

Déformations rachidiennes

Scoliose idiopathique I

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Pathologies rachidiennes

très variées et complexes



Spinal pathologies

deformities

- idiopathic
- congenital
- neuromuscular
- degenerative
- secondary

- cervical
- thoracic
- lumbar

fractures

- traumatic
- pathologic

- frontal plane
- sagittal plane

degenerative

- disc diseases
- osteoarthritis
- instability
- deformities

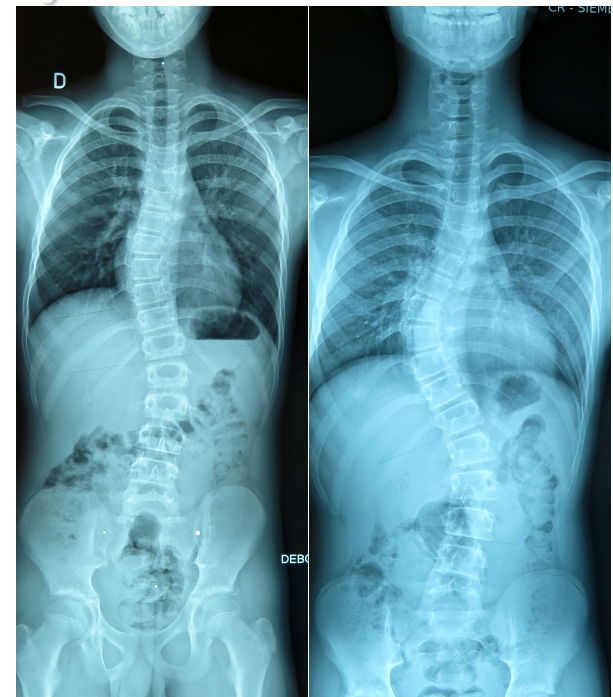
- LBP

Spinal deformities

frontal plane

scoliosis

- idiopathic
 - early onset
 - adolescent
 - adult
- congenital
- neuromuscular
- degenerative
- secondary
 - post-traumatic
 - pathol. fracture
 - tumor
 - infection
 - other



PM, male 13y

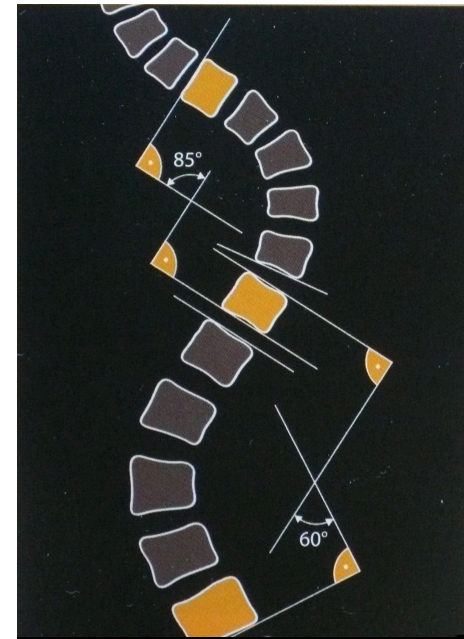
14.5y

Spinal deformities

frontal plane

scoliosis

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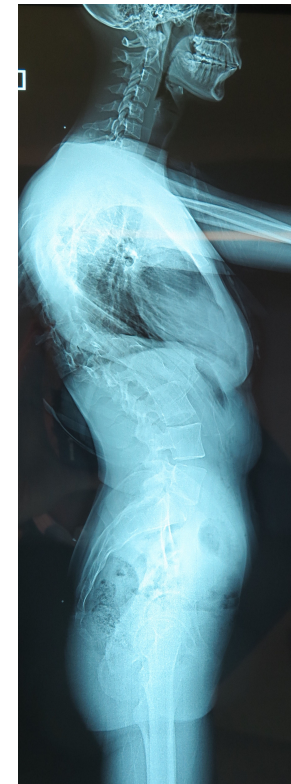
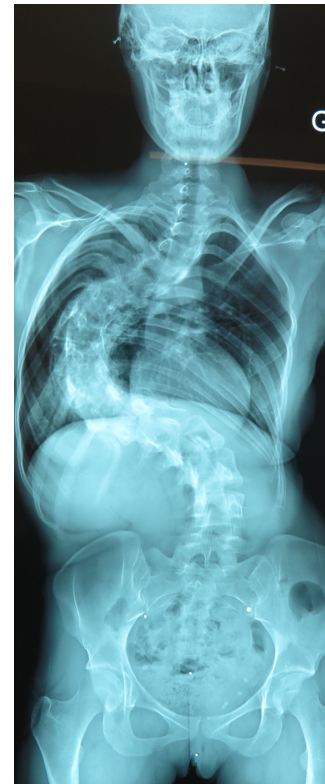


Spinal deformities

frontal plane

scoliosis

- idiopathic
 - early onset
 - adolescent
 - adult
- congenital
- neuromuscular
- degenerative
- secondary
 - post-traumatic
 - pathol. fracture
 - tumor
 - infection
 - other



