

# Halo Gravity Traction in EOS



T E X A S  
**SCOTTISH RITE HOSPITAL**  
FOR CHILDREN

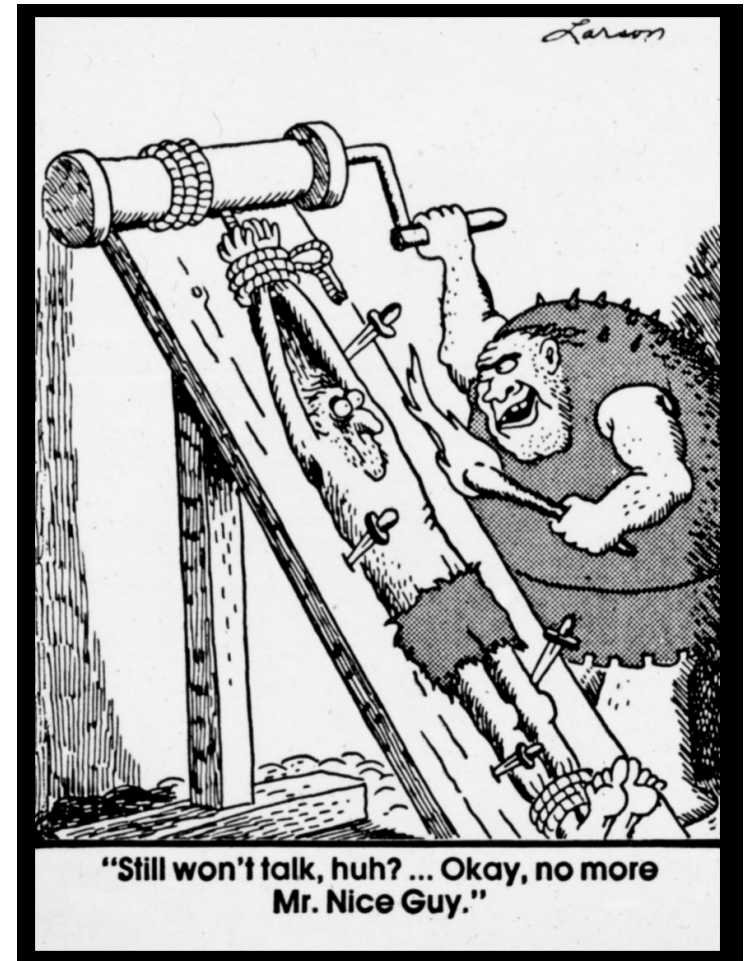
Charles E Johnston MD  
ICEOS Utrecht 2016

# HGT Indications

1. Preop deformity correction in fragile, osteopenic patients (acute correction compromise)
2. Preop correction of stiff curves, esp. kyphotic (↑'d neuro risk)
3. Pre-existing respiratory compromise 2° deformity (impending TIS), anesthesia morbidity = respiratory rehab
4. Delaying tactic in EOS management
5. Facilitates insertion of expandable devices by kyphosis correction

# Halo gravity traction (TSRHC)

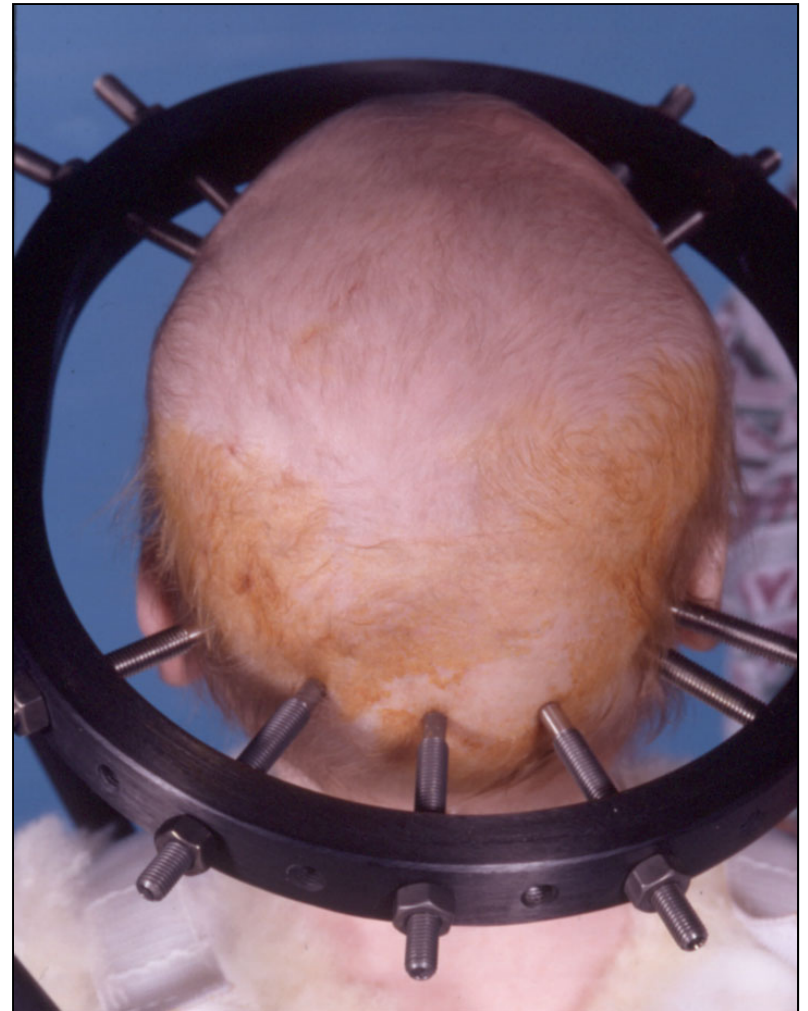
- Sink et al (JPO '01)  
19 pts 1985-96





# Technique

- Lots of pins
- 1 lb torque/ yr age
- Progressive ↑ wt.  
based on neck  
(swallow, pain)  
and neuro tolerance
- Day traction @ max.
- Night for comfort





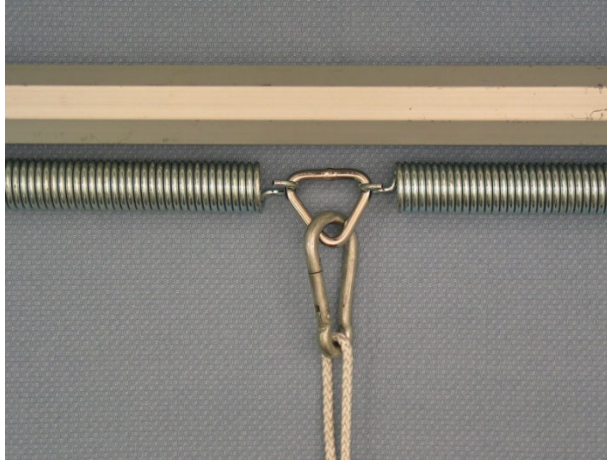
# Halo wheelchair



Manual  
distraction

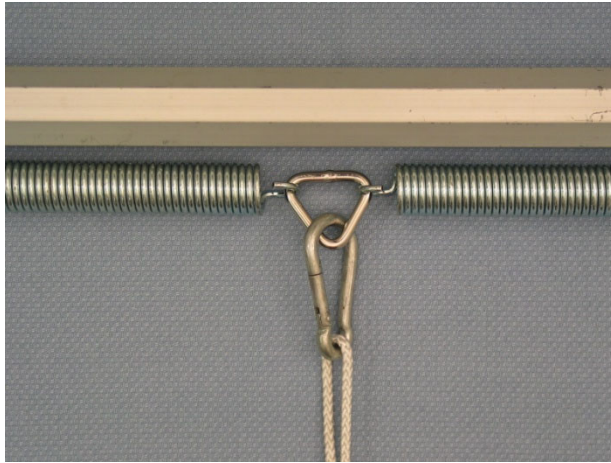


# Halo - Walker



Rope Excursion = 4:1 on  
double windlass  
→ easy 1 hand  
adjustment

# High load bb swivel and transverse loading spring scale



## SAFETY !!!

Patient can relieve traction pull by:  
push up on w/c arms ;  
push up or stand on tiptoes (walker);  
reach up and release rope from cleat





