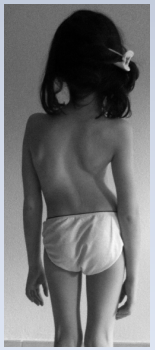
GROWING SPINAL SYSTEMS AND EARLY ONSET DEFORMITIES: IS HYPERKHYPHOSIS A CONTRAINDICATION?

Tiziana Greggi, Elena Maredi, Francesco Lolli, Mario Di Silvestre, Konstantinos Martikos, Francesco Vommaro, Andrea Baioni, Stefano Giacomini, Alfredo Cioni

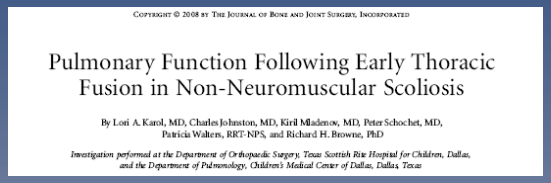


Rizzoli Orthopaedic Institute – Bologna Italy
Spinal Deformity Surgery Department
Dr.ssa Tiziana Greggi
www.ior.it

Early Onset Scoliosis

1. **Instrumented fusion: not yet recommended**

   (Johnston et al. 2008, Vitale et al. 2008)



Pulmonary Function Following Early Thoracic Fusion in Non-Neuromuscular Scoliosis

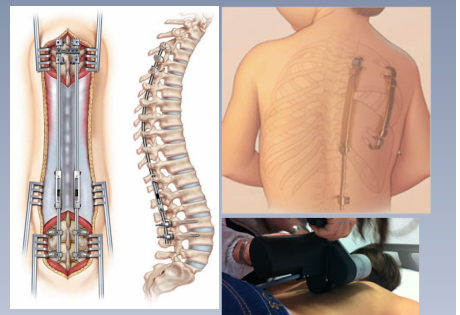
By Lori A. Karol, MD, Charles Johnston, MD, Kiril Mladenov, MD, Peter Schochet, MD, Patricia Walters, RRT-NPS, and Richard H. Browne, PhD

Investigation performed at the Department of Orthopaedic Surgery, Texas Scottish Rite Hospital for Children, Dallas, and the Department of Pulmonology, Children's Medical Center of Dallas, Dallas, Texas

2. **Instrumentation without fusion:**

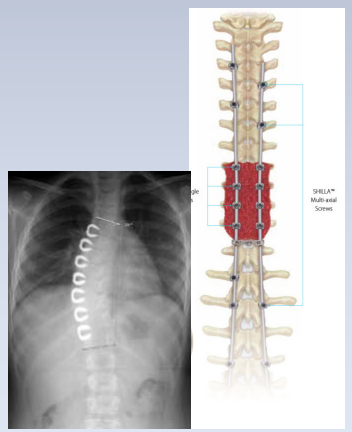
"Growth Sparing" (< 8 YEARS) (Infantile scoliosis)

-Rib based (VEPTR) (Campbell et al)
-Spine based (GROWING ROD) (Akbarnia et al)



"Growth Modulating" (> 8 YEARS) (Juvemile scoliosis)

-Staples (Betz et al)
-Shilla technique (McCarthy et al)
-Spinal tethering (Newton et al)



David Skaggs, M.D., *Personal Comunication: 2nd International Congress on Early Onset Scoliosis & Growing Spine (ICEOS) Montreal, Canada, November 7-8, 2008*

Hyperkyphosis is a correct indication?

Growing Rod – VEPTR

Distraction based systems

Distraction = more kyphosis ???

Aim of the study

To show if those systems can be effectively used in the treatment of spinal kyphotic deformities.

