

Bipolar Minimally Invasive Technique



Early Onset Scoliosis

Surgical Management

3 Techniques:

1- Arthrodesis :

→ Correction and definitive fixation of the spine (fusion)

2- Fusionless Instrumentation (TGR) :

→ Correction et stabilisation provisoire de la colonne, en attente d'une arthrodeuse

3- Early Minimally Invasive fusionless bipolar technique :

→ Correction and stabilisation of the spine (delayed fusion)

Arthrodesis

Developped by Prof Jean Dubousset at Saint Vincent de Paul (1984)

Remains the «Gold Standard» for the surgical treatment of scoliosis for children close to skeletal maturity



J. Dubousset



Hôpital Saint Vincent de Paul



Athrodesis

High complication rates reported in the literature in growing children : 30 à 60% (*) :

1. Anesthesia
2. Hémorragia
3. Neurology
4. Infectious
5. Reanimation
6. Etc.



* *Perioperative complications after surgical correction in neuromuscular scoliosis*, Mohamad F, Parent S, Pawelek J, Marks M, Bastrom T, Faro F, Newton P. J Pediatr Orthop. 2007 Jun; 27(4): 392-7

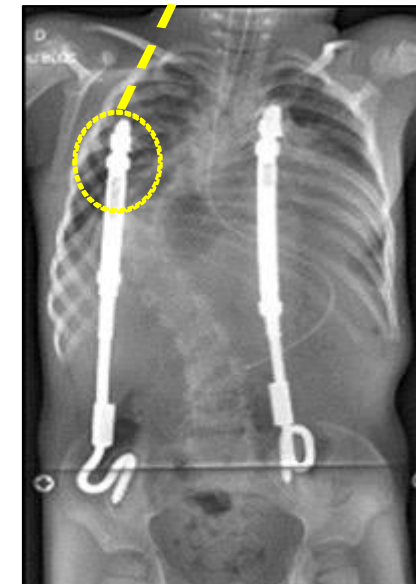
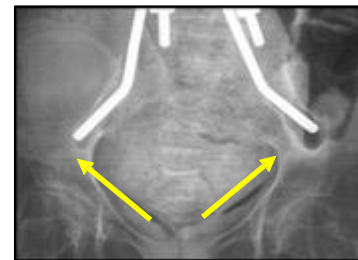
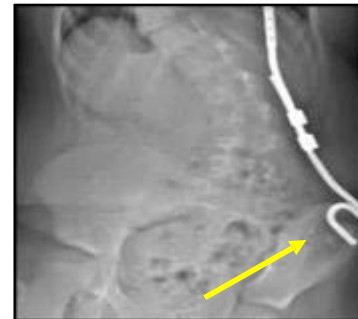
DEFINITIVE SURGERY – STOP GROWTH !

Fusionless TGR

Early Surgery but waiting for final arthrodesis surgery

Complication rate > 50% (*)

- Bulkiness of implants
- Weak implants (small rod diameters...)
- Weak anchorages to the spine



(*) Watanabe & All, April 15, Spine 2013, Complications, all = 57%, Implant dislodgement = 71% (95% proximal)

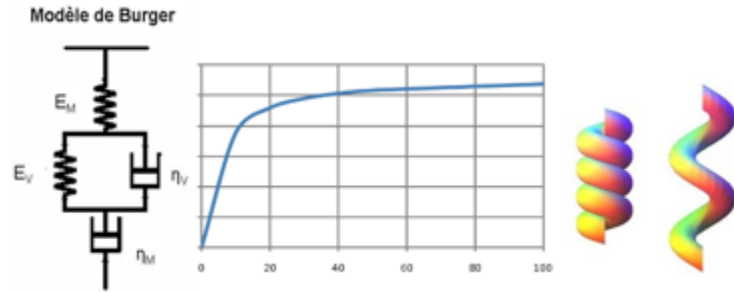
Fusionless Minimally Invasive Techniqiue

- 1/ Instrumentation definitive without fusion
- 2/ Progressive correction with time
- 3/ Less aggressive for biology – Shorter surgery



BIPOLAR TECHNIQUE is based on 40Y clinical Observation

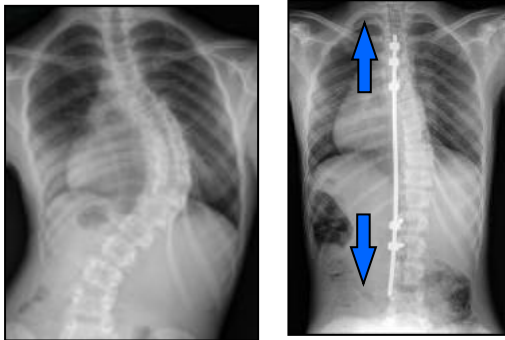
Key Principles



Spine is a visco-elastic structure which accomodates to load over time

- Traction
- Relaxation
- Detorsion

Progressive treatment with time



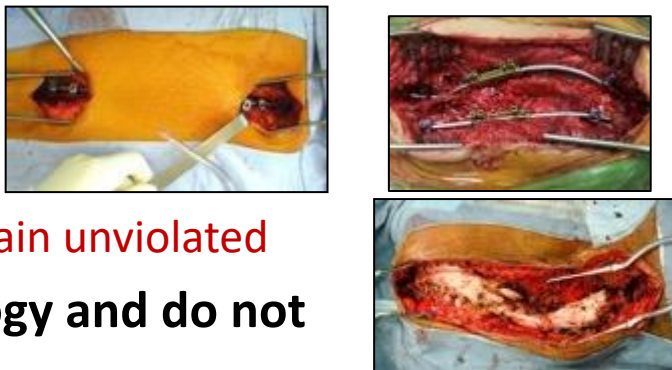
Correction of the spine can be global

- No need for intermediate fixation**
- No need of extreme rigidity**



Bipolar Anchorages must resist to time

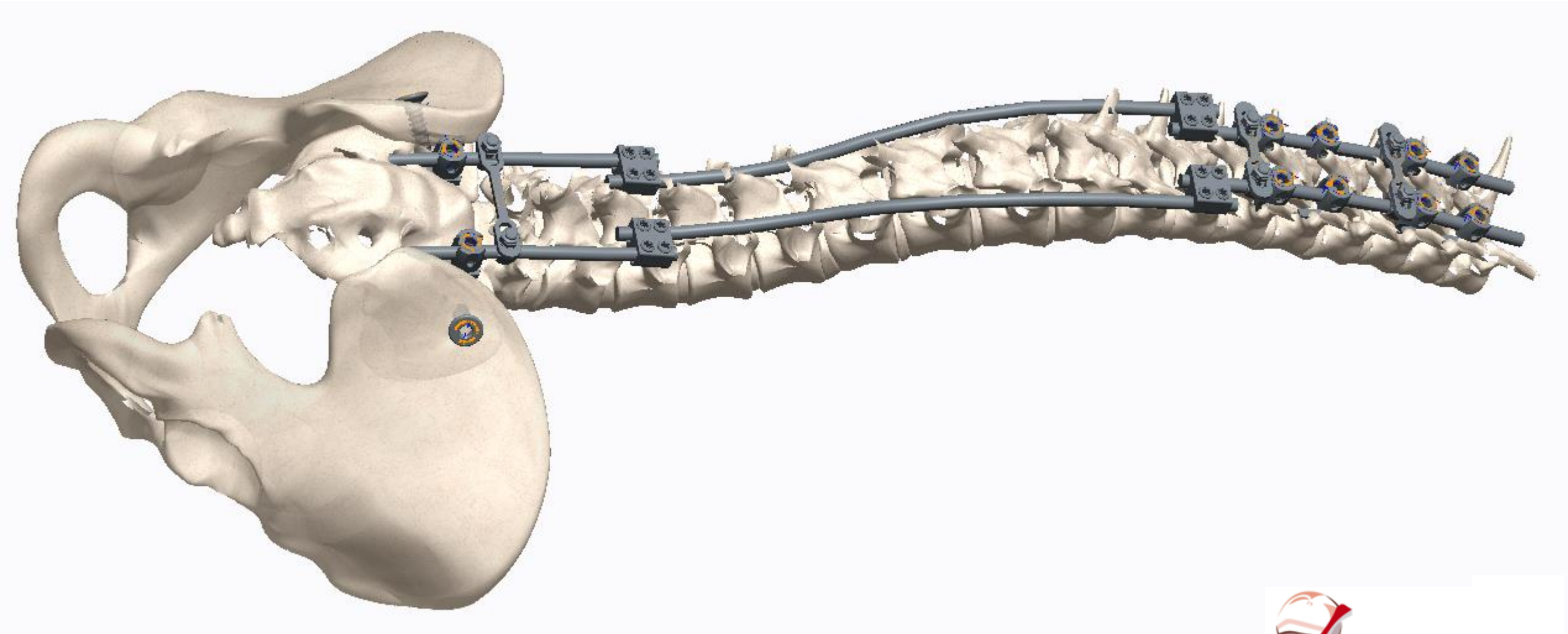
- Limit challenging revision**
- Must hold until skeletal maturity**