BM, female 34y

Spinal deformities

frontal plane

scoliosis

- idiopathic
 - early onset
 - adolescent
 - adult
- congenital
- neuromuscular
- degenerative
- secondary
 - post-traumatic
 - tumor
 - infection
 - other

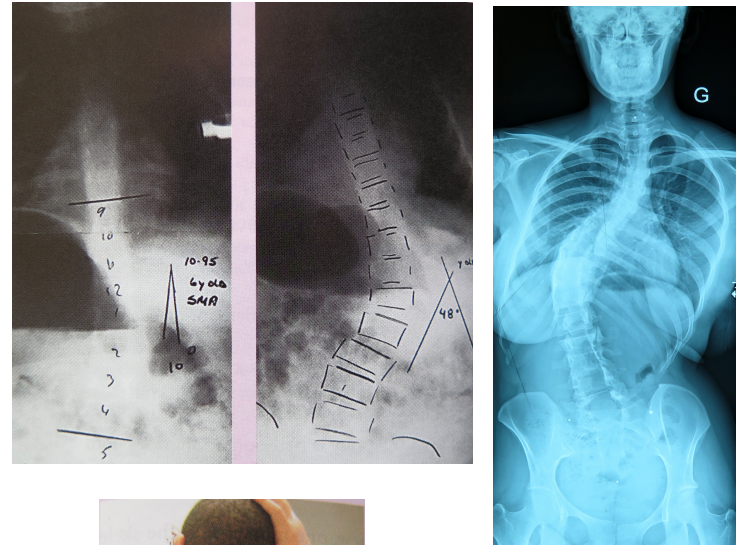


Spinal deformities

frontal plane

scoliosis

- idiopathic
 - early onset
 - adolescent
 - adult
- congenital
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 - tumor
 - infection
 - other



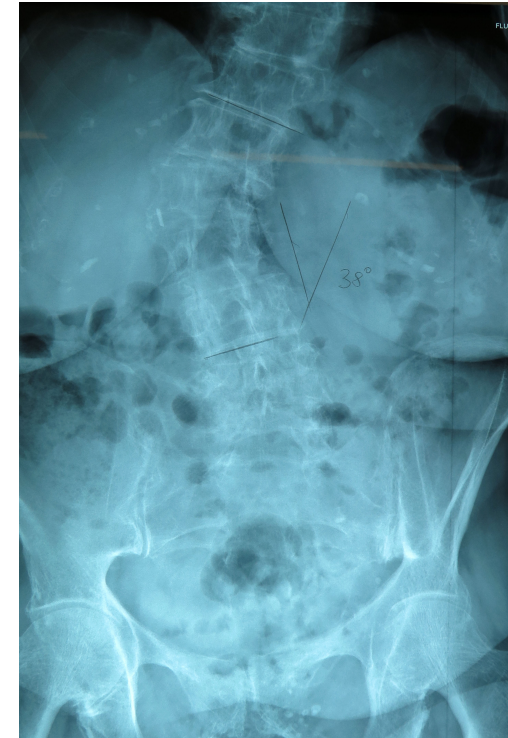
- Duchenne dystrophy
- Friedreich ataxia
- Polio
- Myelodysplasia
- Cerebral palsy
- MMC

Spinal deformities

frontal plane

scoliosis

- idiopathic
 - early onset
 - adolescent
 - adult
- congenital
- neuromuscular
- degenerative
- secondary
 - post-traumatic
 - tumor
 - infection
 - other



NJ, female, 85 y

Spinal deformities

sagittal plane

kyphosis

- Scheuermann
- degenerative
- osteoporosis
- angular

spondylolisthesis

- low-grade
- high-grade



PM, f 35y



CT, f 81y

Spinal deformities

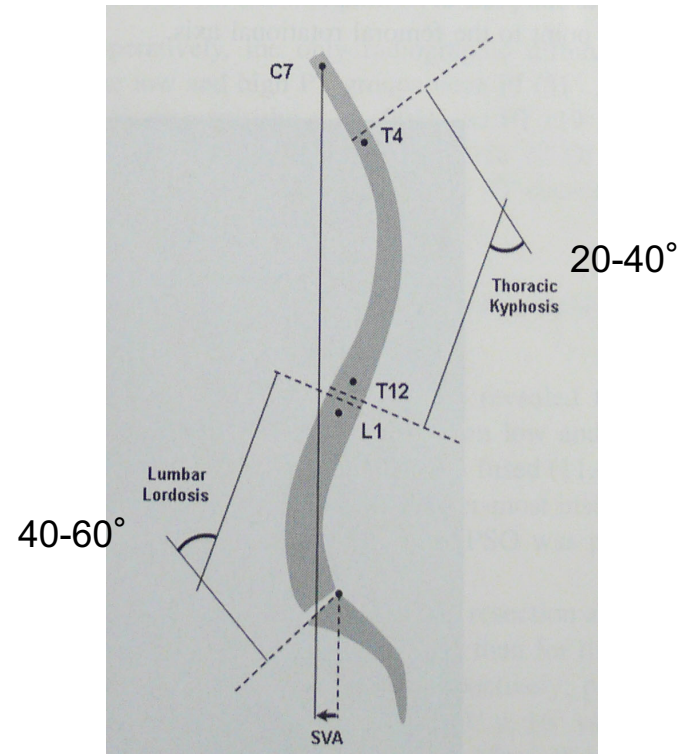
sagittal plane

kyphosis

- Scheuermann
- degenerative
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spondylolisthesis