# Fixed weight - possible explanation for neuro lesions, etc

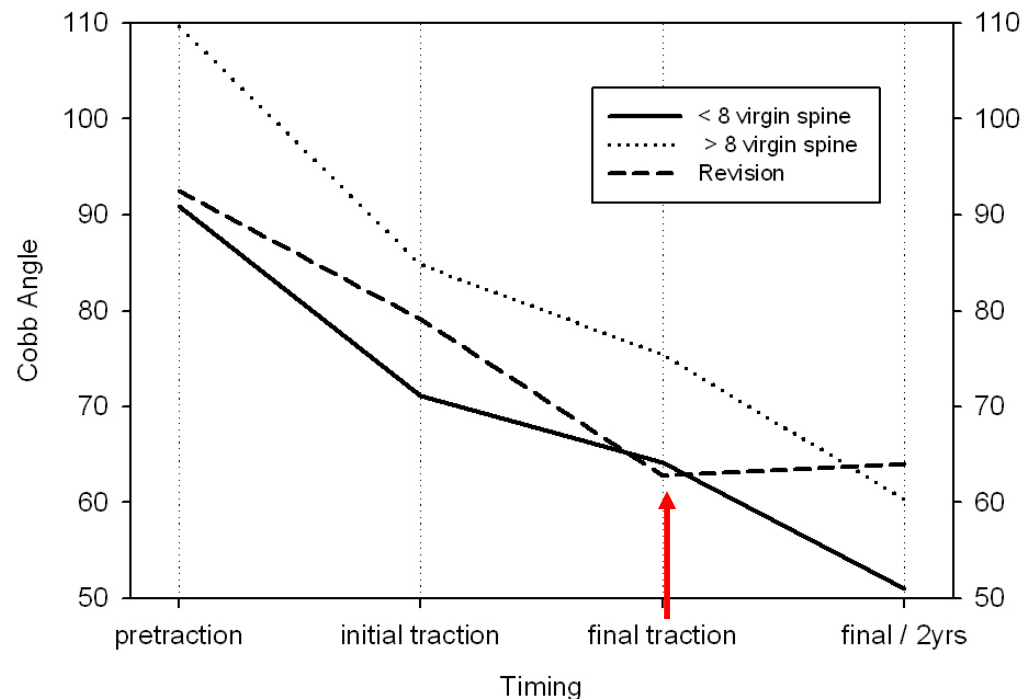


# Advantages

- Mobilization of patients (as opposed to halo-femoral)
- Pulmonary improvement (hard to measure because PFT's don't change rapidly unless mechanical factors due to trunk collapse)
- Curve correction (esp. kyphosis) → other rx's (brace, growing rods) more effective

# Halo-gravity Traction 1997-2007

- Scoliosis correction  $\approx 30\%$



## Correction

$< 8_{\text{virgin}}$ :  $26.3^\circ$  (29%)

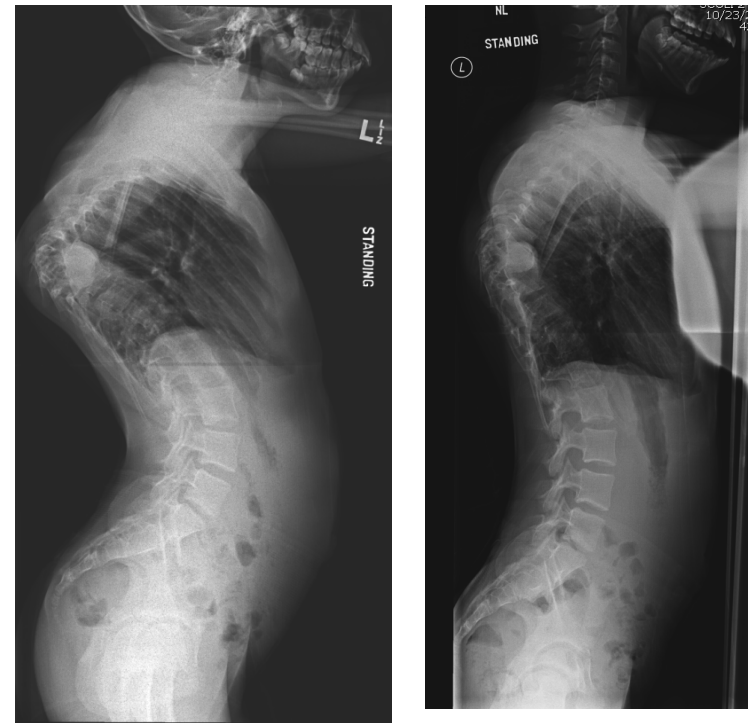
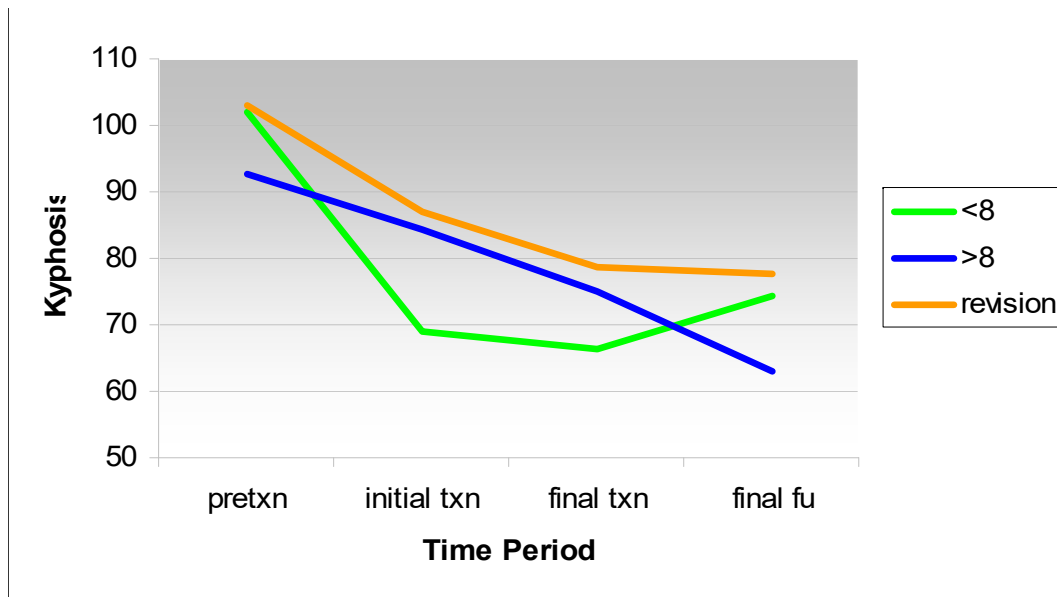
$> 8_{\text{virgin}}$  group  $34.3^\circ$  (29.7%)

Revision group:  $29.8^\circ$  (30%)