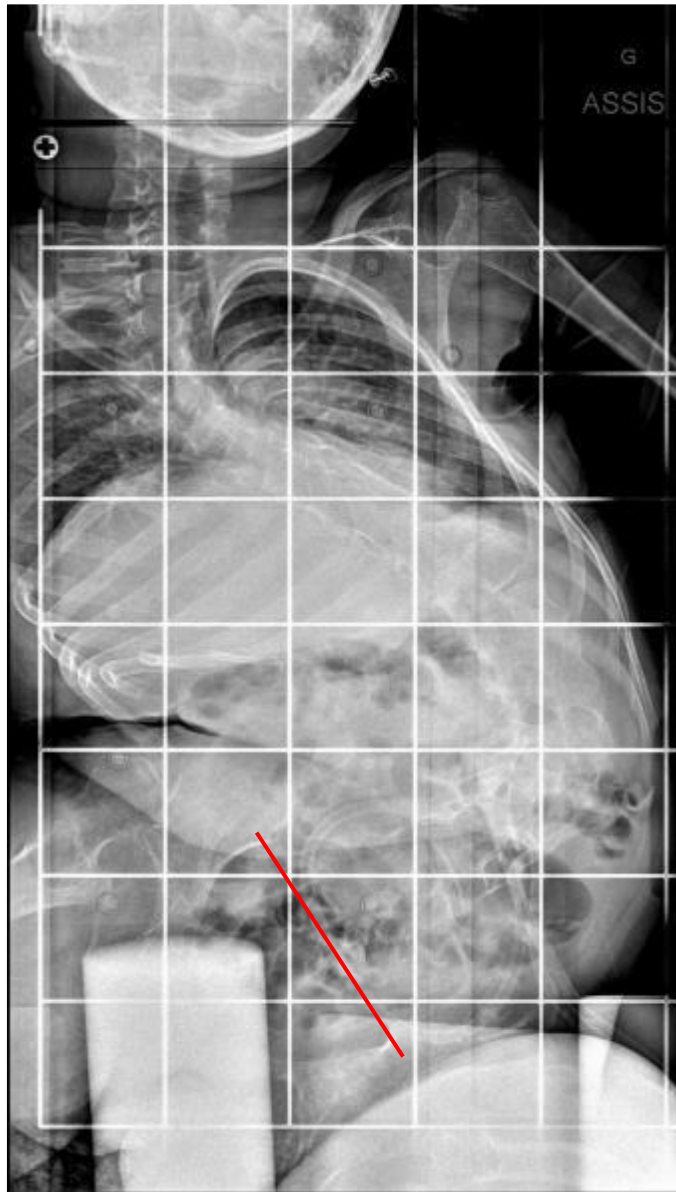
- Apex must remain unviolated
- Preserve biology and do not burn bridges**

Example of a bipolar construct extending to the pelvis

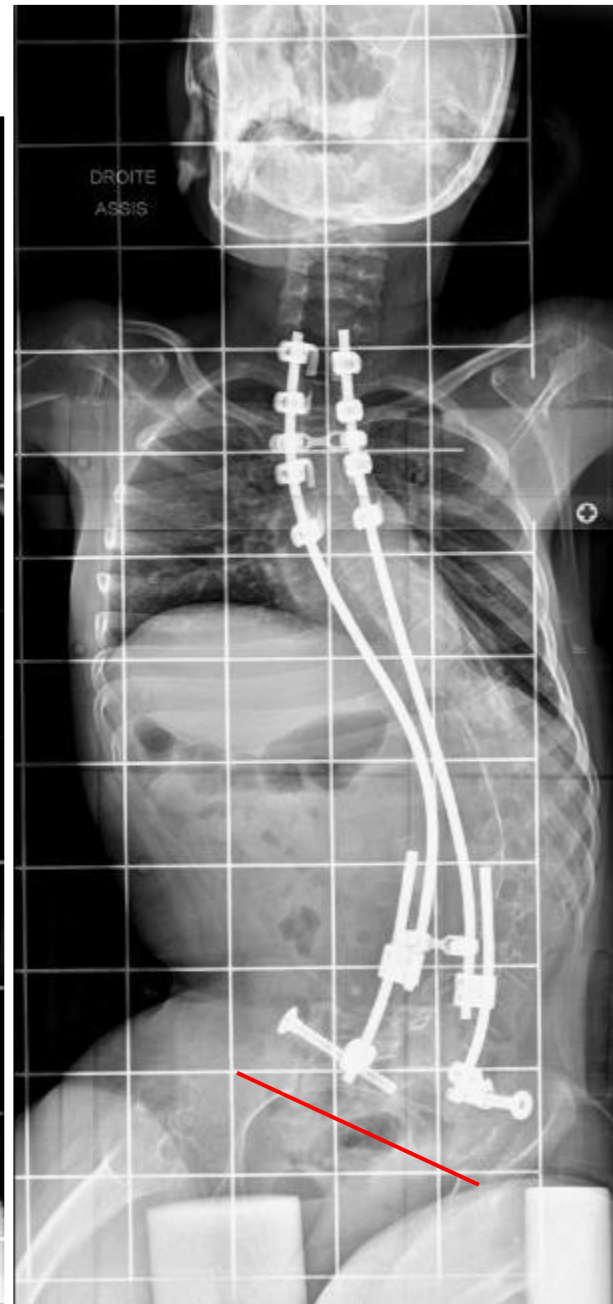
(End of growth view)



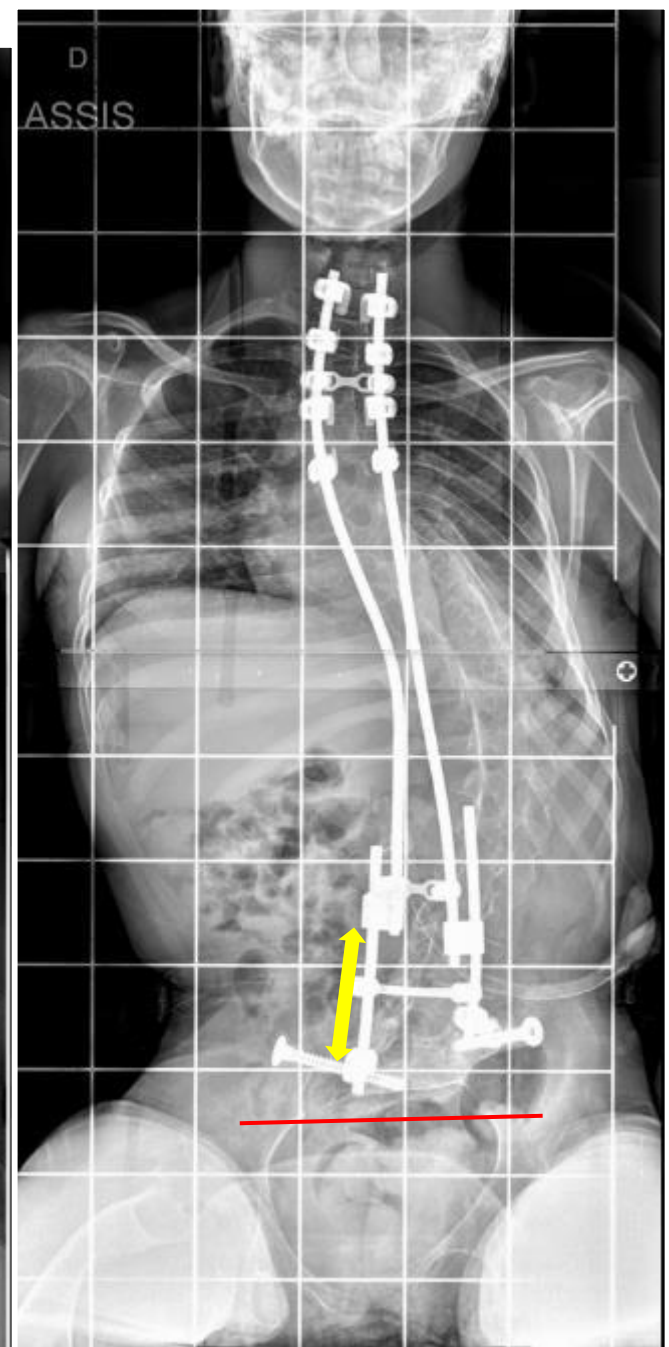
Example, CP Patient, 11Y



Initial



PO



2Y PO (Post RT)