Growing Rod

Kyphosis entity seems to have no effect on clinical outcome and complications incidence:

- rod fracture
- anchors mobilization
- subcutaneous prominence

Yang, Sponseller (SRS 2009)… *Records of* ***322 patients****…****70 rod fractures*** *occurred in 43 patients (****13%****)… Risk factors: single rods, history of previous fracture, small diameter rods, stainless steel rods, proximity to connectors, ambulatory patients, syndromic diagnosis…* ***No effect: size of scoliosis and kyphosis****, n° of lenghthenings, anchor type.*

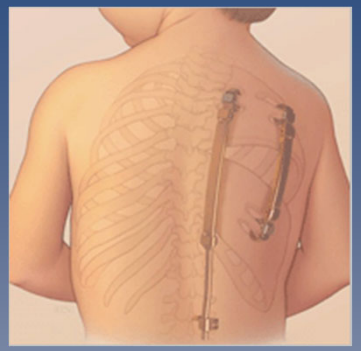
However, in a more recent review, increased incidence of "implant related" complications in case of thoracic kyphosis > 40 °

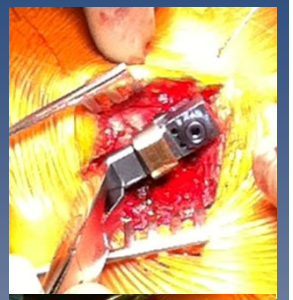
- Linear increase in complications with increasing kyphosis
- More frequent complication: **rod fracture**

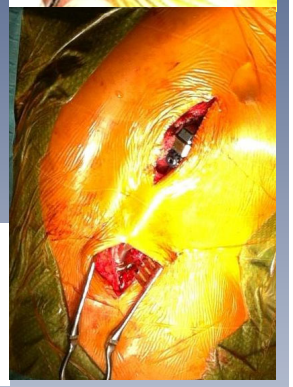
To control deformities correction:
- avoid short instrumentation (adding on)
- prevent PJK (**rod precontouring**, UIV≥ T2), hooks

How does thoracic kyphosis affect patient outcomes in growing rod surgery?
Schroerlucke SR, Akbarnia BA, Pawelek JB, Salari P, Mundis GM Jr, Yazici M, Emans JB, Sponseller PD; Growing Spine Study Group.
Spine (Phila Pa 1976). ***2012***

VEPTR







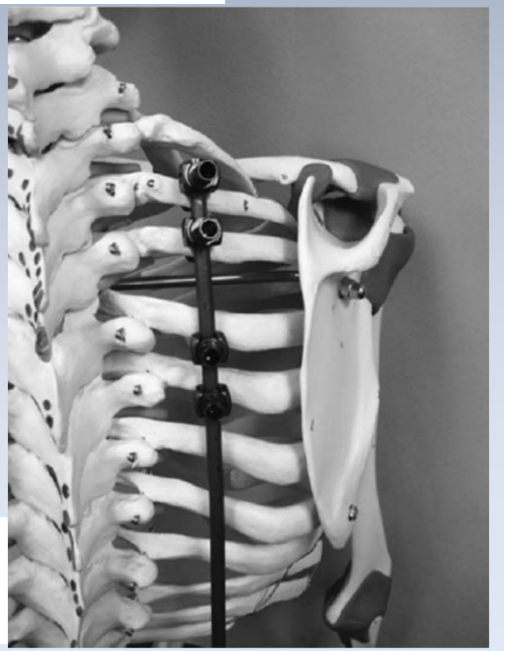
Difficulties to control "high" kyphosis

Kyphotic effect of lengthening procedures

Can VEPTR(®) control progression of early-onset kyphoscoliosis? A cohort study of VEPTR(®) patients with severe kyphoscoliosis.
Reinker K, Simmons JW, Patil V, Stinson Z.
Clin Orthop Relat Res. 2011

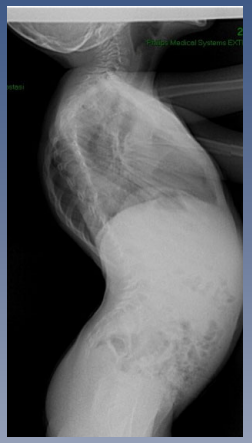
complications incidence:
- rod fracture
- anchors mobilization
- subcutaneous prominence

To control deformities correction:
- Instrumentation as long as possible (> 2nd rib)
- Strong proximal fixation (4 ribs?)



