Results at Skeletal Maturity of a Fusionless Technique for Progressive Scoliosis

Analysis of Final Correction and Complications in 33 Patients

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No Conflict of Interest

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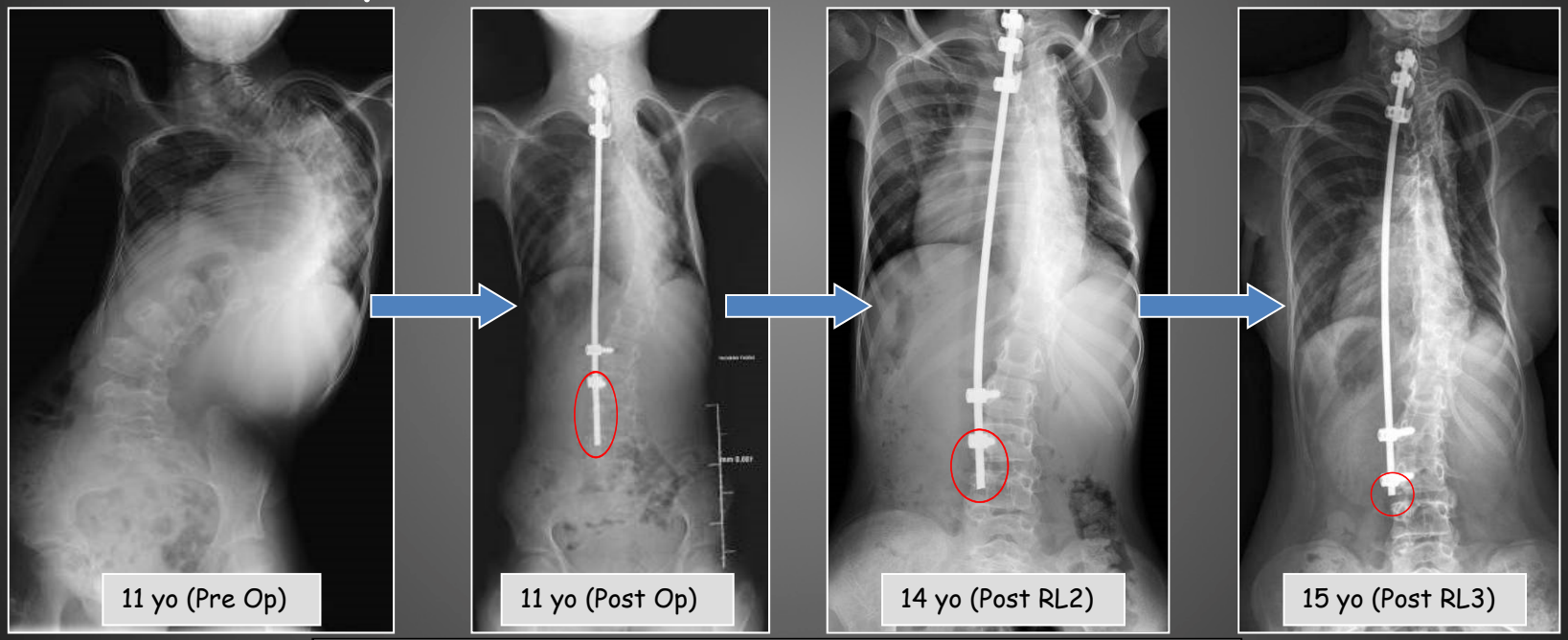
Background

- Fusionless techniques are useful for the treatment of progressive scoliosis
- High rate of complications in the literature (58%):
  . 24% increasing risk for each additional surgery
  . 27.5% PJK, 89% auto fusion
  . Law of diminishing return
  . Etc.