Example



11ans



12ans



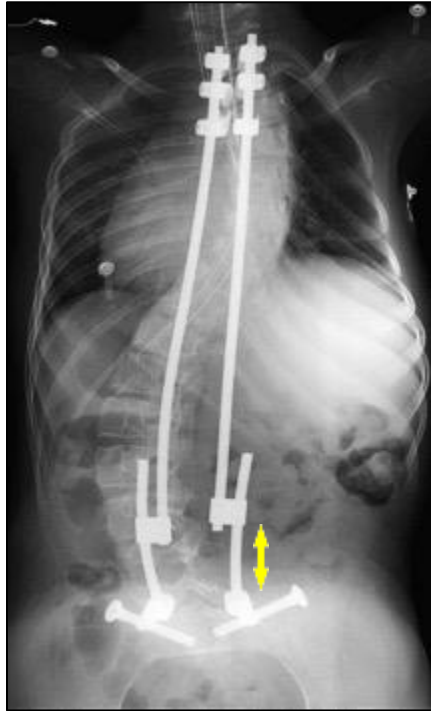
14ans

Fusionless bipolar technique allows :

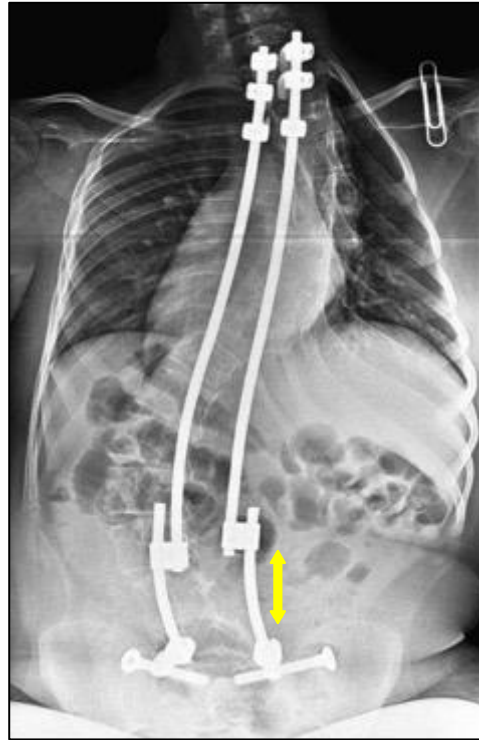
- Growth preservation
- Progressive correction of the spine



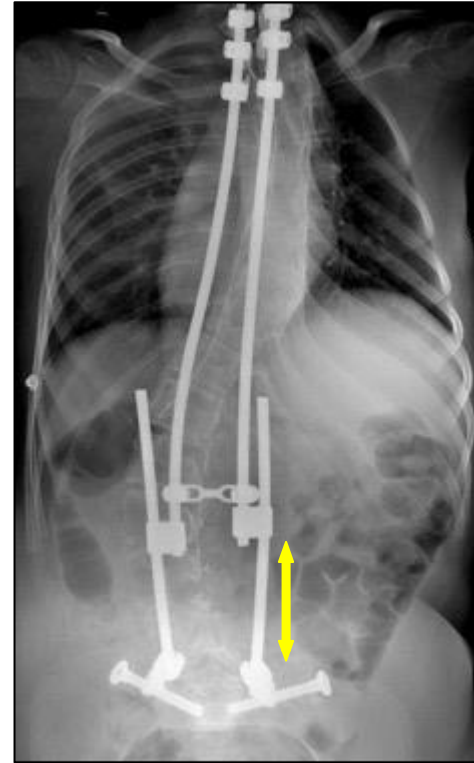
Initiale 9a



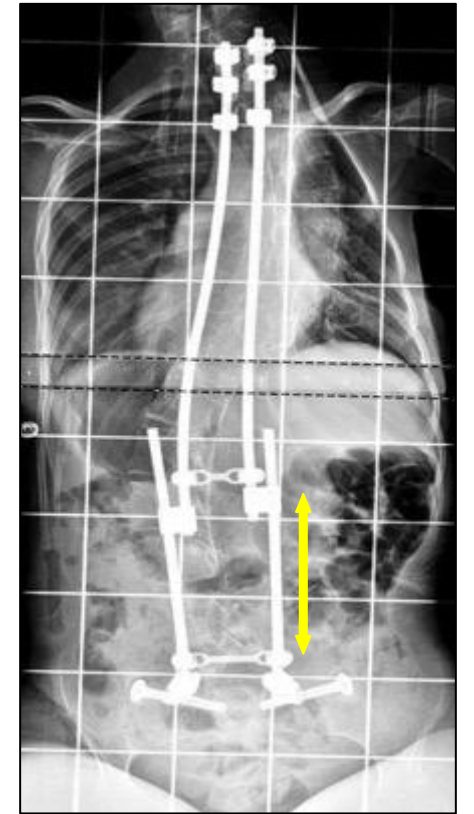
PO



18m PO (RT1)

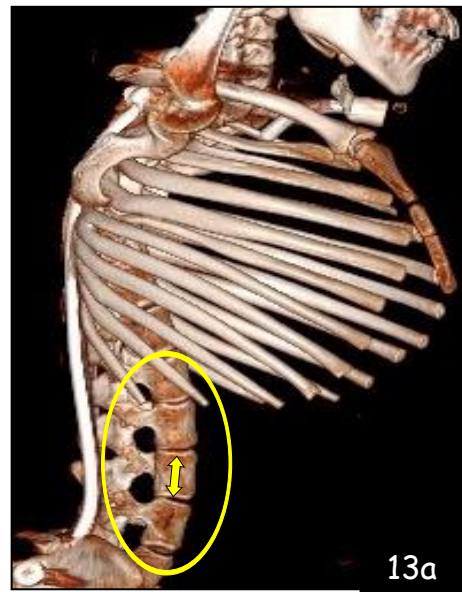


3a PO (RT2)



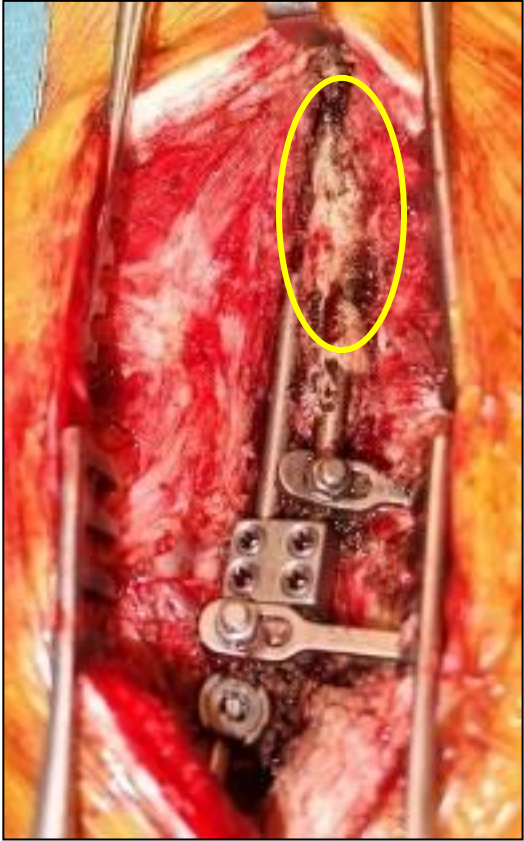
5a PO (RT3)