An alternate method of fixation for management of early-onset deformity with thoracic kyphosis.
Gross RH.
J Pediatr Orthop. 2012

METHODS



- **Retrospective review**

18 patients (9M – 9F)

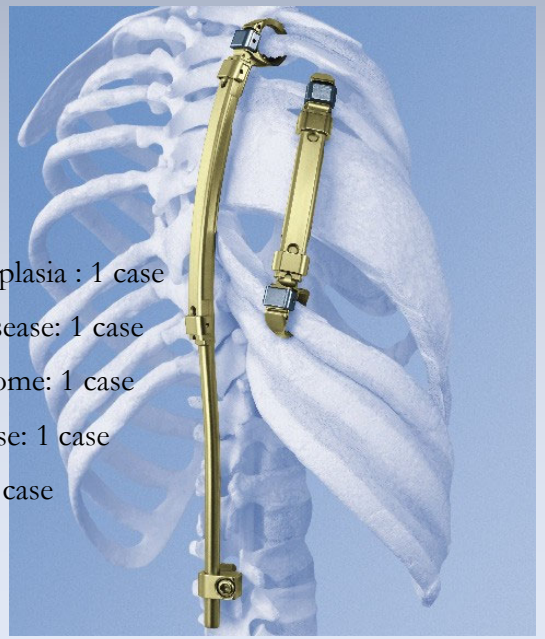
Mean age : 7 yy (4 - 11)

- **Paediatric patients affected by early onset spinal deformity**

- **Surgically treated with distraction based systems (Growing Rod or VEPTR)**

- **Aetiology: any**
  - idiopathic scoliosis: 5 cases
  - congenital scoliosis: 3 cases
  - scoliosis in arthrogryposis: 2 cases
  - scoliosis in trisomy 8: 1 case
  - scoliosis in spondylocostal dysplasia : 1 case
  - scoliosis in Prader Willi disease: 1 case
  - scoliosis in Escobar syndrome: 1 case
  - kyphosis in Morquio disease: 1 case
  - kyphosis in Pott disease: 1 case