Purpose

To analyze the results of an original fusionless technique and its complication rate



Eur Spine J
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ORIGINAL ARTICLE

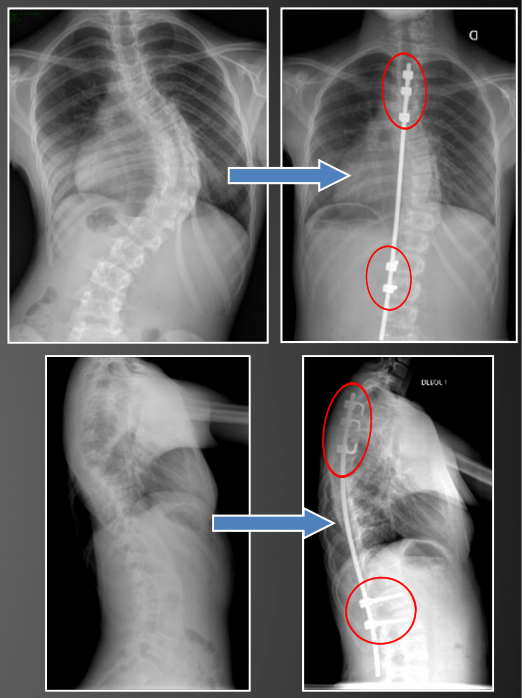
H3S2 (3 hooks, 2 screws) construct: a simple growing rod technique for early onset scoliosis

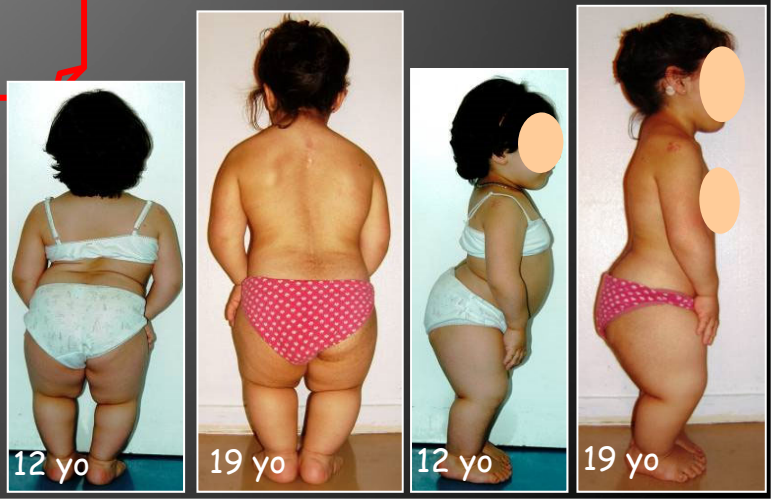
Lotfi Miladi · Alexandre Journe · Maryline Mousny

Materials and Methods

- 33 cases with progressive scoliosis (18 idiopathic, 10 syndromic, 5 congenital)
- Mean age at surgery = 10y (7 to 12y)
- Mean FU = 5y9m (4y to 8y)
- All patients reached skeletal maturity
- Same surgical technique for all cases:

Single 5.5mm concave rod + 3 hooks (2 supralaminar, 1 pedicle) + 2 pedicle screws





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DOI 10.1007/s00586-014-3339-2

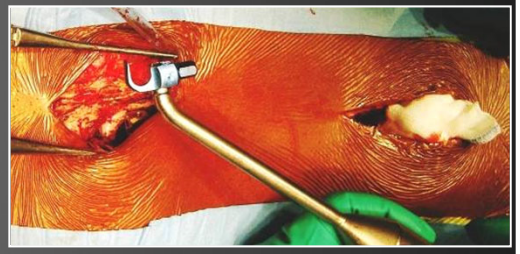
IDEAS AND TECHNICAL INNOVATIONS

A novel technique for treatment of progressive scoliosis in young children using a 3-hook and 2-screw construct (H3S2) on a single sub-muscular growing rod: surgical technique