No diff between groups



# HGT 1997-2007 Kyphosis

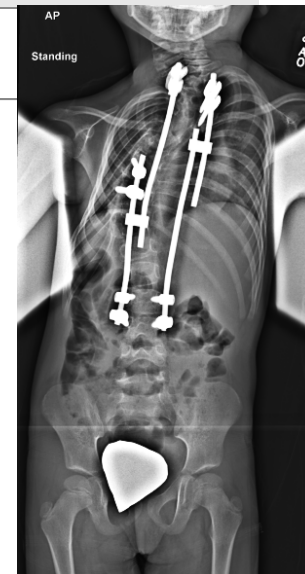
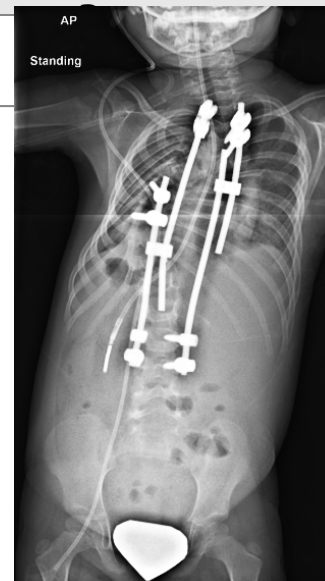
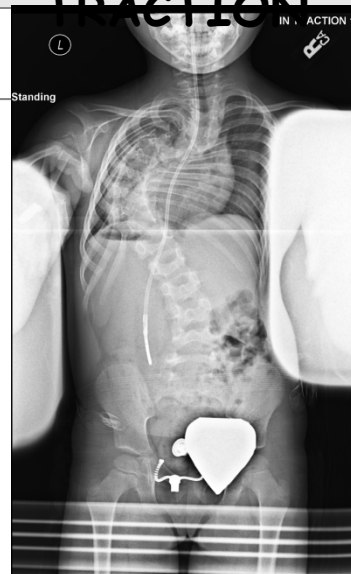
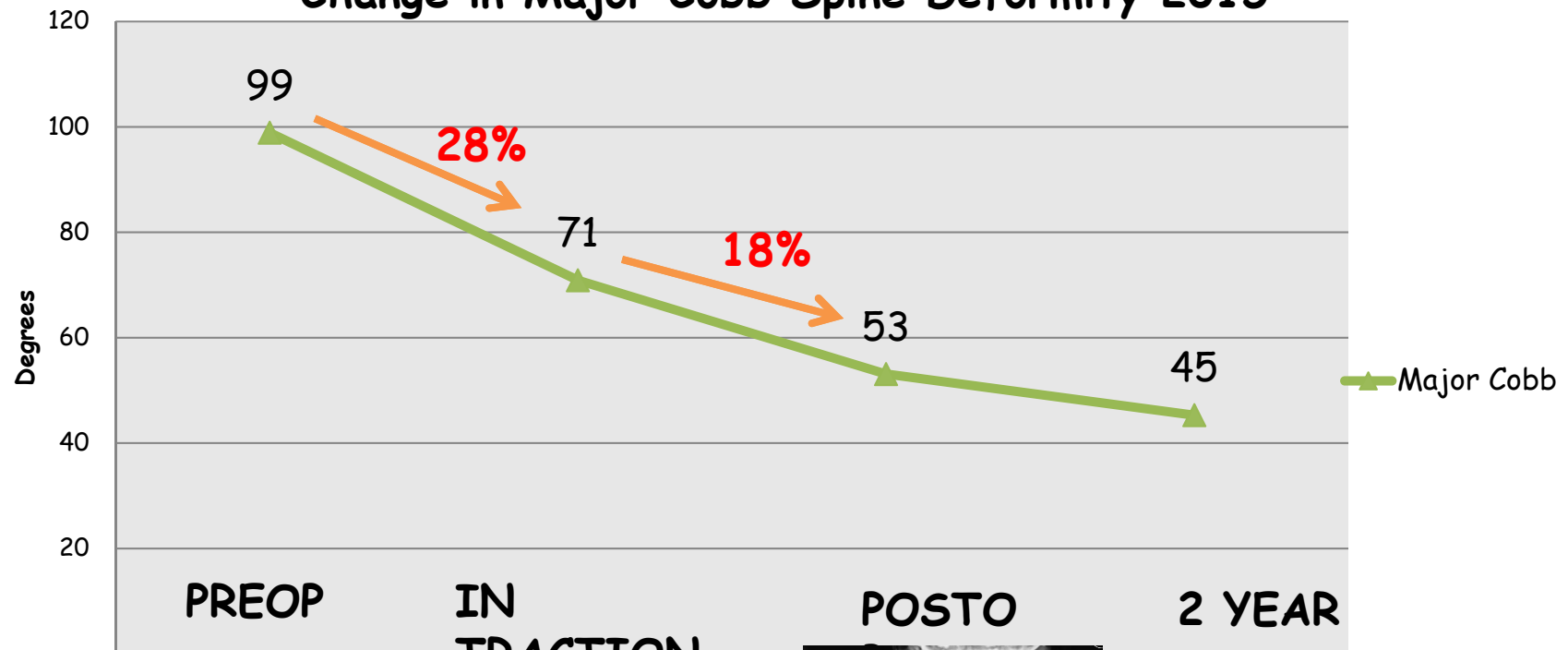


31° mean correction (27%)

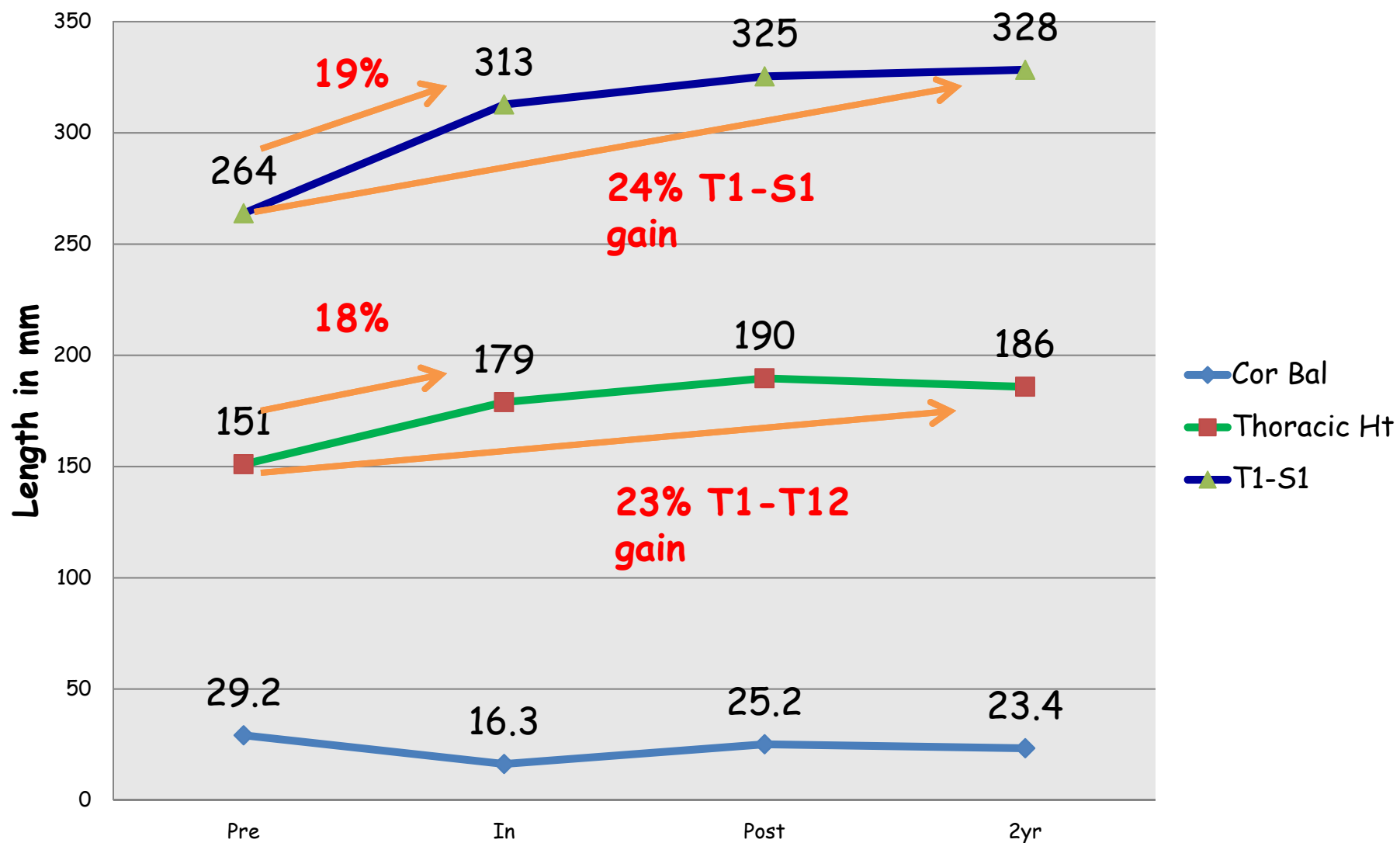
< 8 most effective

3.3 cm T1-12 length ↑ (29%)