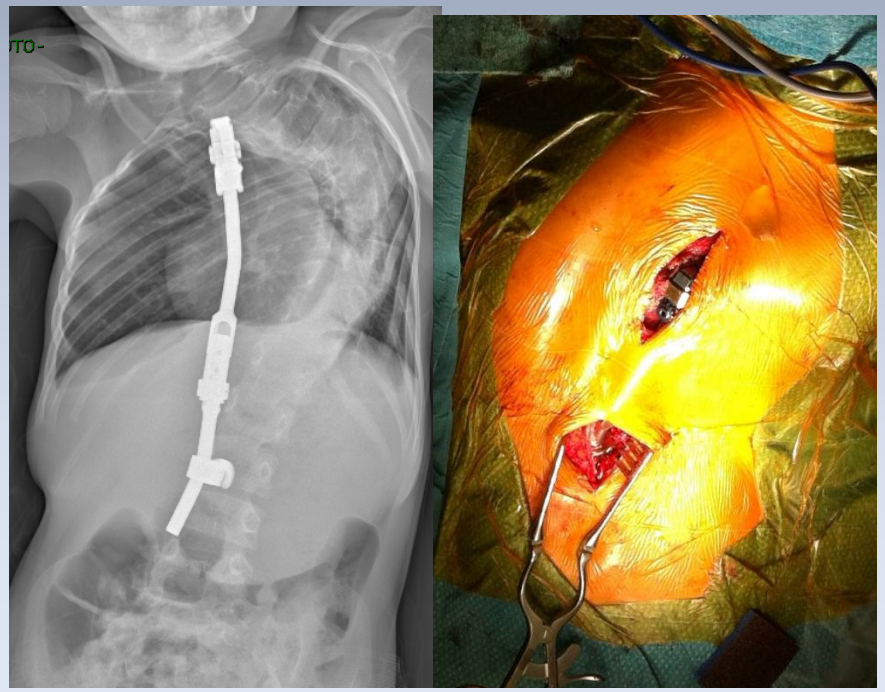
- **T5-T12 kyphosis >60°**

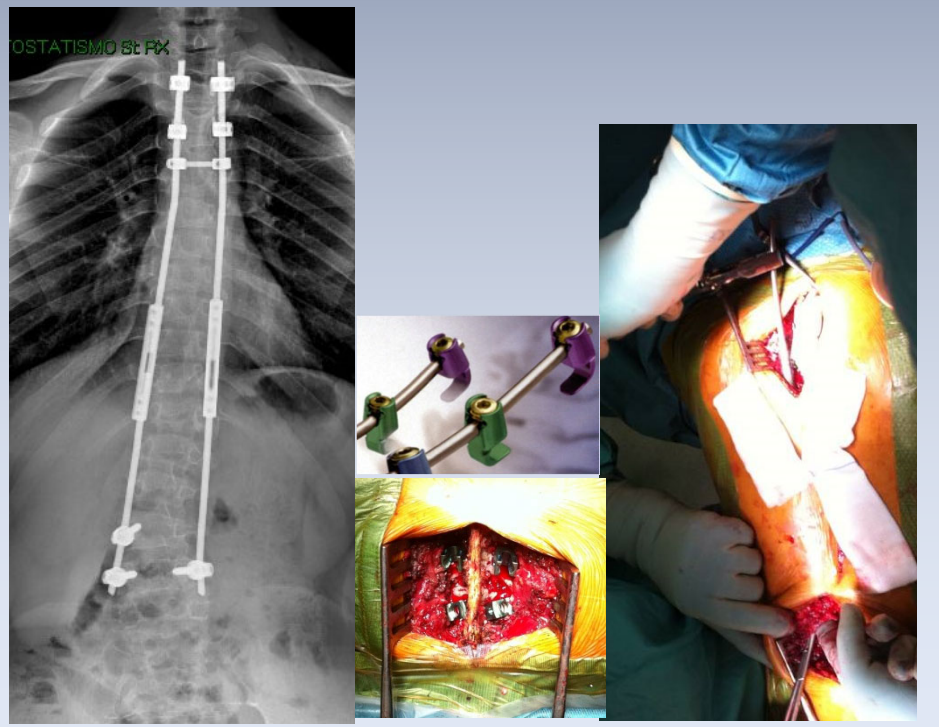


SURGICAL TREATMENT

- **VEPTR: 9 cases**
  (always rib to spine construct)

- **Growing Rod: 9 cases**
  (always dual rod construct)





RADIOLOGICAL OUTCOME

At a mean follow up of 30 months (range, 18 to 67) after 31 lengthening procedures (1.9 per patient)

mean	PREOP	POSTOP	F.U.	Mean correction
SCOLIOSIS	64°	42°	43,4° ($p > 0.05$)	34,4% ($p < 0.05$)
KYPHOSIS	71° (60-90)	52 (21-80)	59° ($p < 0.05$)	20%

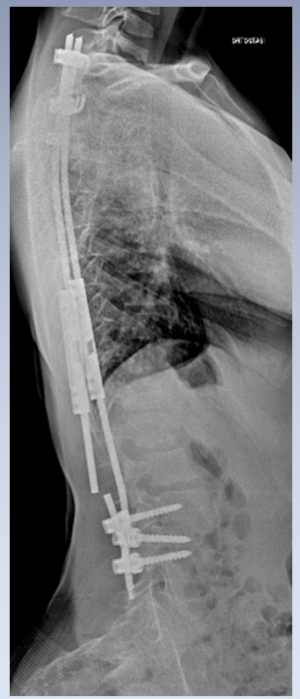
KYPHOSIS	PREOP	POST OP	F.U.
G.R.	67°	44°	50° ($p < 0.05$)
VEPTR	77°	58°	68° ($p < 0.05$)