Lotfi Miladi · Maryline Mousny

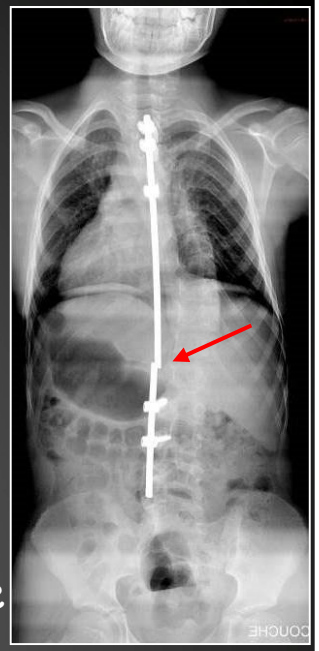
Materials and Methods

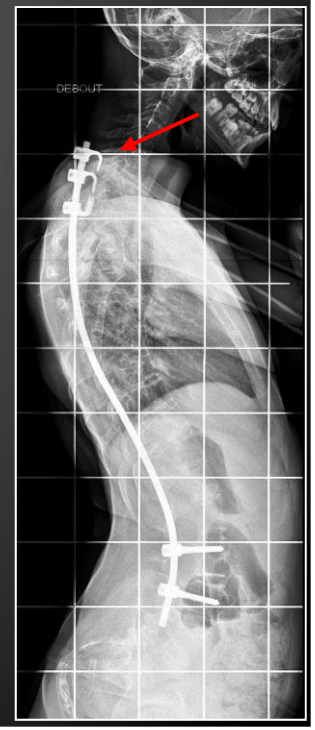
- Minimally invasive technique
  - 2 short incisions
  - No laminotomy before hook insertion
  - Sub-fascial insertion of the rod
  - Rod length for future distal lengthenings
- Intra-operative traction + spinal monitoring
- Pre-operative progressive correction for Cobb >90°
- Anterior hemi-epiphysiodesis if Cobb >70° after pre-operative correction
- Rod lengthening every 10m on average
- Final fusion if Cobb >30° at Risser 4



Results

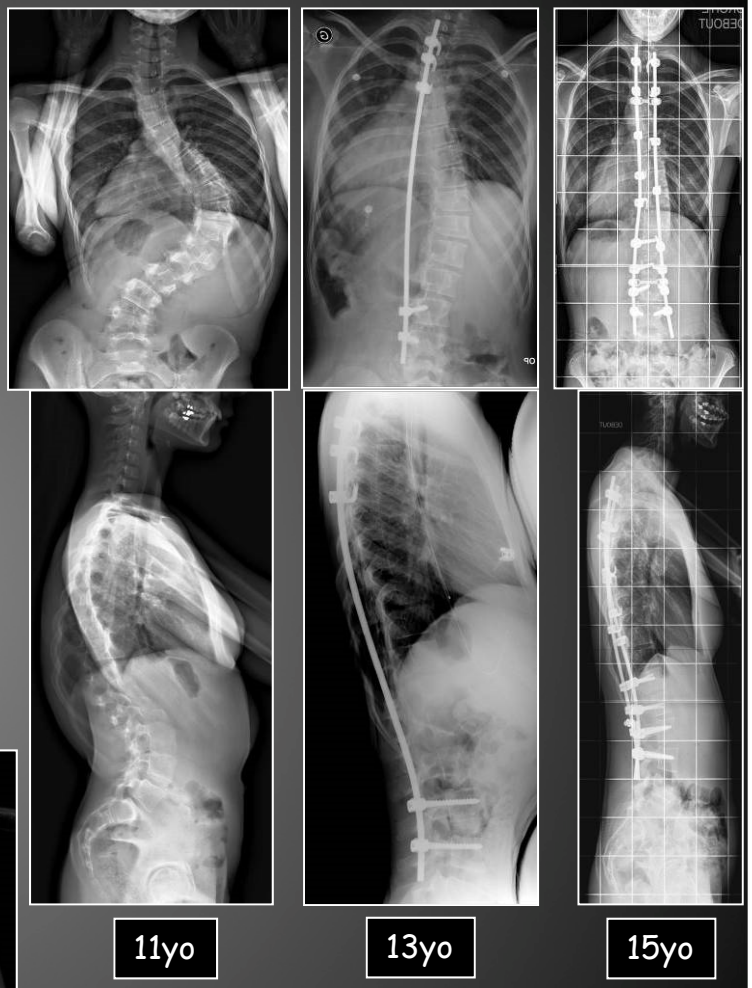
- Mean curve correction : 57%. Coronal plane improvement
- 12 complications in 6 patients (18%) : 9 rod breakage and 3 infections, leading to 9 unplanned surgeries (3 asymptomatic broken rod was changed while planned lengthening)
- 8 Radiologic PJK (24%), without need for additional procedure
- No neurologic deficit (1SSEP alert), no failure of anchors