Allows a progressive remodelling of bone

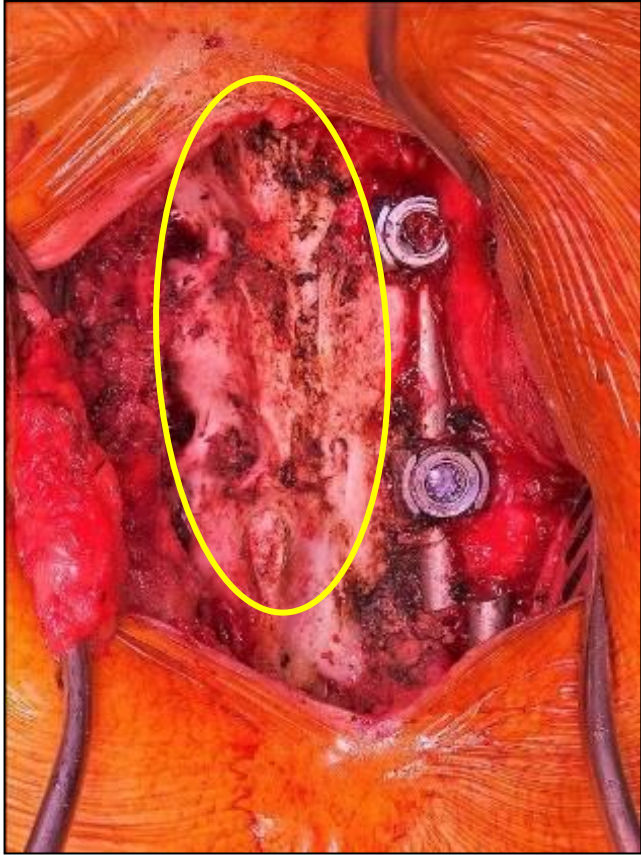


7Y FU

Spine progressively ankyloses and creates a stable fused spine after time



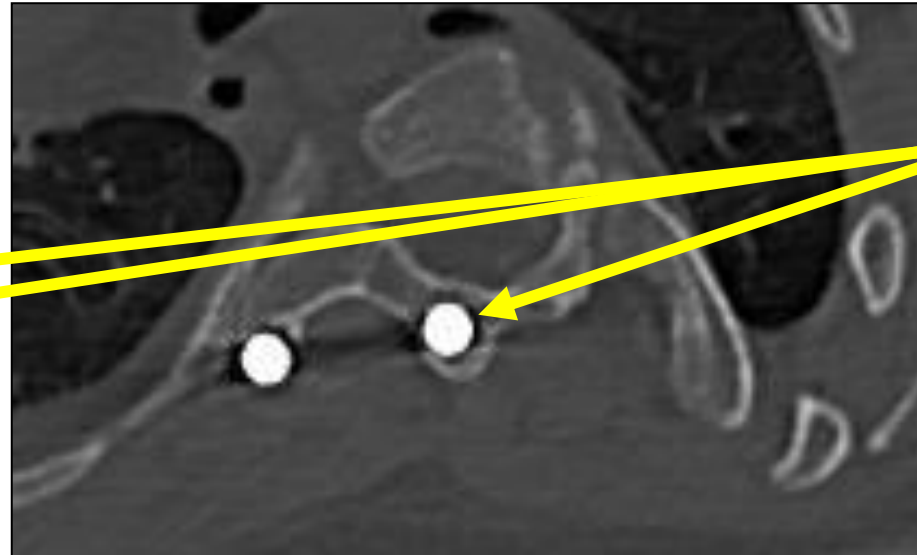
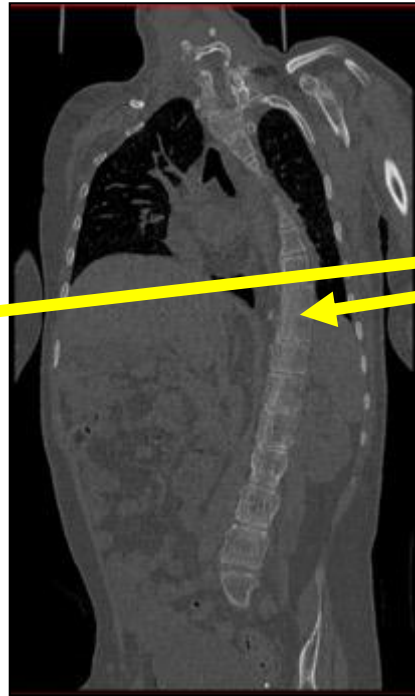
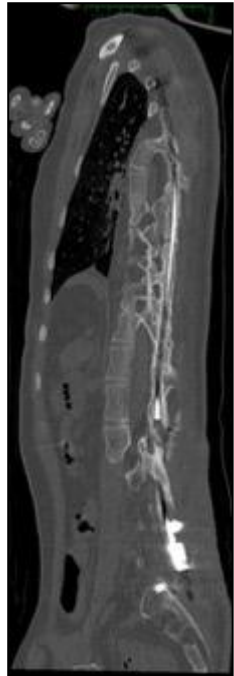
2Y Post
H4 Sacrum



5Y Post
H3 S2



Pre op

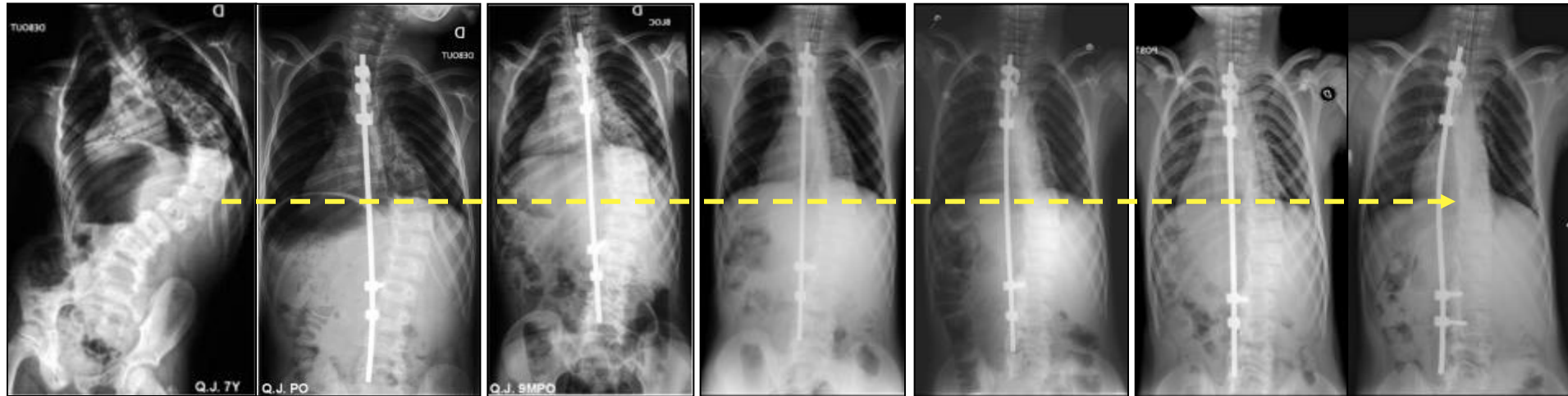


Post op 5Y

Progressive ankylosing of spine with time (Scanner)

But...

- PROMISSING RESULTS



Initial 7Y

5Y PO + 6 Lengthenings

- BUT REQUIRES ITERATIVE SURGERIES

- Annual lengthening surgery – 2 to 3 days hospitalization
- Effect of repeated anesthesia and X-Ray Exposure
- Infection risk increase by 24% for any additional surgery
- Bone Anchorages are highly stressed during extension surgeries
- Mechanical complications are frequent

Remains an heavy treatment for the patients and the parents

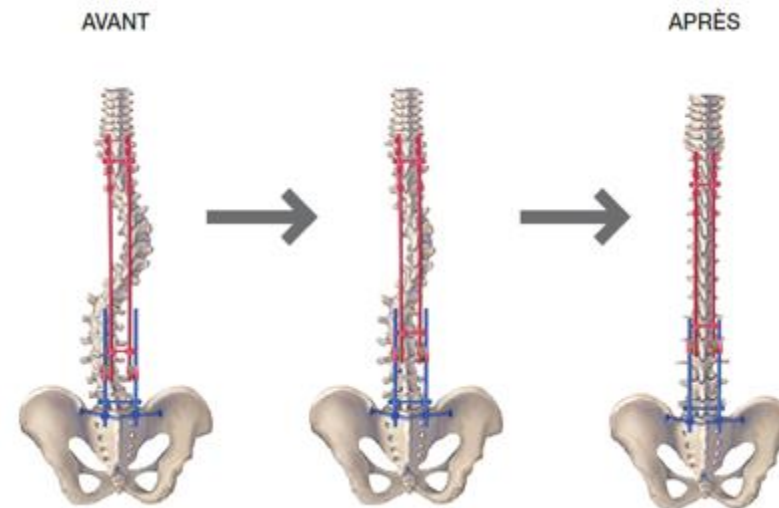
Risks +++

- Mechanical
- Neurological
- Infections

NEMOST Growing Domino

Description

- The desired effect is an elongation of the device following natural growth and daily movements / manipulations while preventing its shrinkage.
 - Used passively: growth
 - Actively used: External traction
- Avoiding iterative construct elongation surgeries
- CE Mark since July 2013
- 250 + Patients operated since 2016
 - Neuromuscular scoliosis
 - Syndromic cases