At final follow up, after 31 lengthening procedures
loss of correction on sagittal plane

COMPLICATIONS

- 15 minor complications occurred in 8 patients (47%)
- Revision surgery was performed in 7 patients (43.7%)

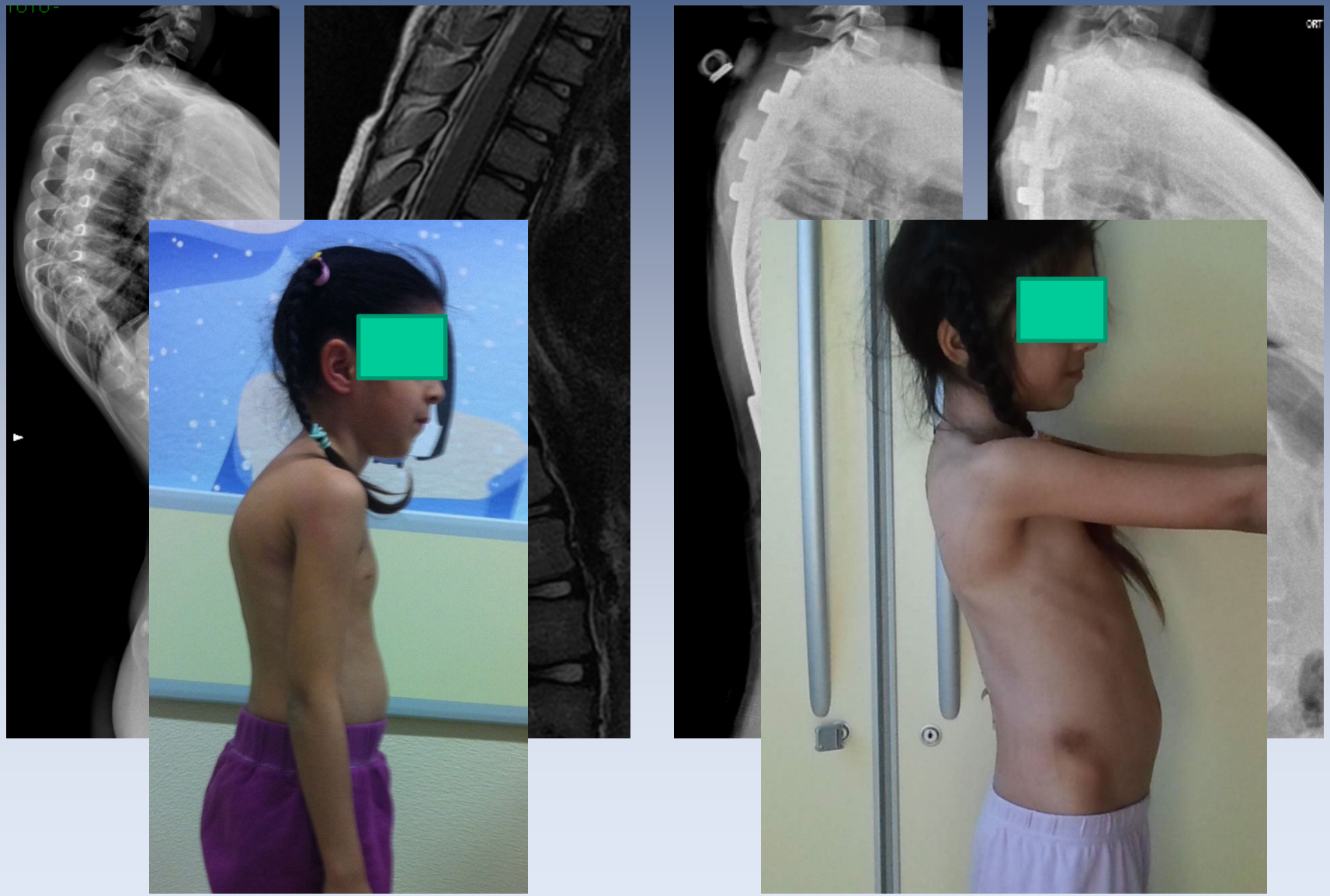
4 cases due to proximal junctional failure (screw loosening or PJK) 22%