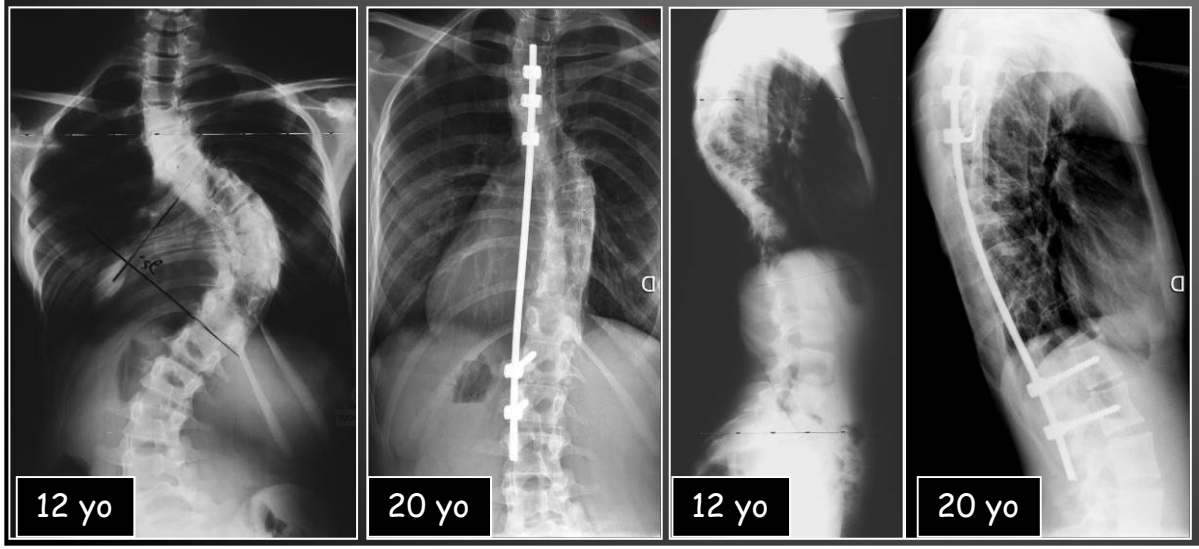




Results

- 20 arthrodesis at a mean age of 15y3m (13y8m to 16y)
- 40% of patients still have the rod at the end of growth and treatment (13 cases)





Discussion

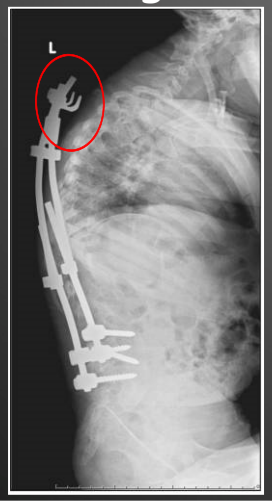
1- Fibrosis and auto fusions are severe complications. Rod fractures are benign complications and don't compromise continuation of treatment

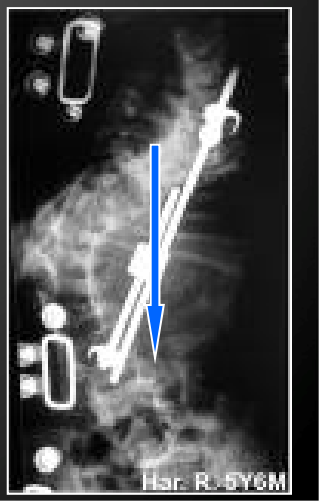
2- Reasons of the high rate of complications :

a- Mechanical : rib fixation, screws as proximal anchors, thin rods (4.5mm or less), dominos connectors, . . .

b- Biological : large subperiostal approach, middle zone dissection, too much metal, . . .

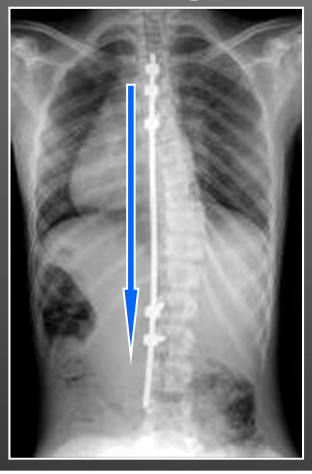
c- Planning : stiff construct (too much metal), unbalanced rod, poor rod contouring, bad choice of fixed levels, . . .