NEMOST[®] growing domino

Automatic lengthening

- Made up of two rods pre-assembled on a double tunnel domino:
- Standard Biocompatible material (TA6V et PEEK)
 - MRI, CT Scan compatibility
- Simple mechanism :
 - Minimal number of components
 - Limited metal / metal contacts
 - Reduced overall profile
- Notched rod - Growth « reservoir »
 - 50mm or 80mm



Independent clinical study Hôpital Necker - Paris

75% spontaneous growth reported

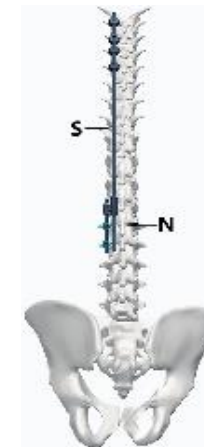
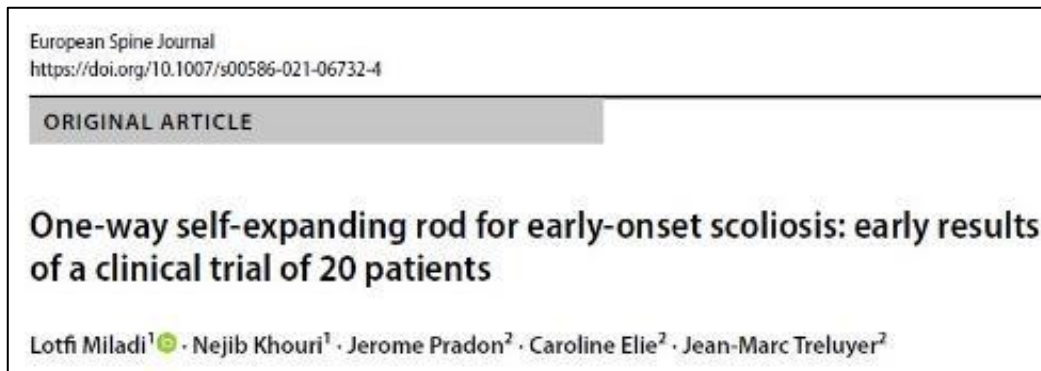
ANSM : DMTCOS/DMTCHIR/LAB/2014-A01043-44-A ClinicalTrial.gov : NCT02266667

NEMOST implanted from 2016 to 2019

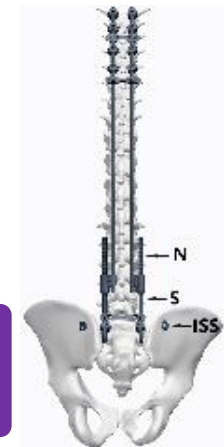
20 patients:

- 10 unilateral constructs → 5 cases did grow (50%)
- 10 bilateral constructs → All cases grew (100%)

➔ Recommendation =
Bilateral construction is mandatory



20 Patients



10 single rod

10 double rods

5 non growing

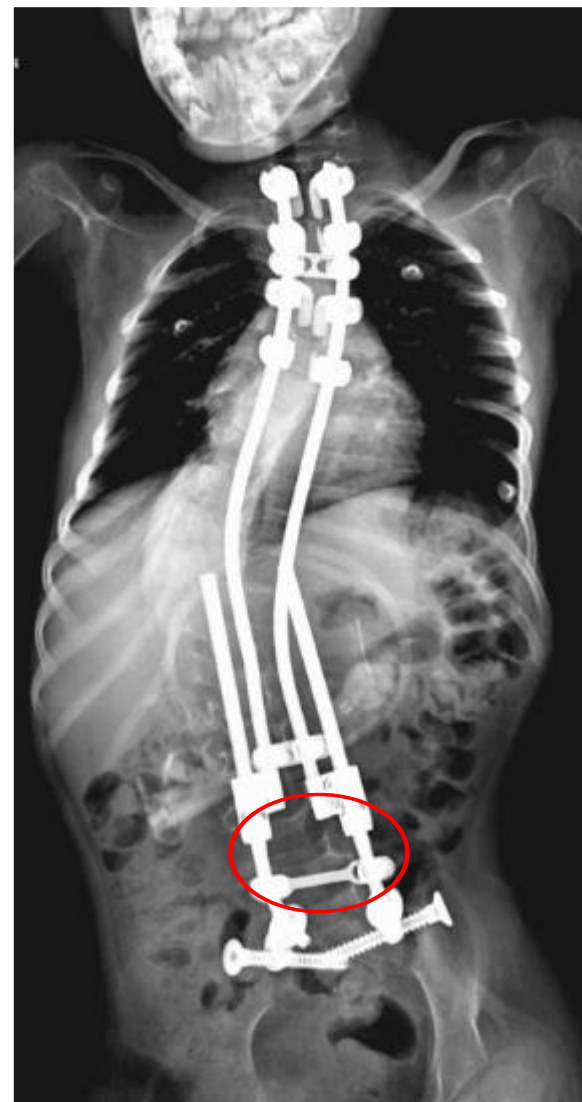
5 growing (50%)

10 growing (100%)

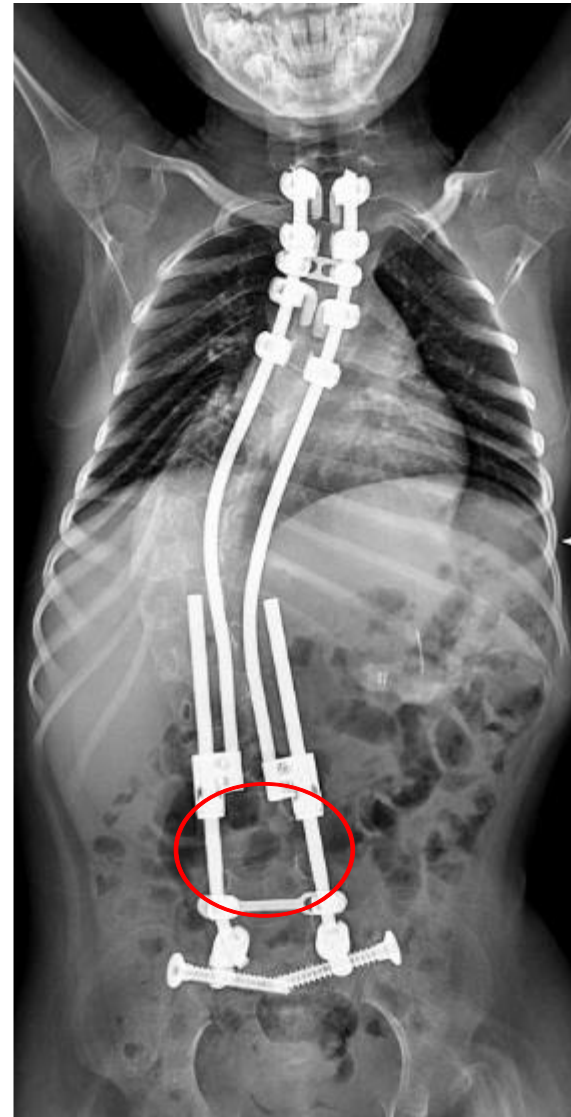
Example 1 (ISA, 7Y)