## Change in Major Cobb Spine Deformity 2015



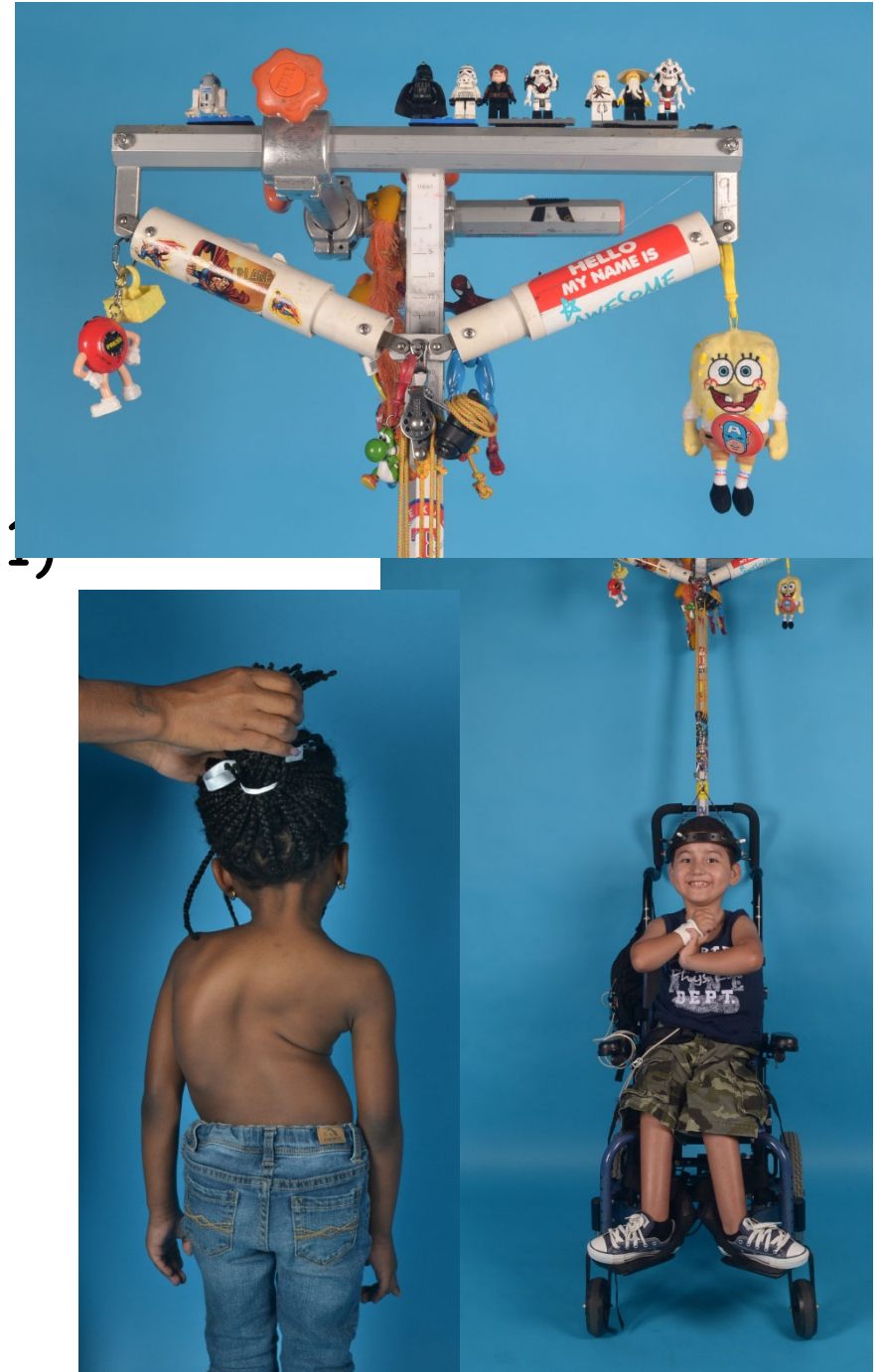
## Improvement in Spine Length and Balance





# EOS specific population

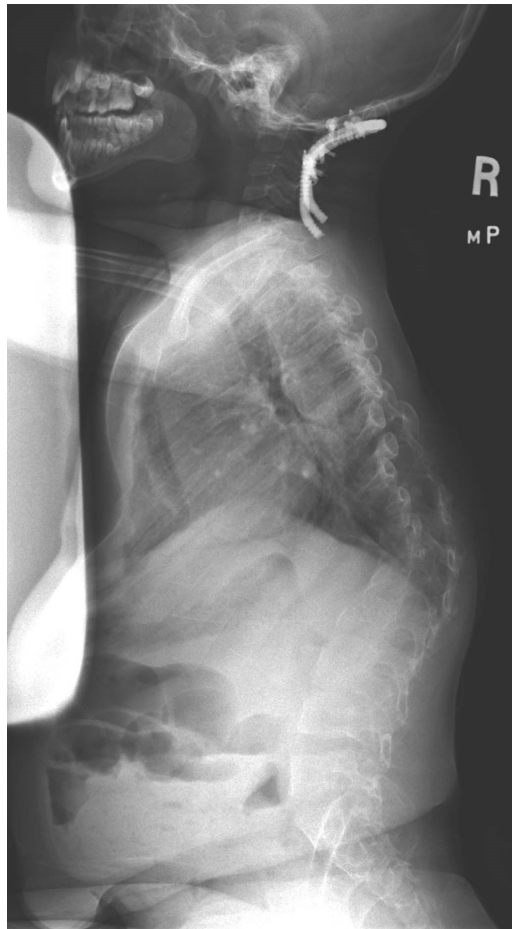
- 37 patients age  $\leq 10$
- At least 4 weeks in tx
- Mean age 6.6 years  $\pm 2.4$  (1.8-10.1)
- Weeks in traction 14.7 $\pm$ 12.9 (4-68)
- Maximum traction 57% body wt
- 64% primary, 36% revision
- Procedure:
  - 24 growing rods
  - 7 PSF
  - 6 ASF/PSF



# EOS POPULATION (AGE $\leq 10$ )

	n	Pre-traction	In Traction	Post-Op
Coronal Major Cobb	37	90.5°	62.0°	46.9°
Sagittal Major Cobb	37	71.2°	51.9°	43.0°
<b>T1-T12 height</b>	<b>37</b>	<b>12.3 cm</b>	<b>15.7 cm</b>	<b>20.2 cm</b>
T1-S1 height	37	21.8 cm	27.0 cm	34.2 cm
Weight Z-score	37	-1.9	-1.4	-2.1
Weight percentile	37	15 <sup>th</sup> %	23.8 <sup>th</sup> %	16.7 <sup>th</sup> %
Nutritional Risk Subgroup (Z-score < -2)				
Weight Z-score	13	-3.5	-2.8	-1.7
Weight percentile	13	<1 <sup>st</sup> %	1 <sup>st</sup> %	13 <sup>th</sup> %

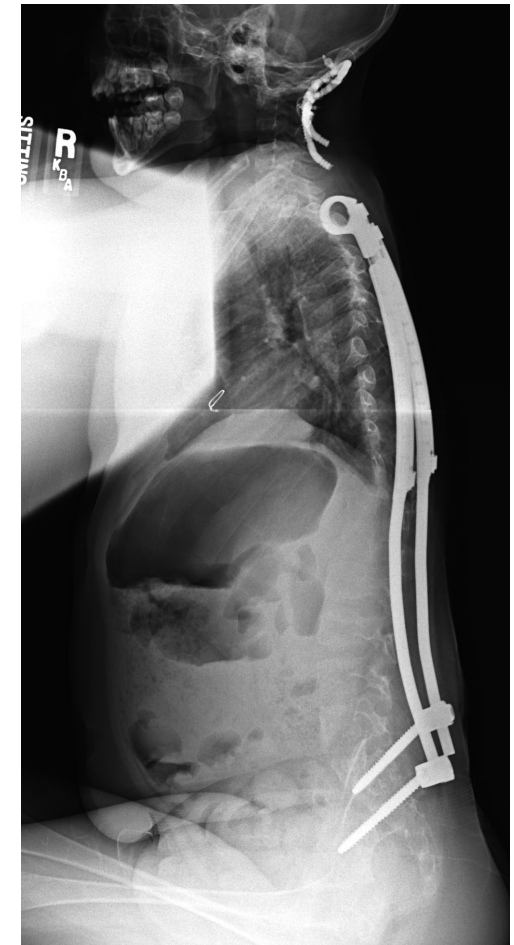
Preliminary traction facilitates placement of longer, straighter devices with better proximal anchors due to decreased kyphosis



