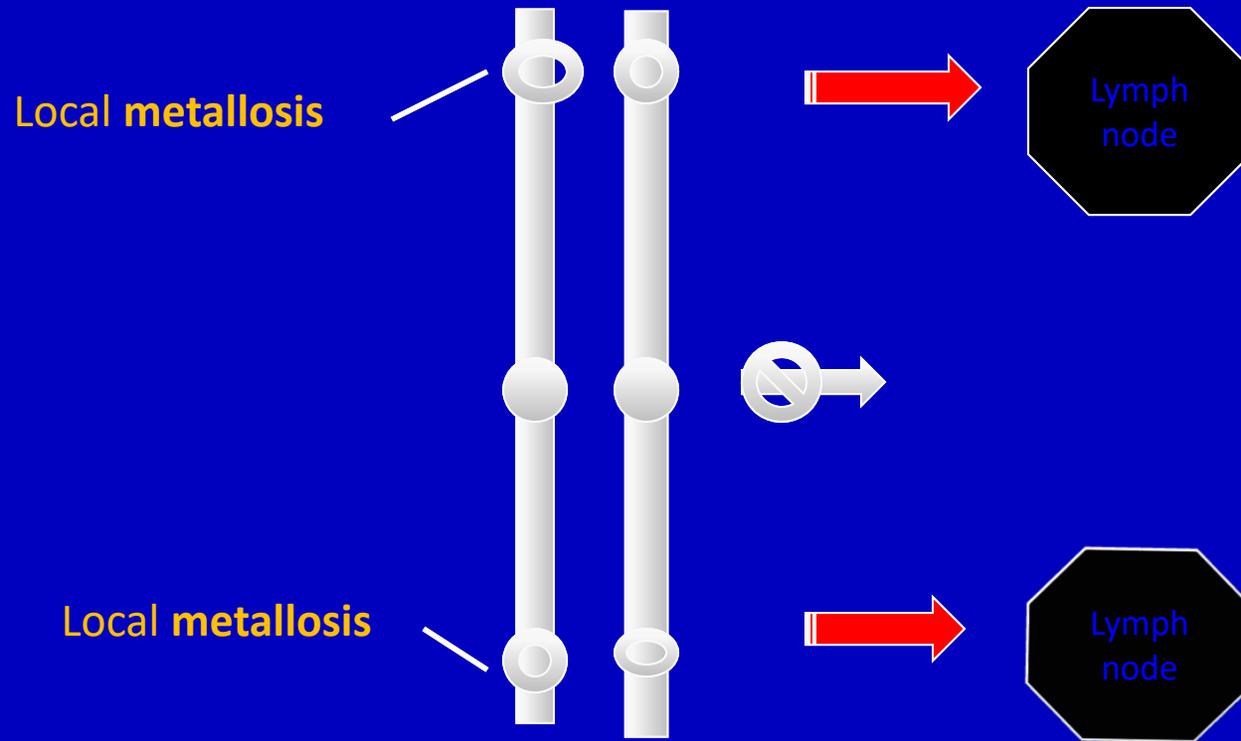
#4b Titanium vs. Stainless Steel



Neurofibromatosis
Titanium (2 patients)