3 cases due to growing rod fracture

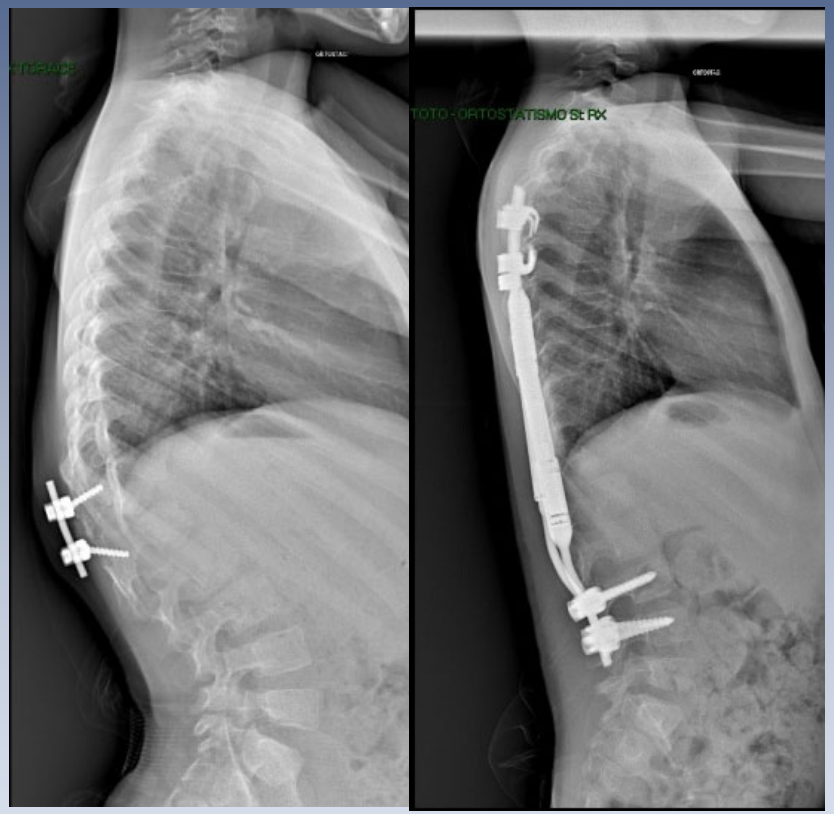
CASE 1

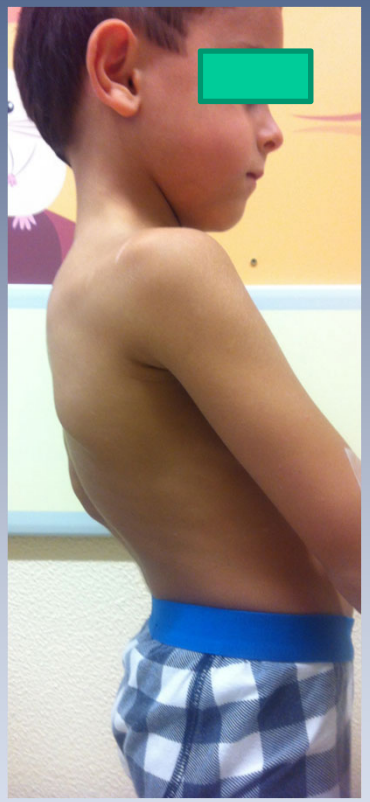
R.N., 7 yrs, hyperkyphosis in Pott disease