initial



traction



postop



# Complications (n>150)

Pin tracts/

Pin change prn <5%

C spine disrupt 1

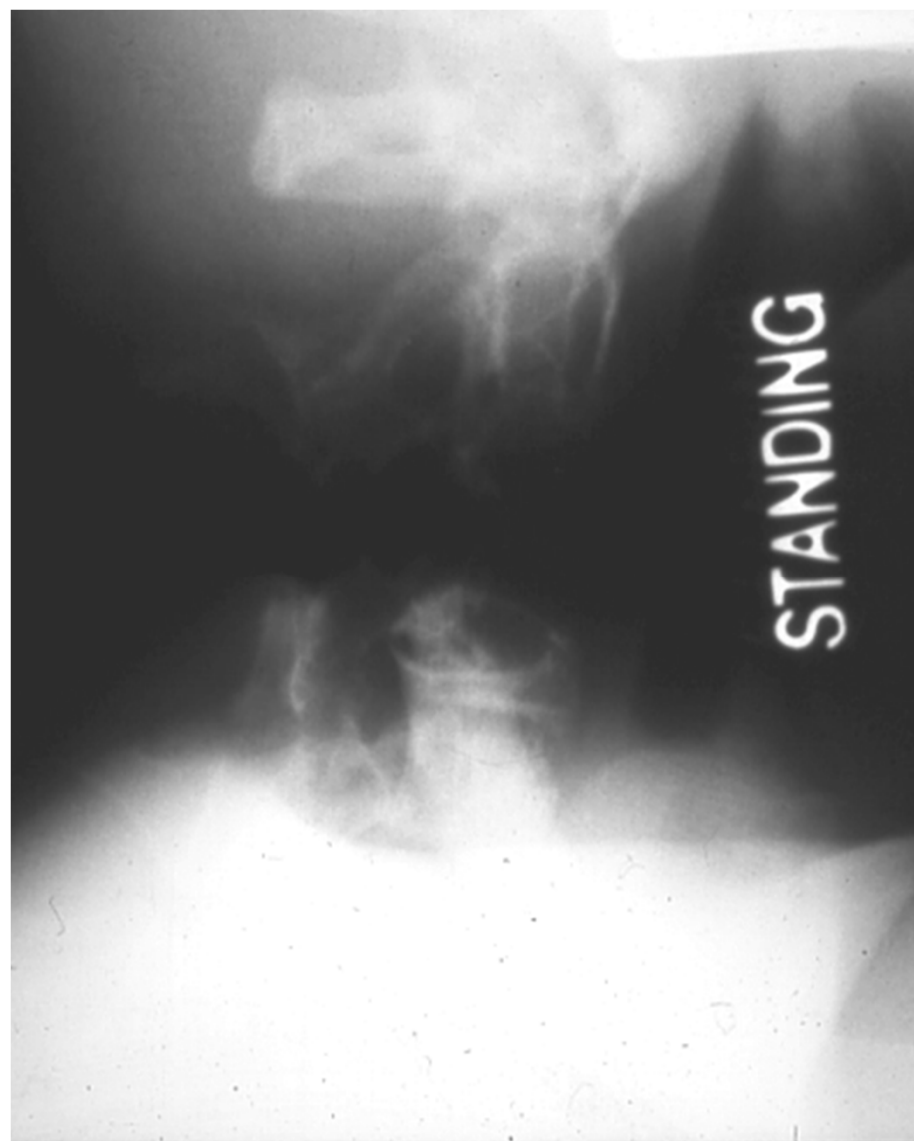
(Klippel-Feil)

Paraparesis (tumor) 1

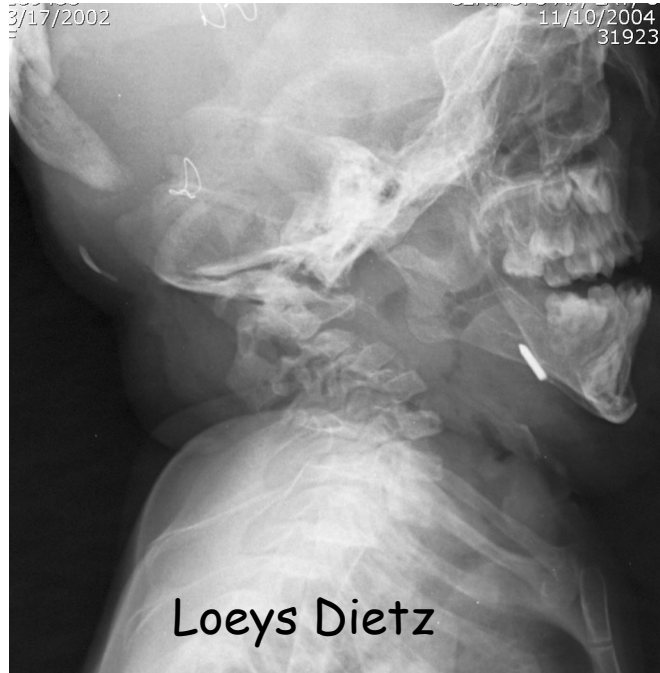
Excess pain 1

? Neuro sx (cong kyph)

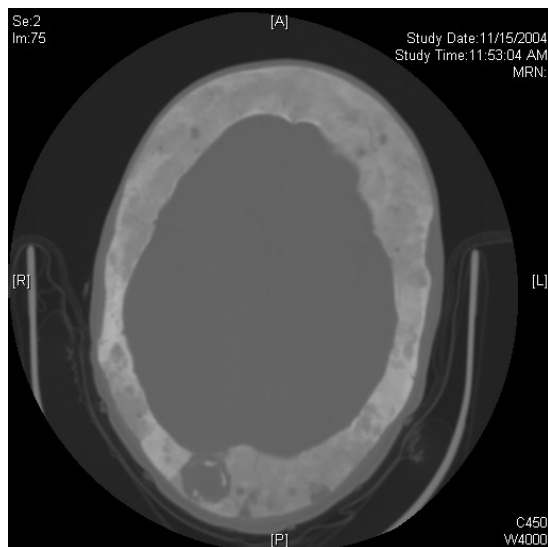
Unilateral 11<sup>th</sup> n. 2



# Contraindications - absolute



- No skull  
(fibr dyspl, O.I.)
- Intradural mass



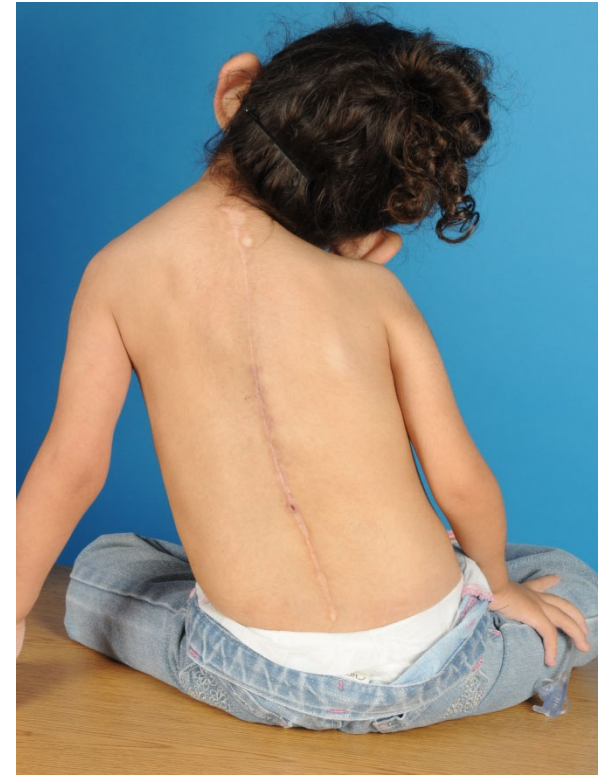
# Other complications



Pin tract -> orbital cellulitis



Loss of head control s/p txn + GRI  
paper #42



# Most difficult case - 15 Months

- Pulling to Stand
- Hospitalized: FTT & URI
- MRI: Negative
- CT: Negative
- Weight: 5.2 kg (<5<sup>th</sup>%)
- Curve is "quite rigid"



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- Hospitalized: FTT & URI
- MRI: Negative
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Casting not feasible

Bigger curves get traction  
(White/Punjabi)