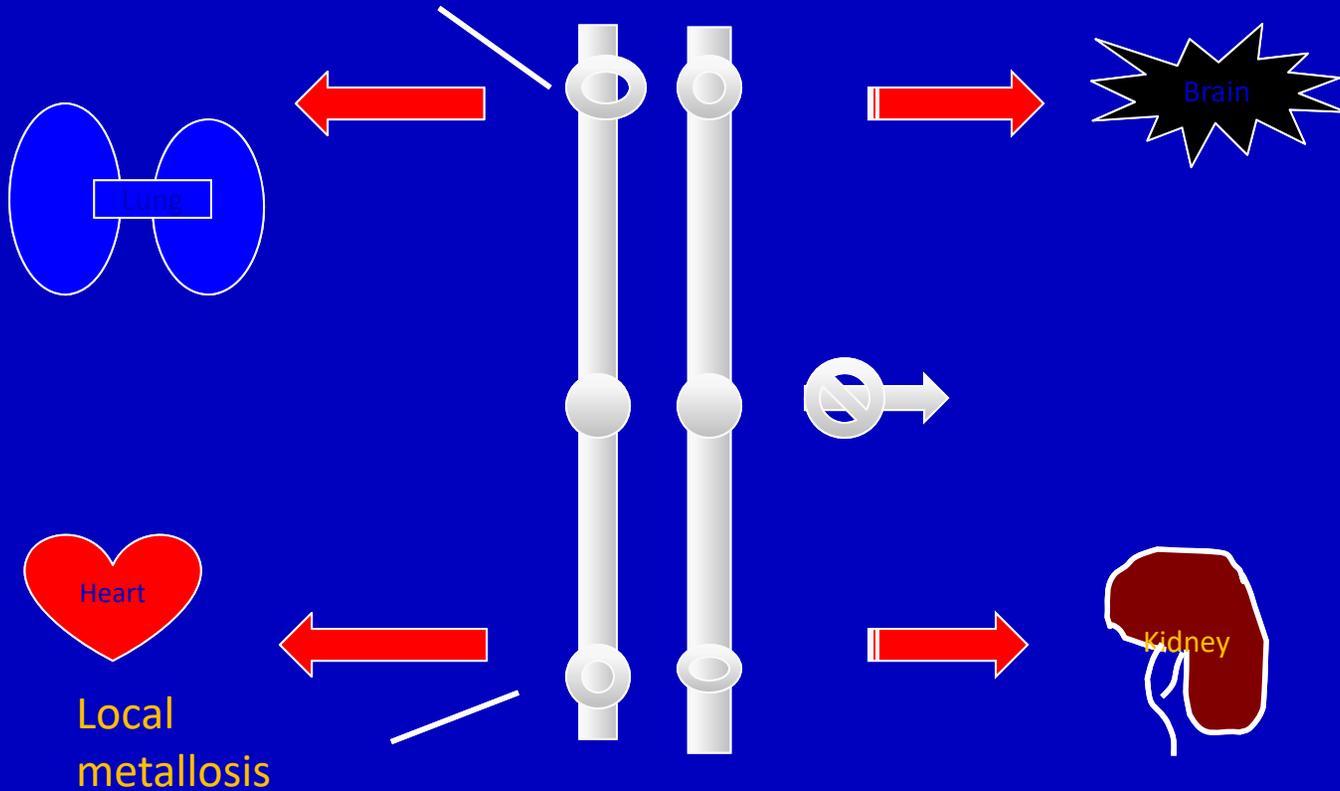


Idiopathic
Stainless Steel (60 patients)



Pattern of Spread for Stainless Steel

Local metallosis

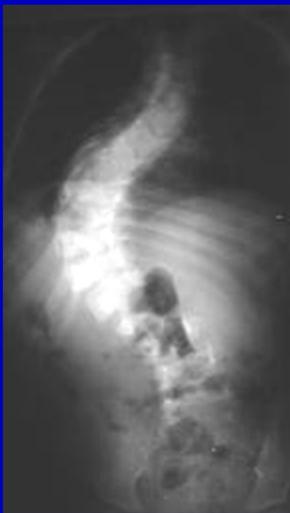


Pattern of Spread for Titanium

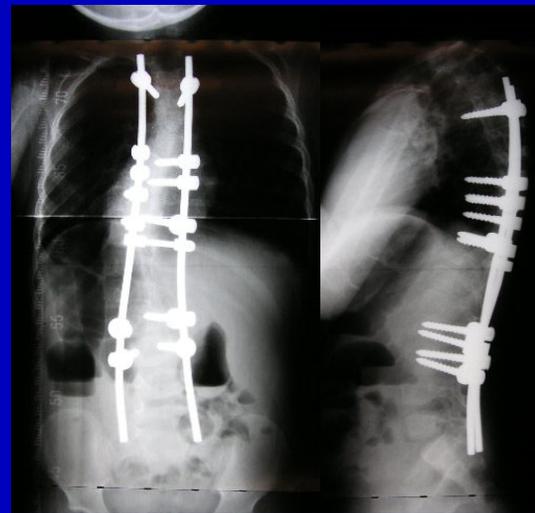
#5 Axial rotation of spine may return

- In the Index procedure the apex is corrected to neutral - significantly reducing rotation