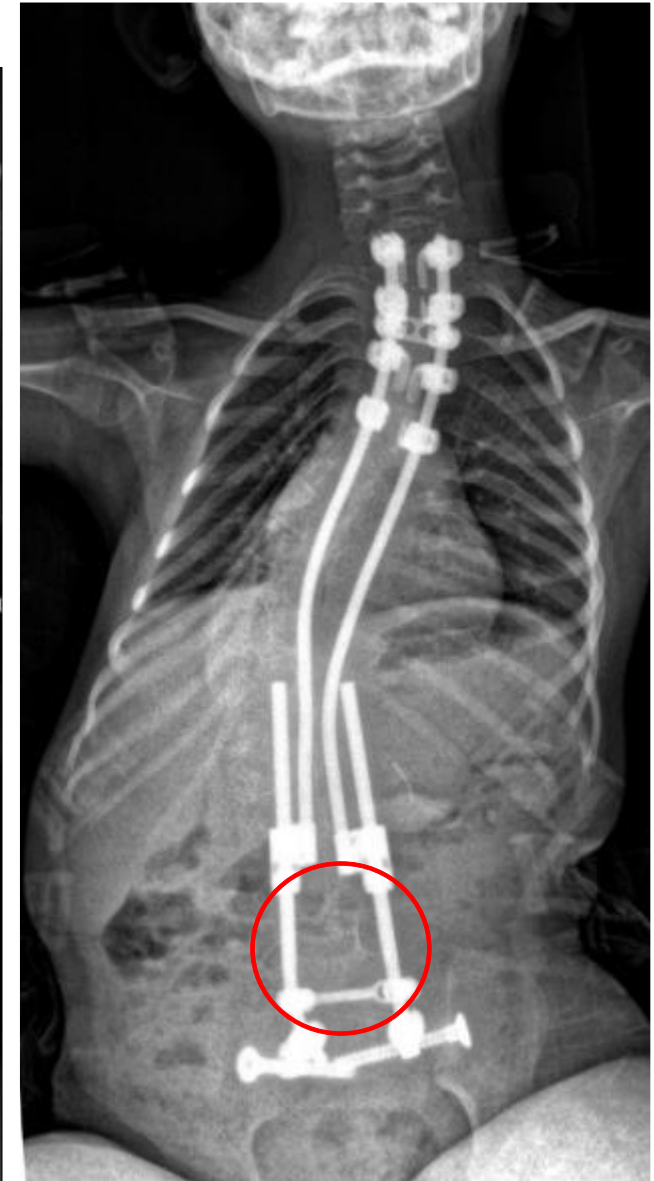
Initial



1Y PO



6 months PO



1Y PO



Initial



5 days PO

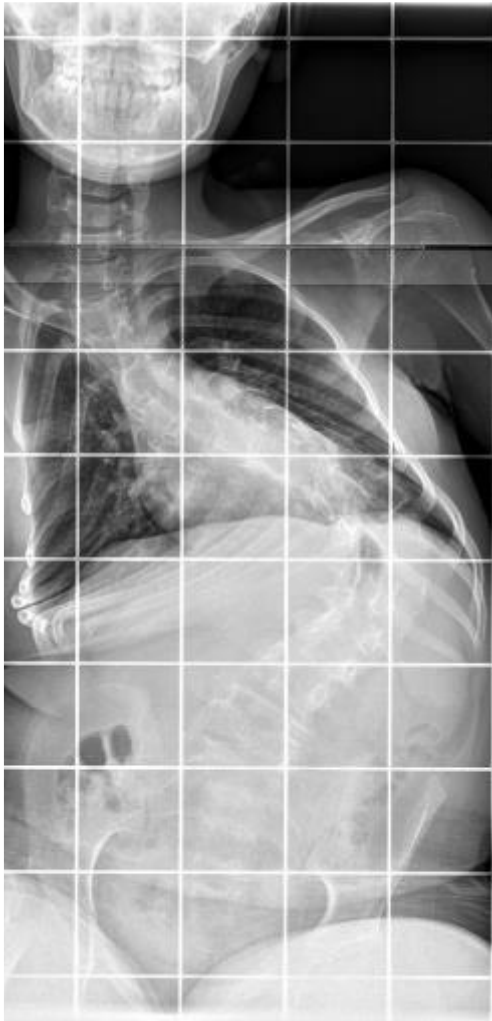


6 months PO



1Y PO

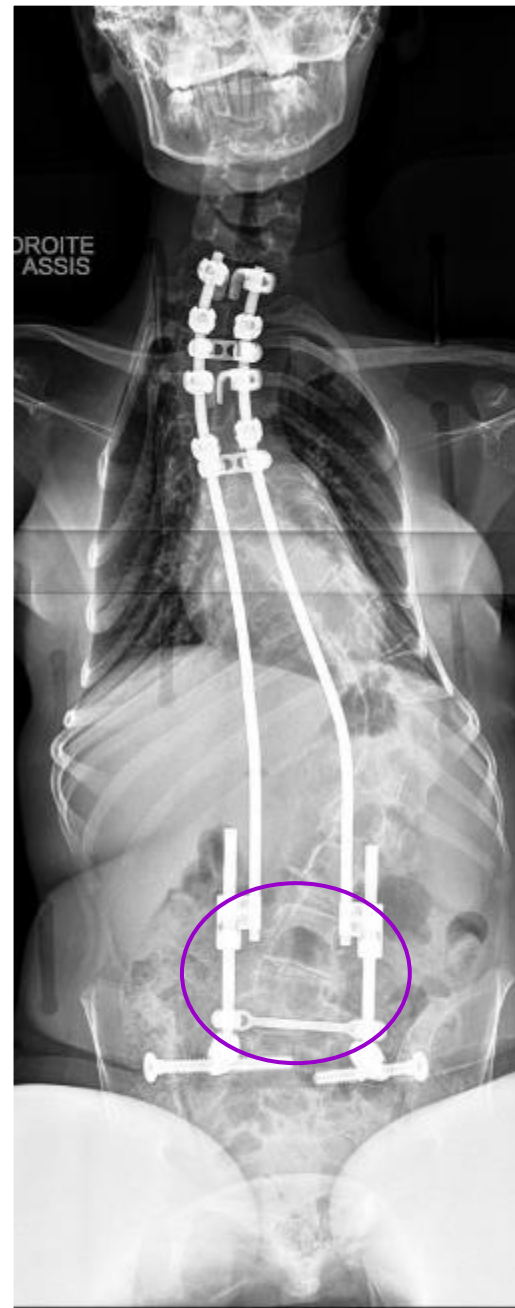
Exemple 2 (ISA, 10Y)