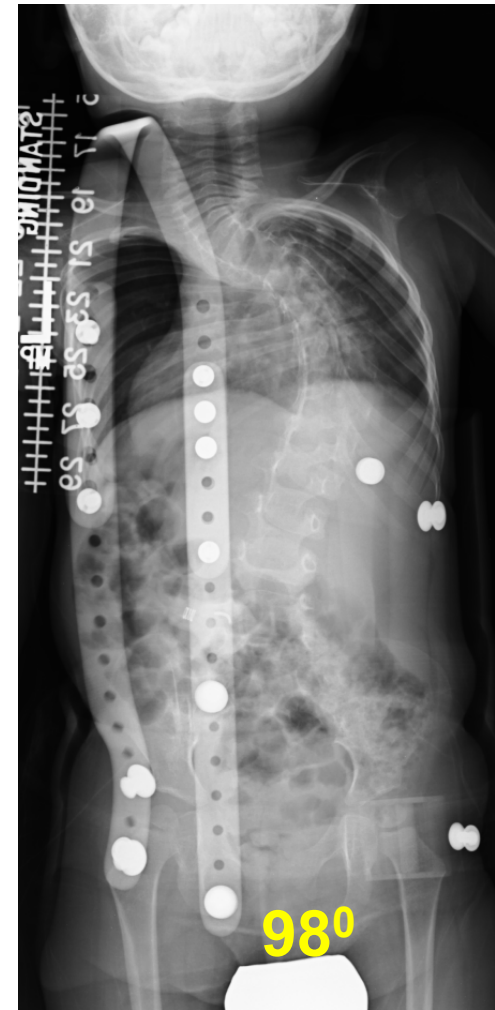
# 18 Months (2 mo txn)

- Halo Txn
  - 2 lbs initial
  - 10 lbs @ DC
- Curve:  $68^{\circ}$
- Kyphosis better

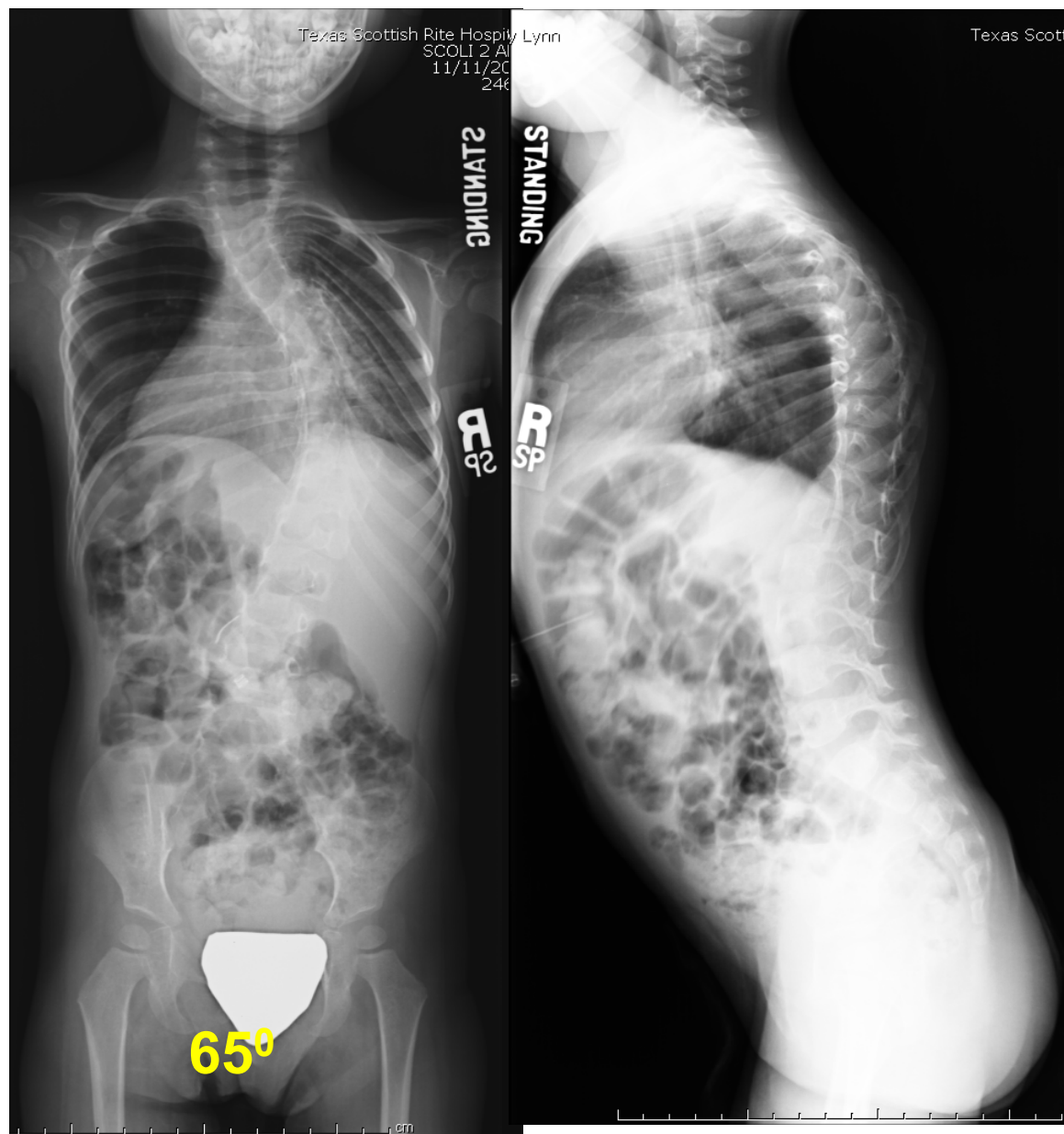


## 2+6 Years - recurrence -ve workup

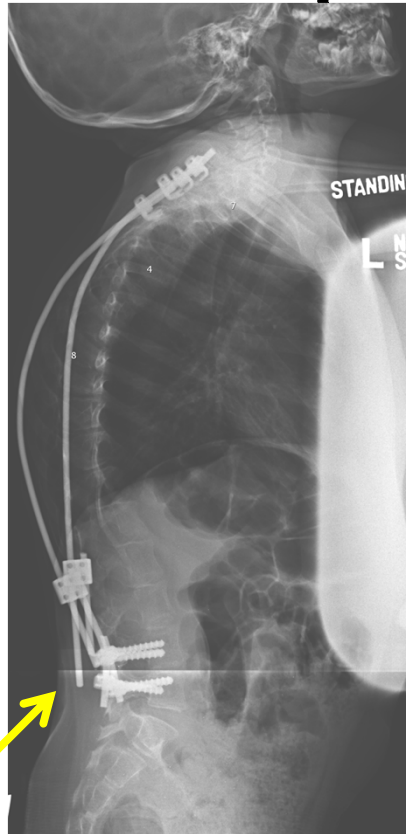
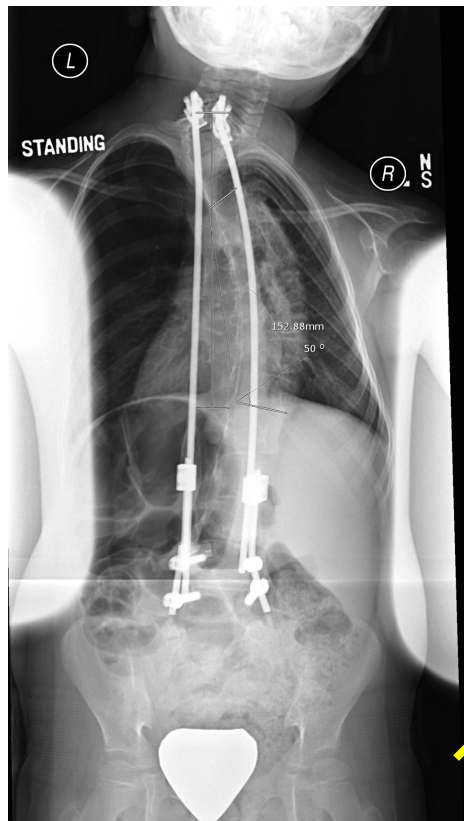
- Brace: 8 mos.
- Plan - halo txn
- Cycle repeated 3 more times until age 4+6