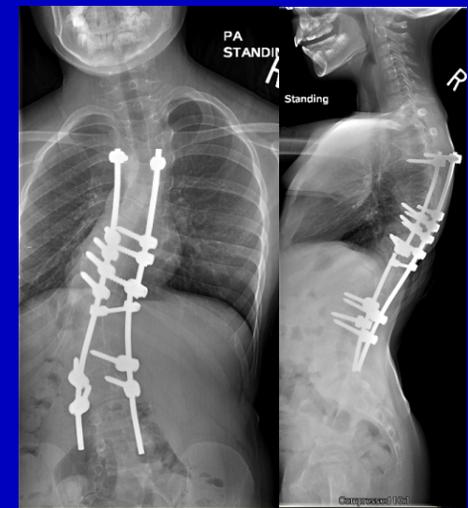
?Does this recurrence represent crankshaft at apex or “adding on”



Preop



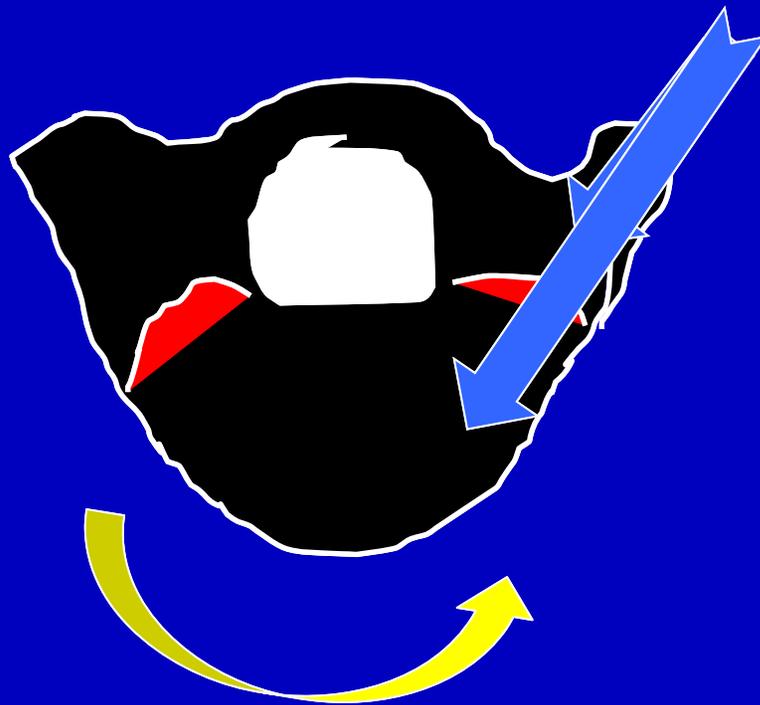
1 yr. postop



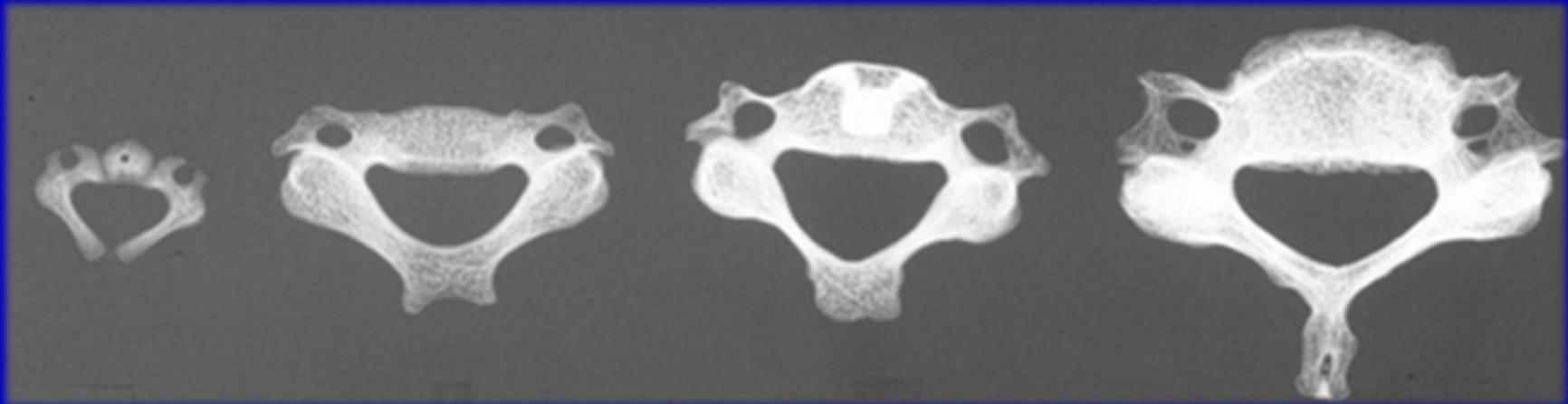
7 yrs. postop

#5b ?Solution?

- Shut down neurocentral growth on concavity