Initial



PO



2Y PO



4Y PO

Exemple 2



Initial



1Y PO



2Y PO



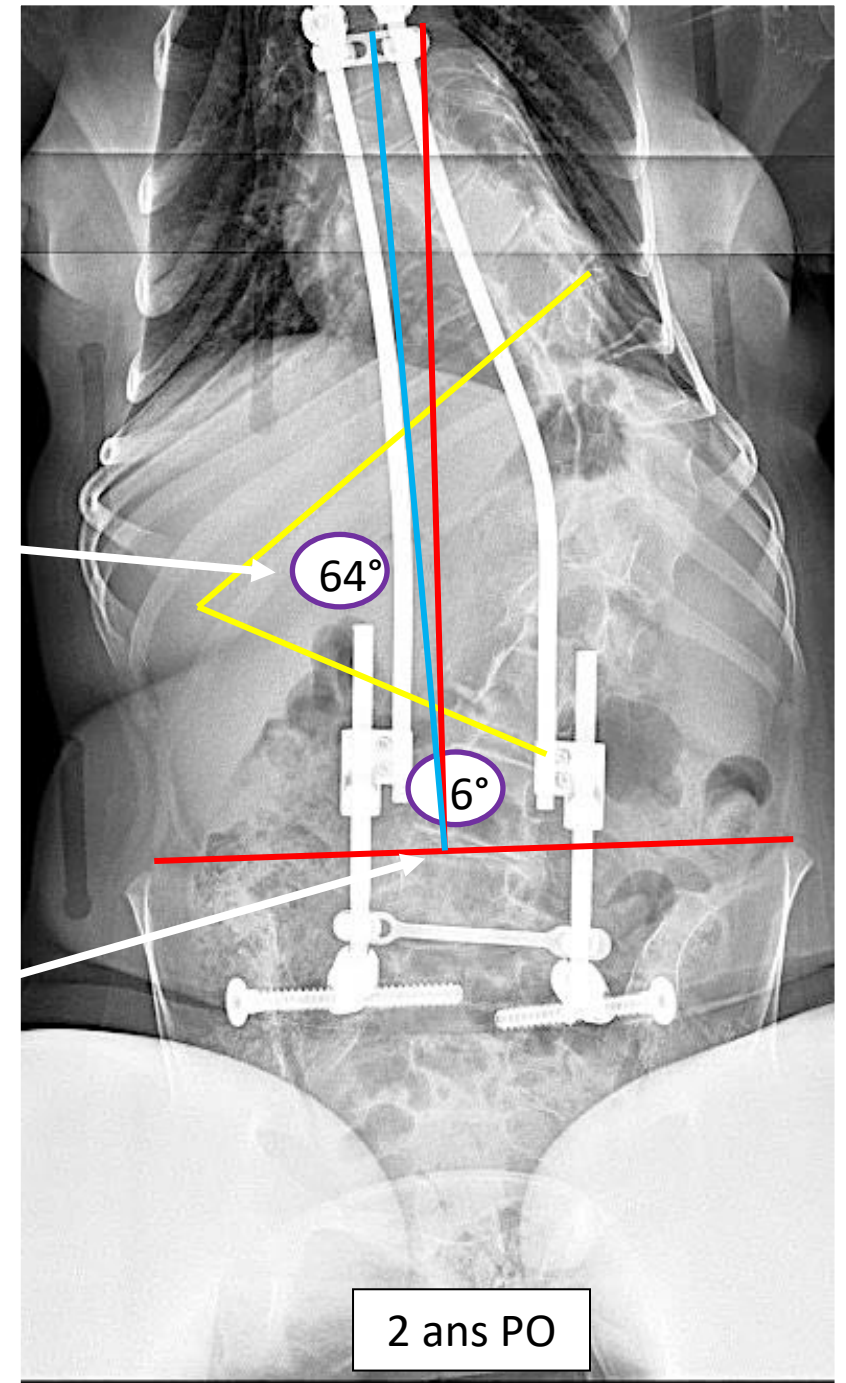
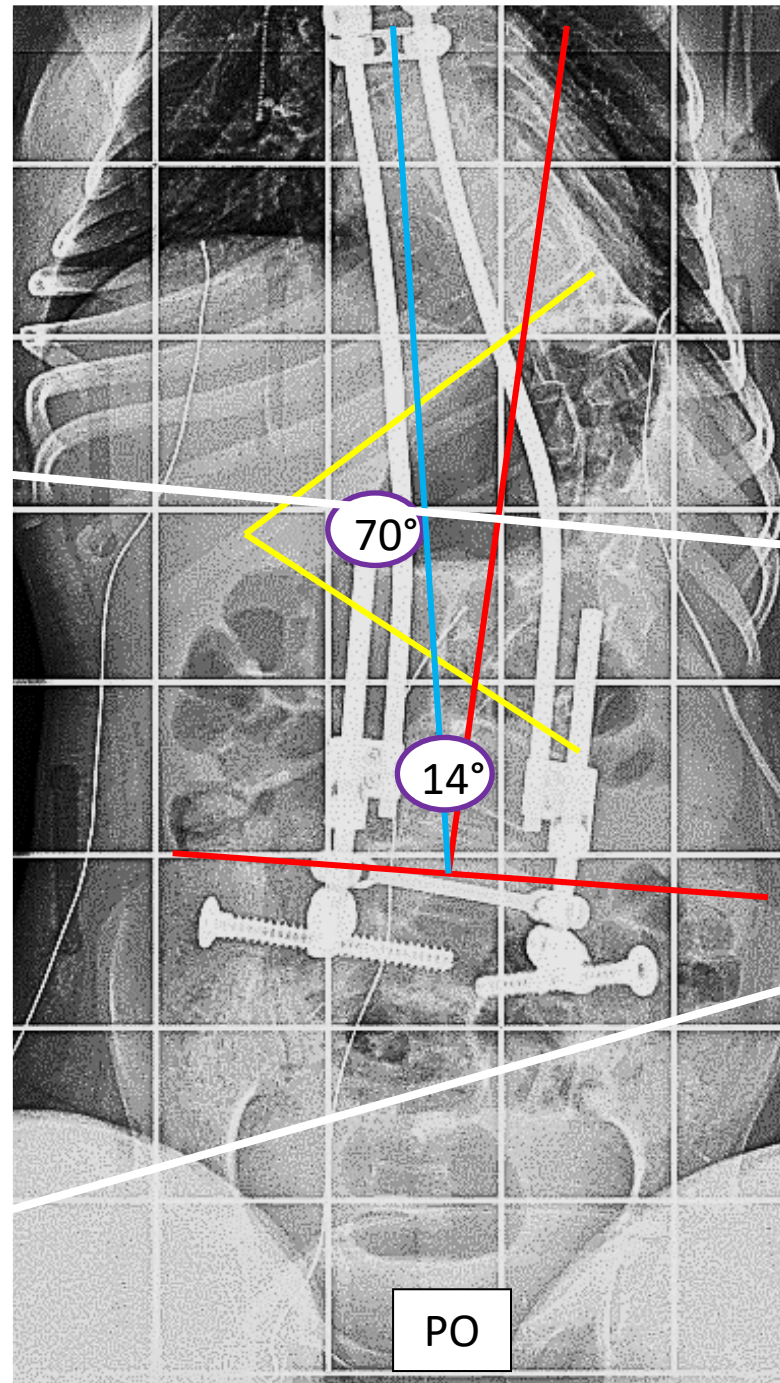
4Y PO

Progressive correction remains

...

Spontaneous improvement of the residual deformity

Spontaneous improvement of the pelvic obliquity





Il trattamento chirurgico delle
deformità vertebrali neuromuscolari
con accesso mininvasivo senza
artrodesi: una tecnica innovativa

*Surgical treatment of neuromuscular spine deformity with
minimally invasive fusionless surgery: an innovative technique*

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Specializzazione in Ortopedia e Traumatologia Università Politecnica delle Marche, Ancona