## Re-corrected in txn



# GRI implanted 4+6



50° T1-12 = 15.2

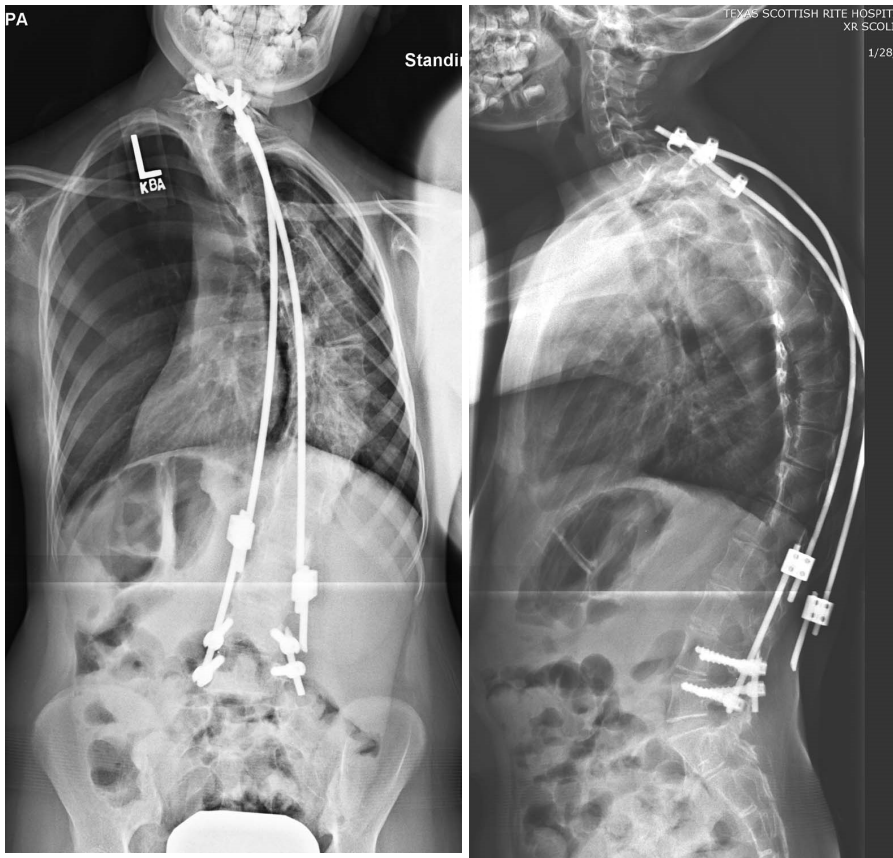
6 planned lengthenings

2 unplanned broken rod  
revisions

Age 7+6



Jan '11 age 9+8 Broken rod #3  
(+ 9 scheduled lengthenings)



Decision for  
final  
traction +  
fusion

Final improvement  
accepted  
Open TRC

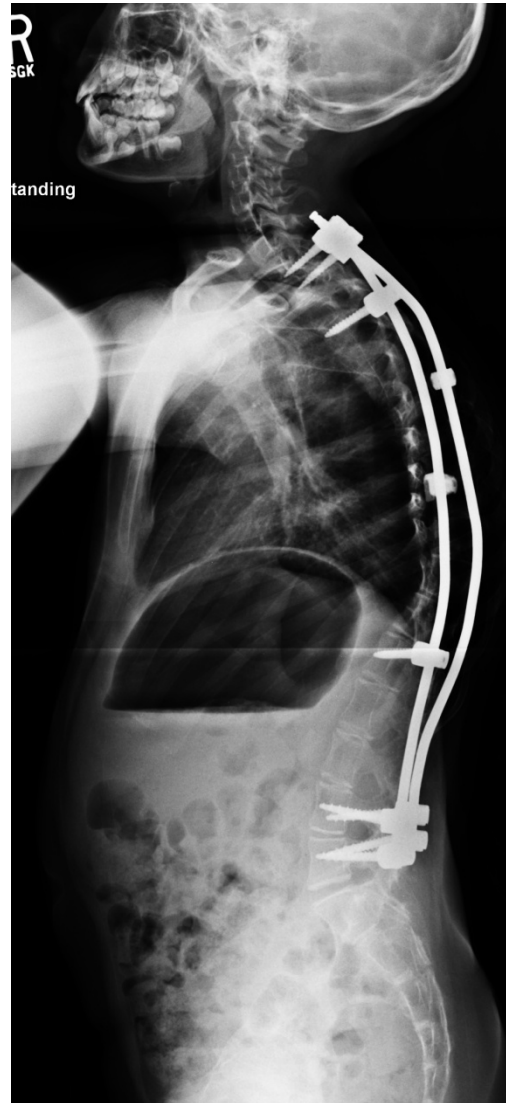
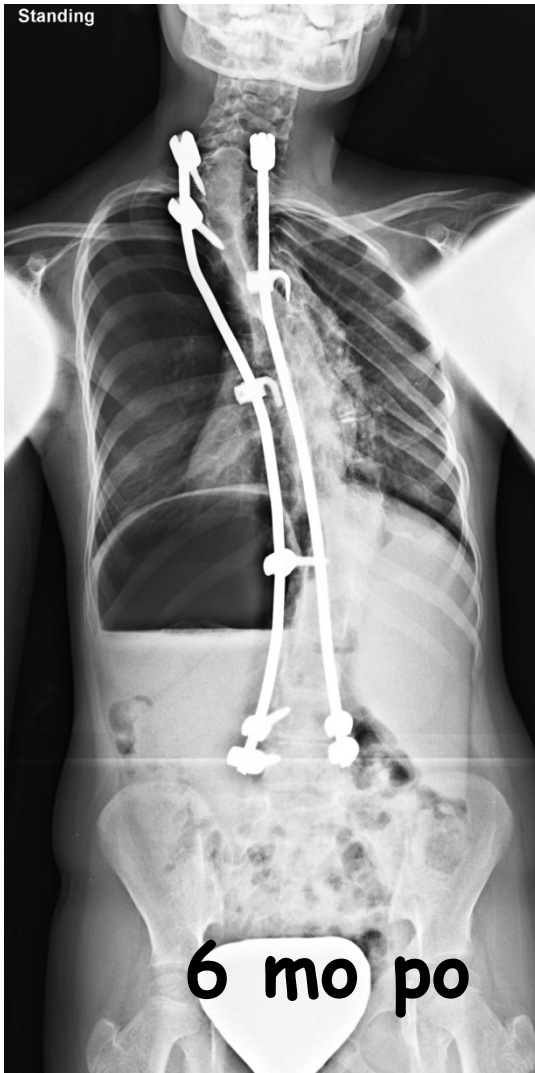


# Rod removal, final HGT -> ASF/PSF



Best corrections still by HGT

# ASF (vats)/PSF with extensive posterior facet ankylosis



T1-12 = 22.0 cm  
T1-S1 = 32.3 cm  
T4-L1 48°

FEV1= 47% pred  
FVC = 45% pred

Are we finished ?  
Outcome  
dependent on:  
PFT's in future  
Total spine fused  
to L5

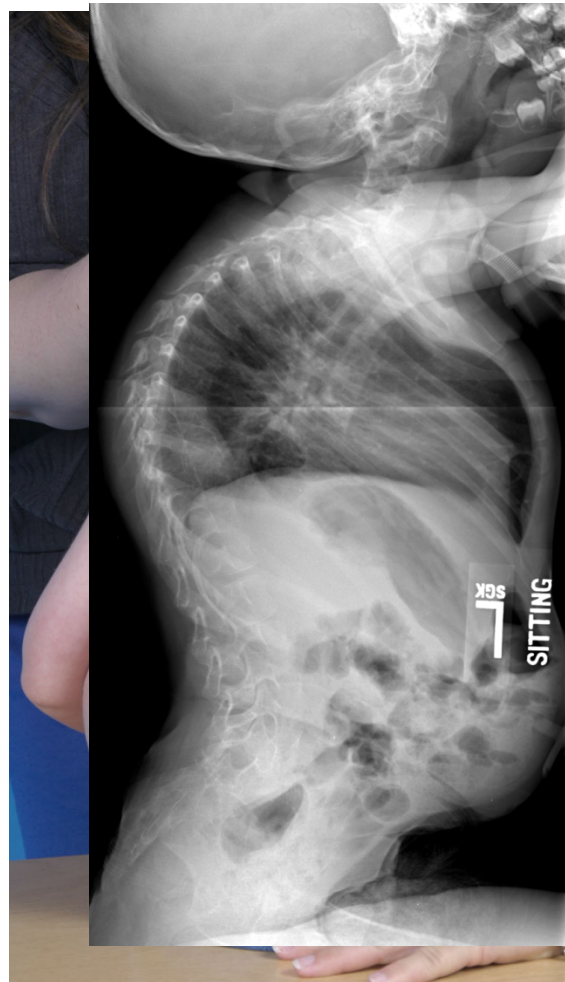
Axial plane =  $\downarrow$  PFT ?