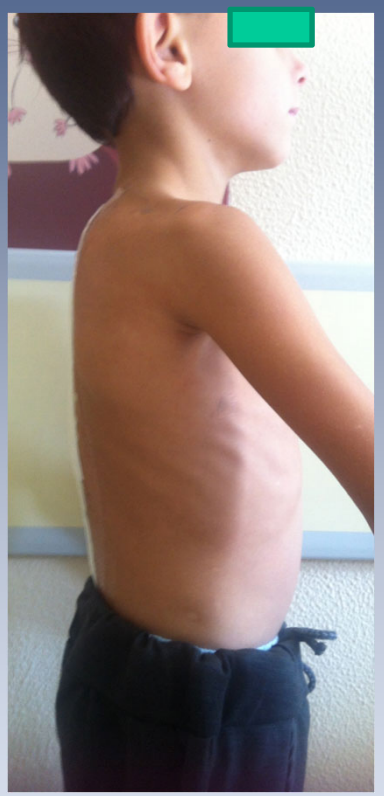


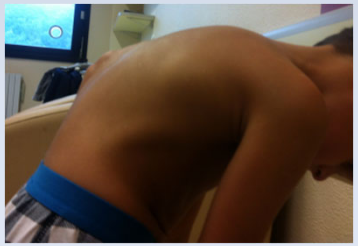
CASE 2

A.F., 6 yy, Thoracic Hyperkiphosis (Hemiepiphysiodesis for T10 hemivertebra)