#6 Spinal Stenosis doesn't seem to be a problem



New Born

5

10

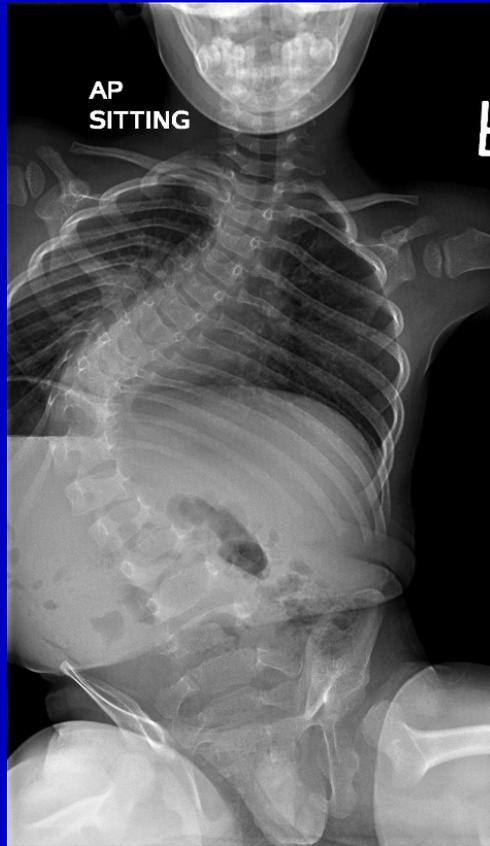
15 years

Ruf Pedicle screws in 1- and 2-year-old children: technique, complications, and effect on further growth.

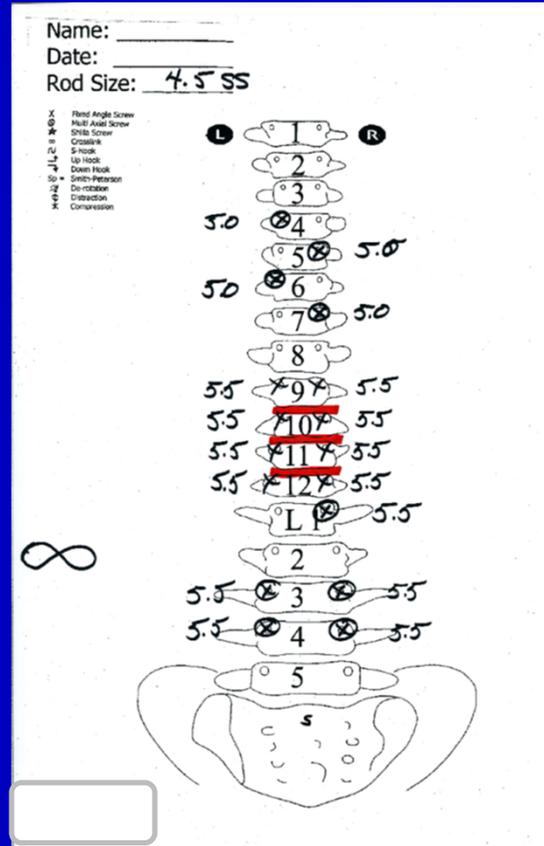
Spine (Phila Pa 1976). 2002 Nov 1;27(21):E460-6.