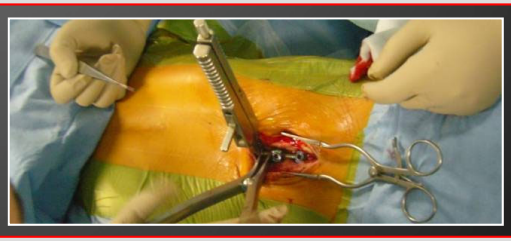


Discussion

- 2 rod constructs are certainly stronger, but they are too stiff and lead to auto fusions
- 1 rod construct is more efficient, more elastic, less osteoinductive, and "low profile" therefore well tolerated in small thin patients.
- Certain principles must be followed:
  1 . Proximal hooks are more stable than screws and reduce PJK risk
  2 . Good rod contouring and verticality reduces risk of rod breakage
  3 . Preservation of integrity of concave soft tissues avoids fibrosis, auto fusions and "law of diminishing return"



Auto fusions after an aggressive approach

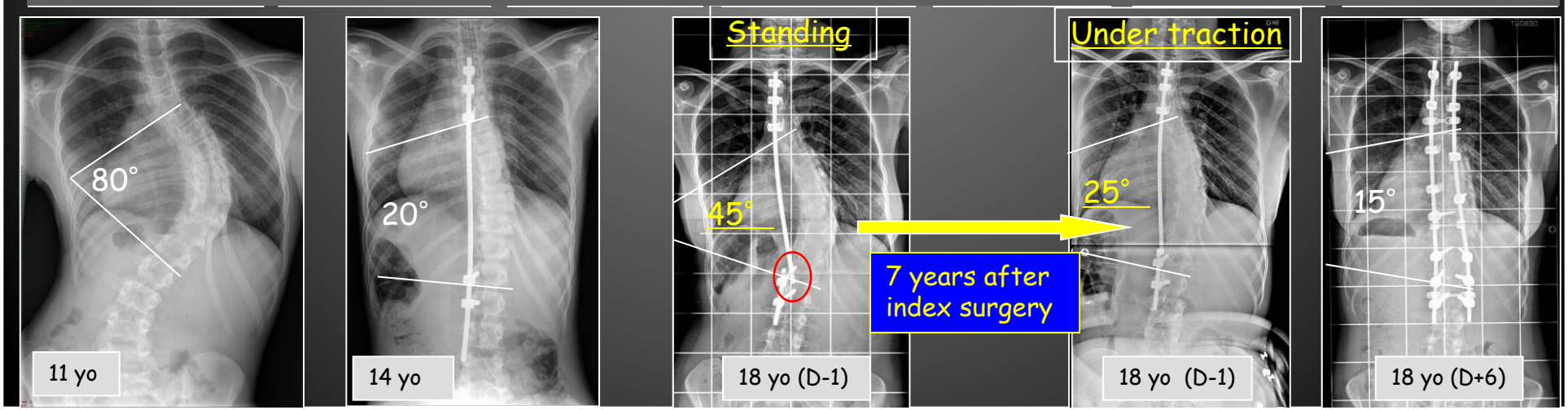


H3S2 Rod lengthening "out of concave area"

Discussion

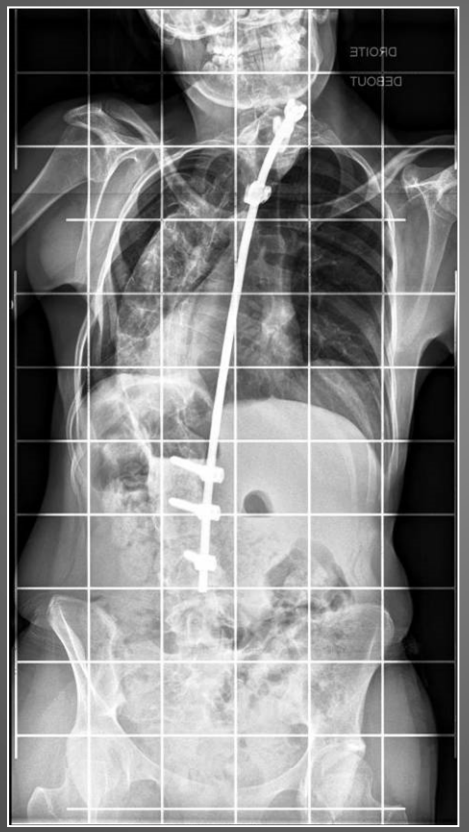
-1 rod construct delays age of arthrodesis and improves final correction