NEMOST Experience in neuromuscular

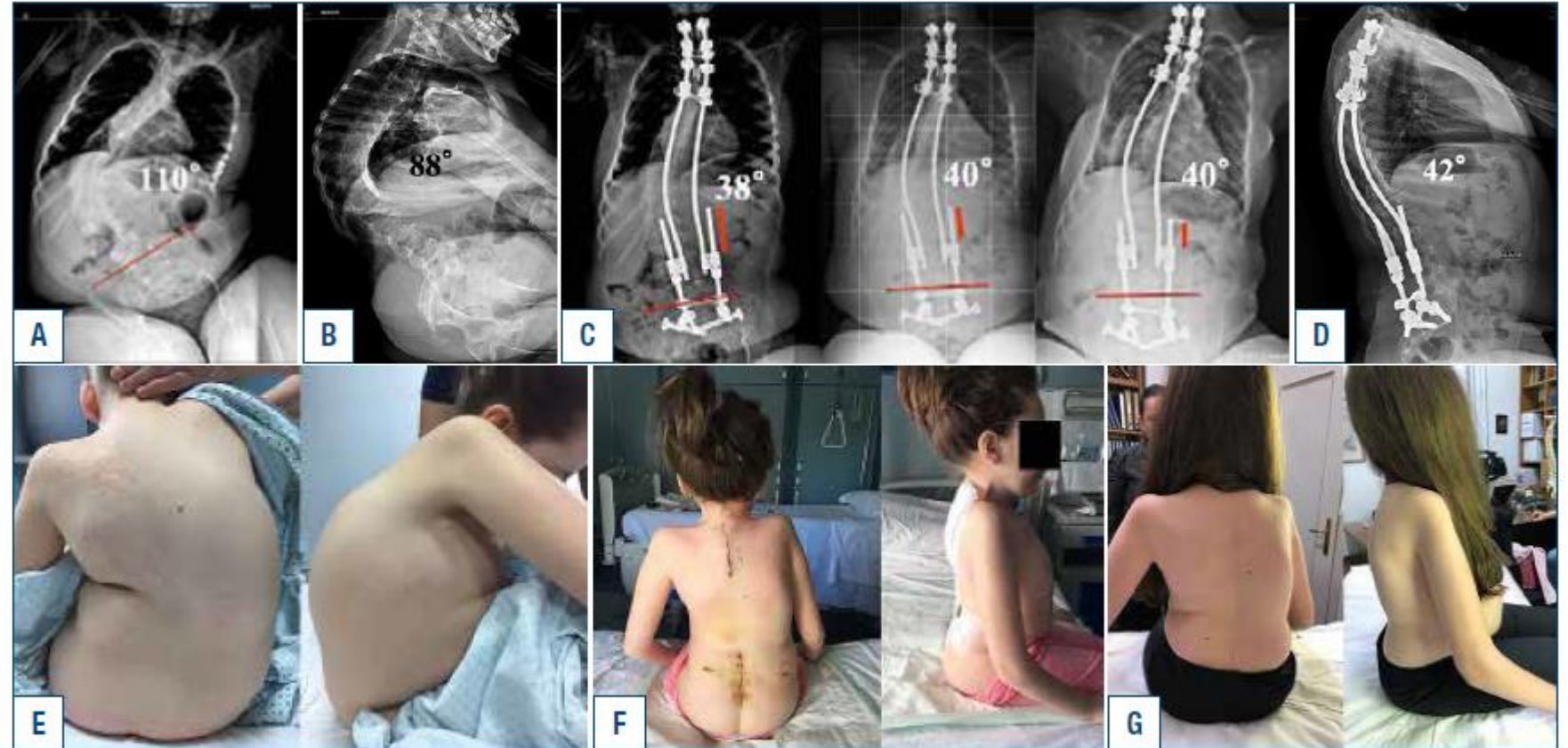
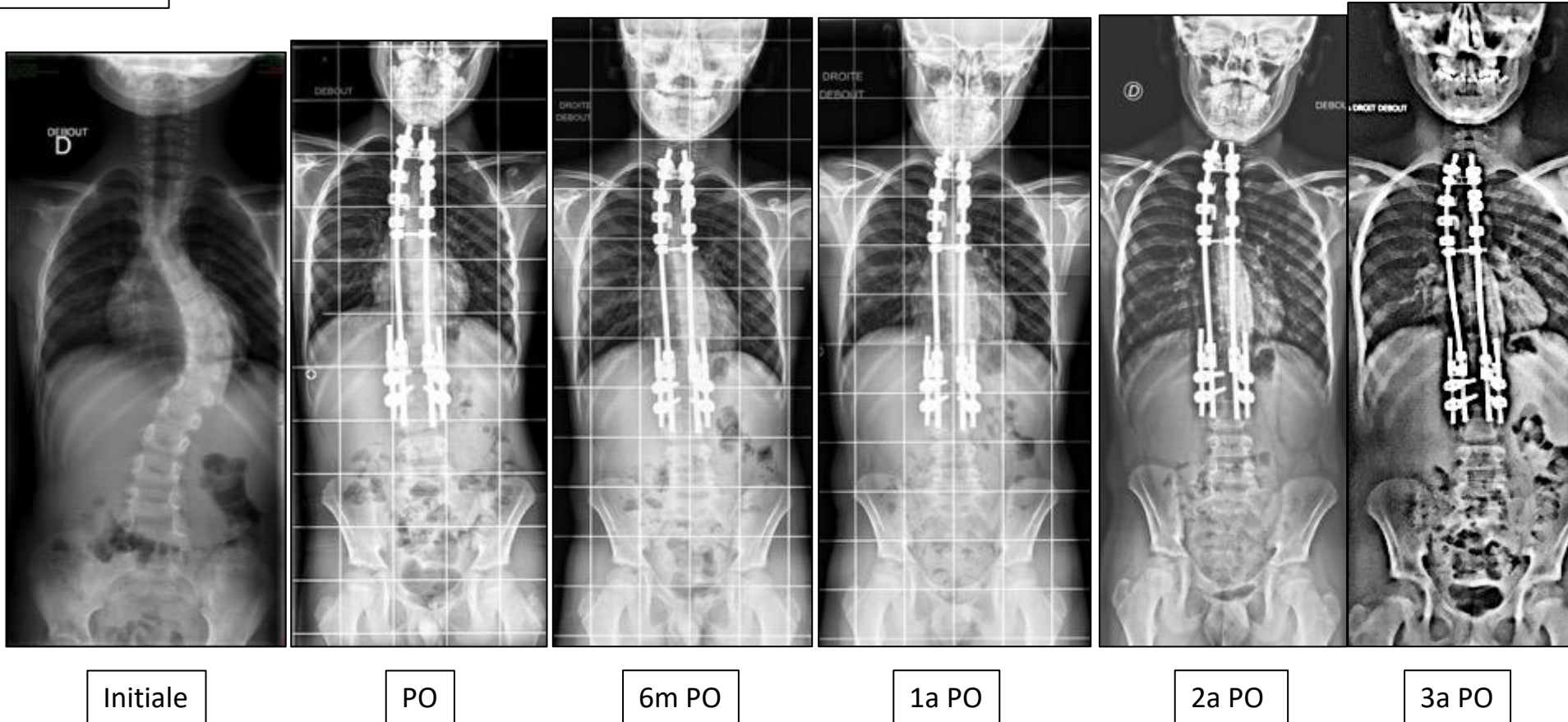
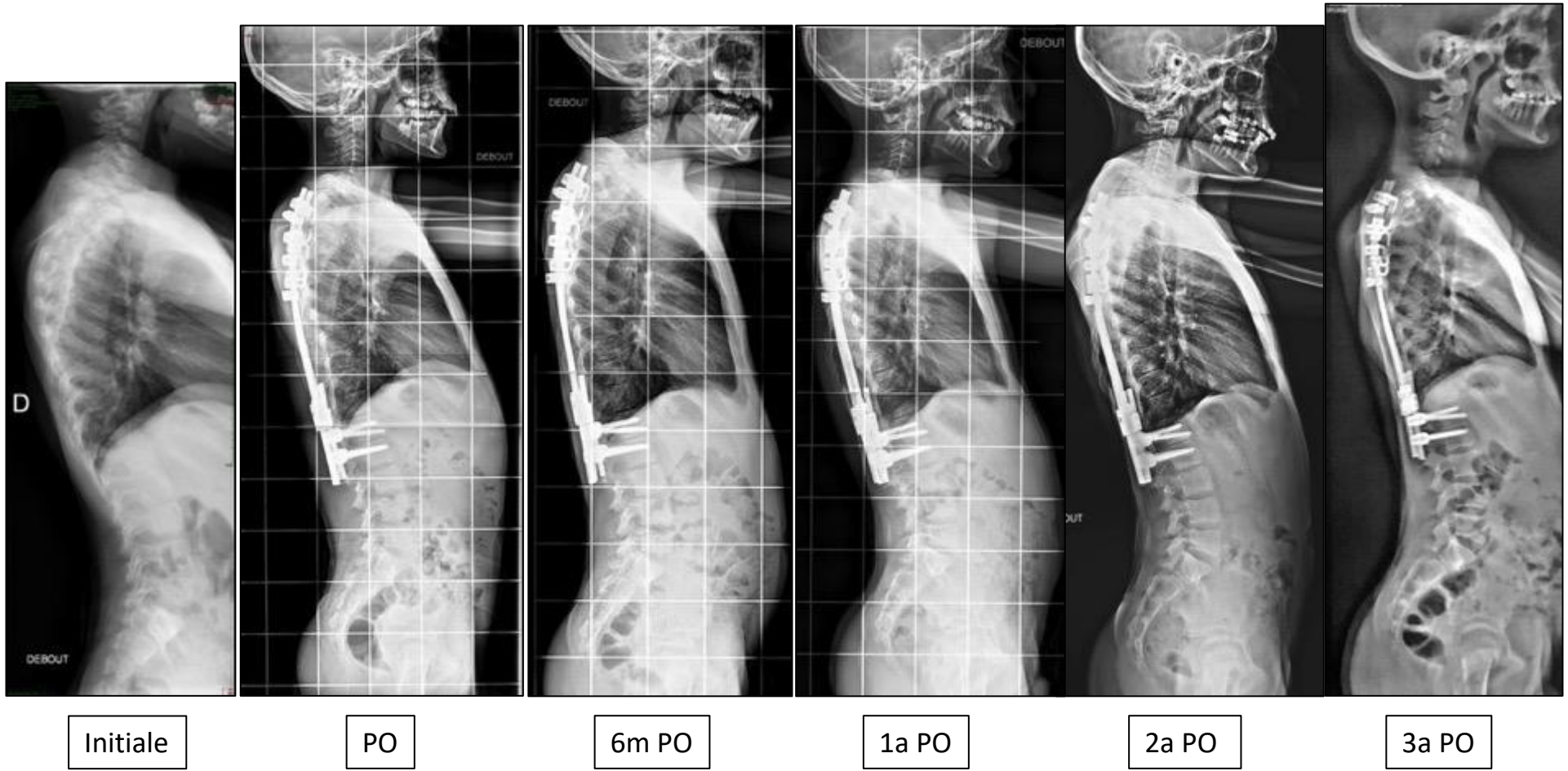


Figura 5. (A-B) Paz. di anni 11. Grave cifoscoliosi in atrofia muscolare spinale di tipo 2. (C) Operata di osteosintesi mininvasiva senza artrodesi con sistema di auto allungamento della strumentazione. La radiografia in proiezione anteroposteriore postoperatoria (sin) confrontata con quella ad un anno (centro) e a 3 anni (destra). (D) la radiografia in proiezione laterale a distanza di 3 anni. (E) Quadro clinico preoperatorio. (F) Quadro clinico post operatorio. (G) Quadro clinico a 3 anni.

NEMOST Experience in idiopathic

C. N. 9ans





Case Dr Lotfi Miladi