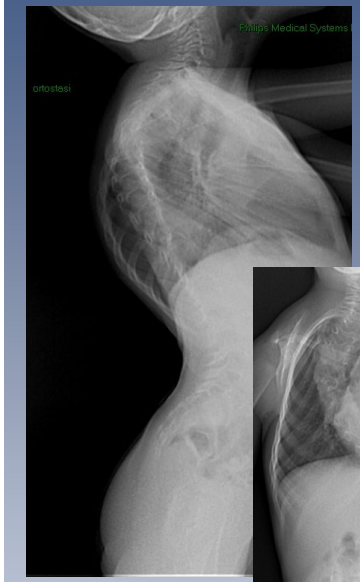


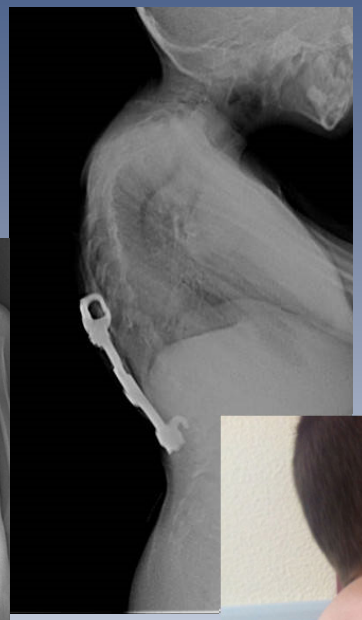


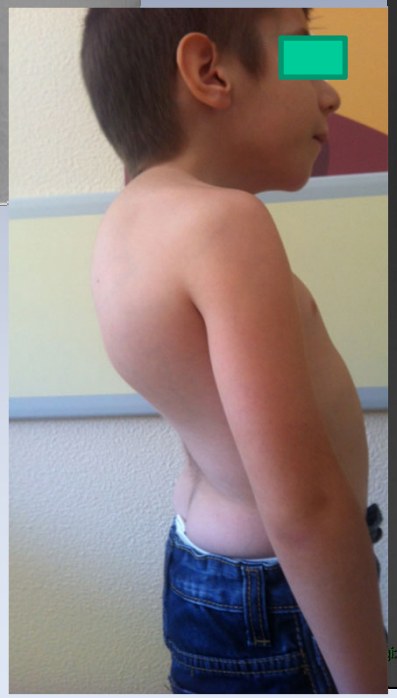


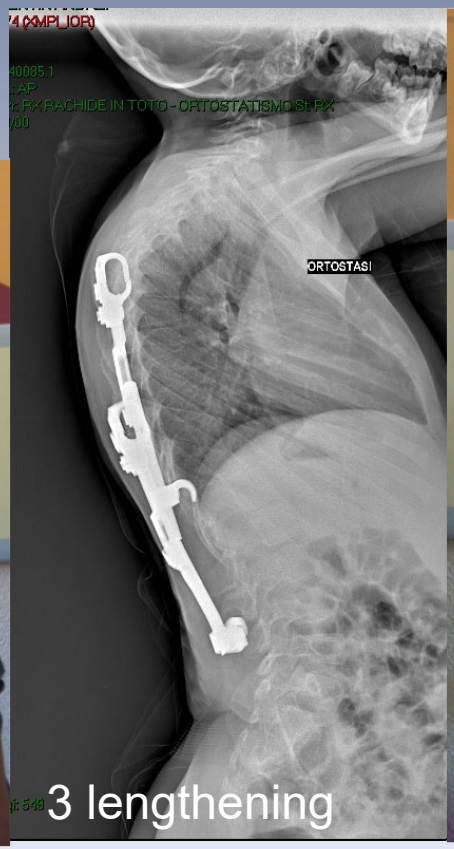
CASE 2

P.V., 5 yy, kyphoscoliosis with hyperkyphosis in Arthrogryposis









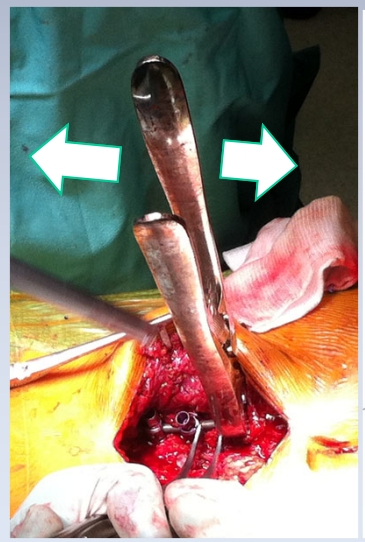
3 lengthening

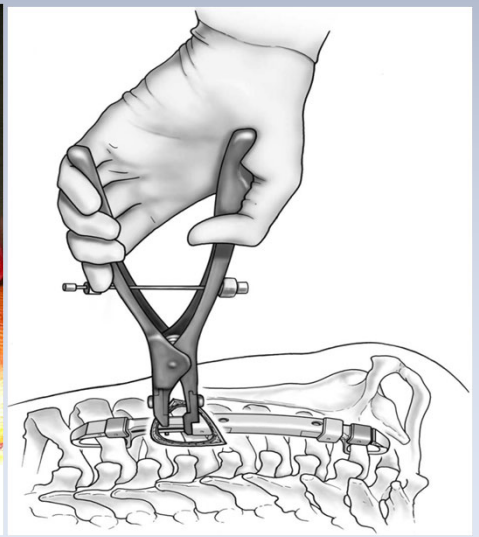
CONCLUSIONS

- Our results showed that growing spinal implants can be **safely used** in the treatment of **kyphotic deformities**

- Acceptable **complications incidence** (47%) if compared with literature

- Due to distraction procedures, a **loss of correction on sagittal plane** is commonly observed at follow up (on average, 6° after growing rod and 10° after **VEPTR)**





CONCLUSIONS

- **The final result** is mostly related to kyphosis correction obtained during **first surgery but the loss of correction is always less** then the first correction.

- **Growing rods,** through **cantilever** manoeuvre performed during **first surgery,** seem to grant a **better sagittal plane** restoration compared to VEPTR.

How Does Thoracic Kyphosis Affect Patient Outcomes in Growing Rod Surgery?
*Samuel R. Schroerlucke , MD , * Behrooz A. Akbarnia , MD , *† Jeff B. Pawelek , BS , * Pooria Salari , MD , *Growing Spine Study Group **
SPINE Volume 37, Number 15, pp 1303–1309 ©2012, Lippincott Williams & Wilkins

THANKS

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www.ior.it