-Respect of concave soft tissues integrity preserves growth and spinal motion



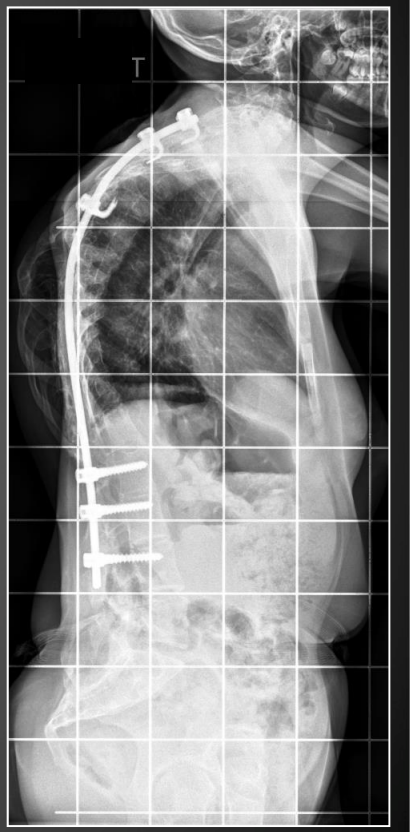
Case 1 (Gordon Sd, 10y)

10 yo



17 yo

10 yo



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Case 1

10 yo

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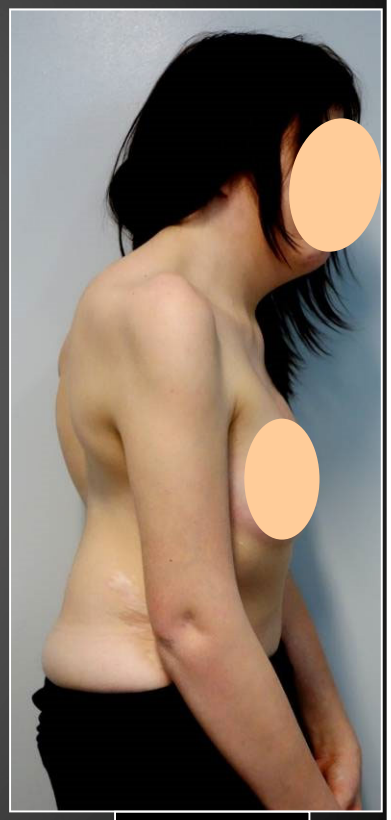
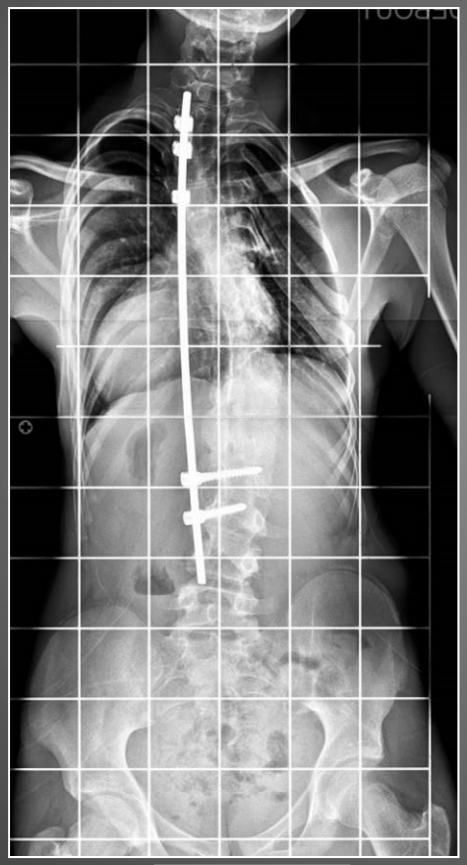


17 yo

Case 2 (VACTER Sd, 9y)

9 yo



17 yo

9 yo

17 yo


9 yo


17 yo


9 yo


17 yo

Conclusion

- H3S2 Technique is an efficient fusionless method to preserve spine and chest growth, with a reduced rate of complications, thanks to respect of some mechanical and biological principles
- It is low cost and no special instrumentation is required
- 40% of our patients did not need final fusion at skeletal maturity