# Longest Time in Traction

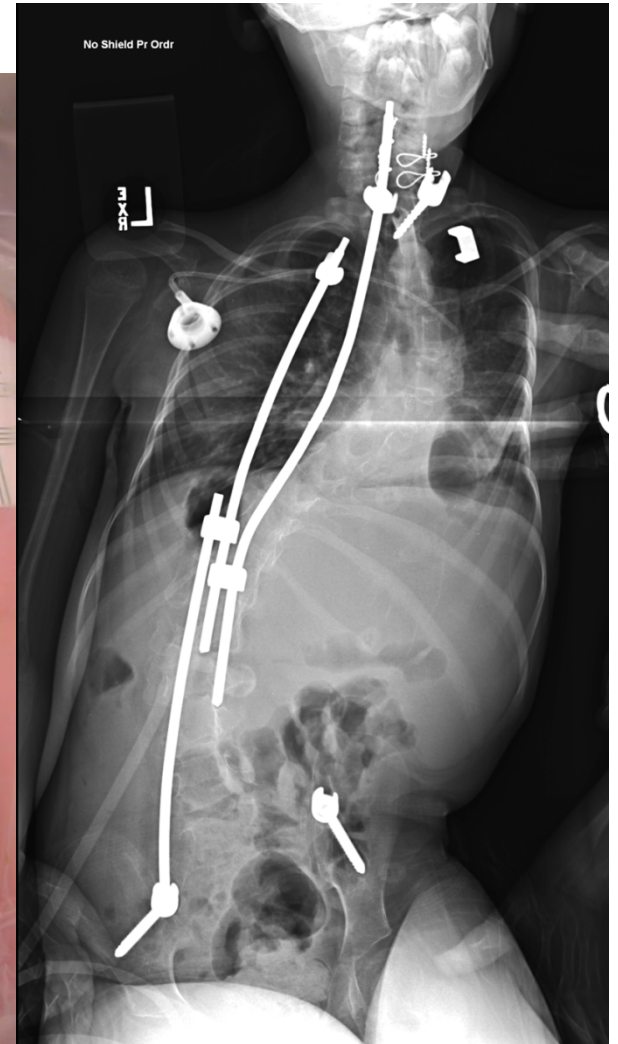
## 4 yo M w/ cong myopathy - 3/07



# Surgical rx -> spine and rib anchors



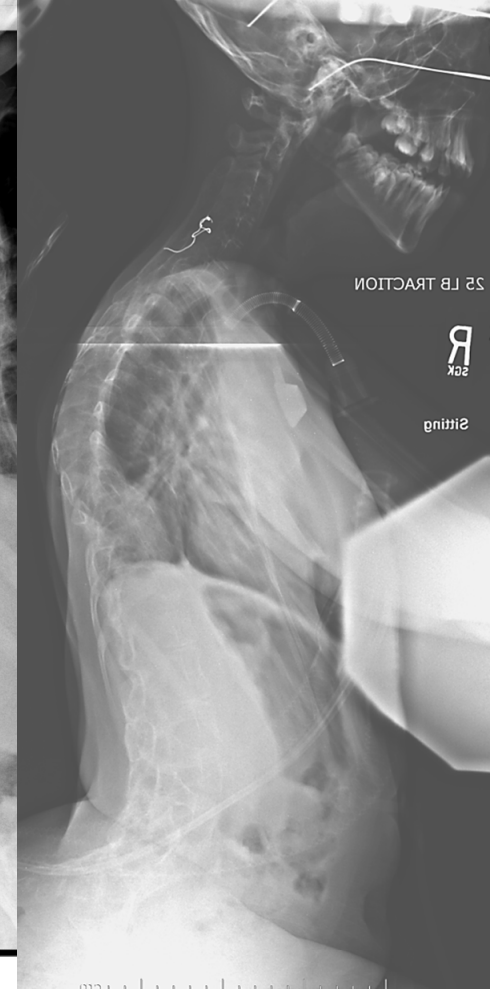
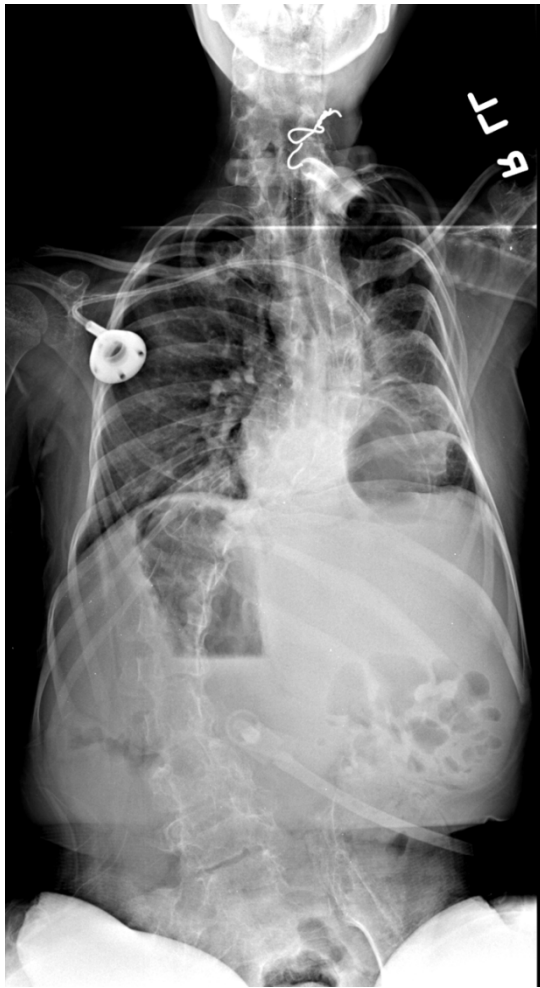
Dec 2008





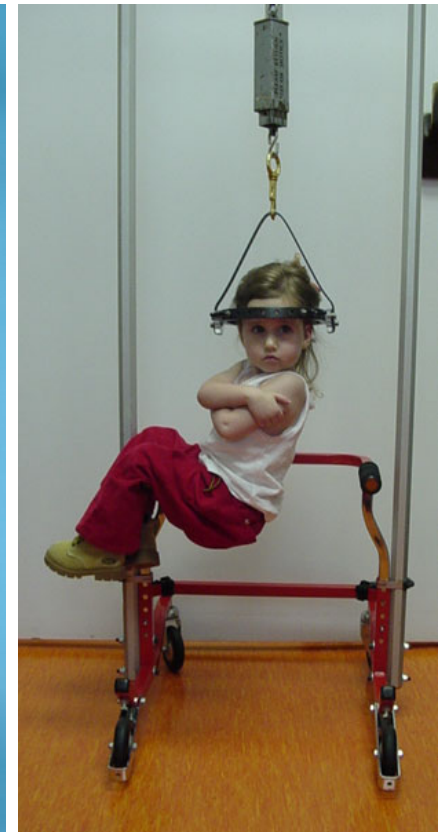
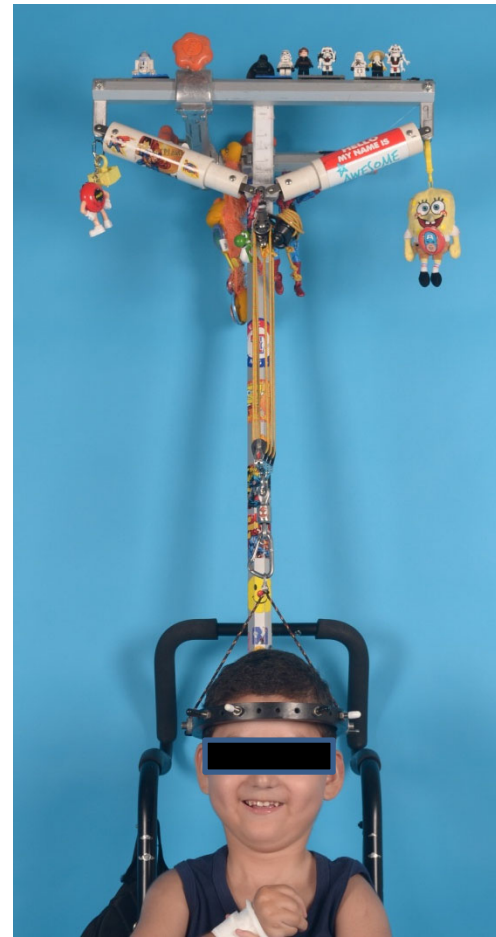
Jan 2010 - continued  
sepsis, all hardware  
removed, start HGT

Parents refuse  
further surgery, wait  
for spontaneous  
fusion



# Traction Works

- Deformity correction when operative choices limited
- Burns no bridges
- Safe mobilization of any age patient
- Can be repeated prn





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Thanks