Department of Orthopedics and Traumatology, Center for Spinal Surgery, Klinikum Karlsbad-Langensteinbach, Karlsbad, Germany. michael.ruf@kkl.srh.derr

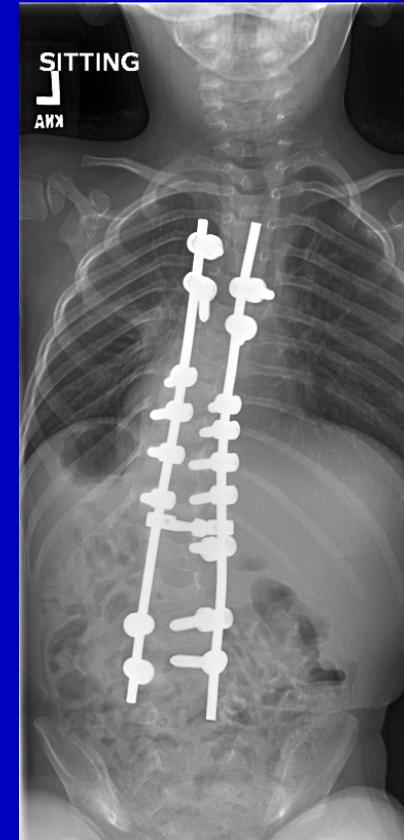
#7 Small pedicles tolerate large screws



3 yrs old
Neuromuscular



Blueprint



2 mo postop

#8 Shilla patients have been able to participate in “normal” childhood activities

- School
- Recreational sports
 - Baseball
 - Softball
 - Basketball
 - Bicycle riding



#9 Spina Bifida patients have more skin breakdowns over implants that lead to “outside→in” infections and failures



#10 Low grade infections can be tolerated with suppressive antibiotics with retention of implants(2 cases)

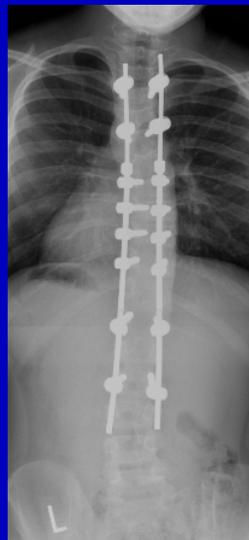
What to do at maturity ?

Recommendations for the future:

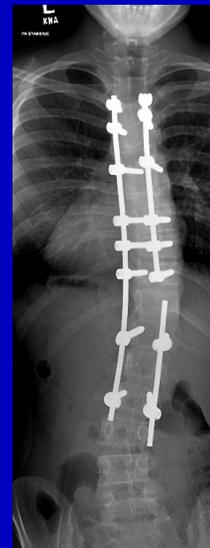
- **Tailor the treatment to the needs of the child at maturity**
 - if residual deformity exists then correct with final fusion and instrumentation



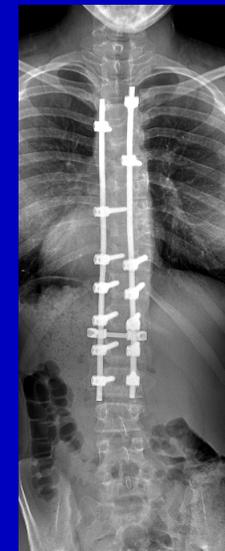
Pre-op
7 yrs old



Post growth
guidance



Pre definitive
fusion



Post op
definitive fusion

Thank You