- low-grade
- high-grade



Spinal deformities

sagittal plane

kyphosis

- Scheuermann
- degenerative
- osteoporosis
- angular

spondylolisthesis

- low-grade
- high-grade
- degenerative



IM, m 27y



DJ, f 55y

Spinal deformities

Adolescent idiopathic scoliosis (AIS)



scoliosis: coronal curve $> 10^\circ$
with vertebral rotation (SRS)

- structural deformity 2-3% adol. pop.
30° 0.1- 0.3% >
- females > males
- aetiology unknown
imbalance ant/post spinal growth (?)
- benign natural history

Spinal deformities

Adolescent idiopathic scoliosis (AIS)



Physical examination:

- inspection (skin,..)
- curve location/side
- flexibility
- rib hump
- shoulder level
- pelvic obliquity
- sagittal profile
- balance (frontal, sagittal)
- physical maturity
- neurological examination

Spinal deformities

Adolescent idiopathic scoliosis (AIS)



Physical examination:

- inspection (skin,..)
- curve location/side
- flexibility
- rib hump
- shoulder level
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Scoliosis is a 3-dimensional deformity

frontal



Lateral deviation

horizontal



Axial rotation

MEDICOL
sagittal



Hypokyphosis

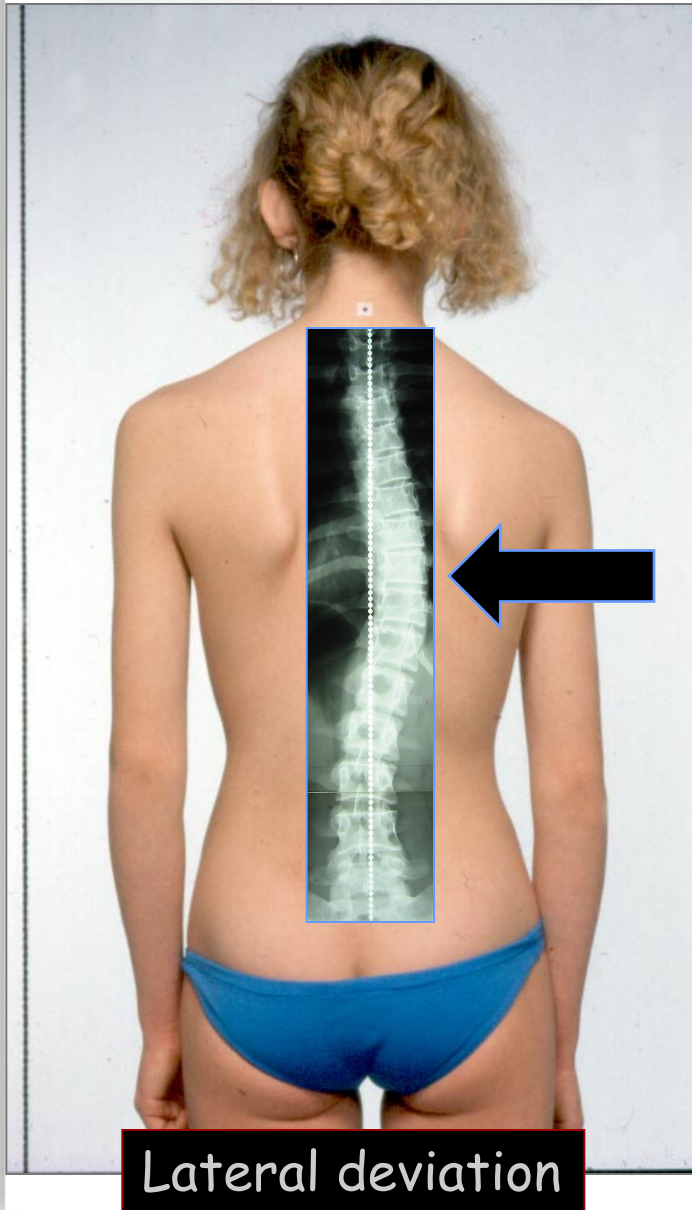
Frontal

Classification

- Age onset
- infantile (0-3y)
 - juvenile (3-10y)
 - adolescent (10-18y)
 - adult (>18y)
 - “de novo” (degen.)

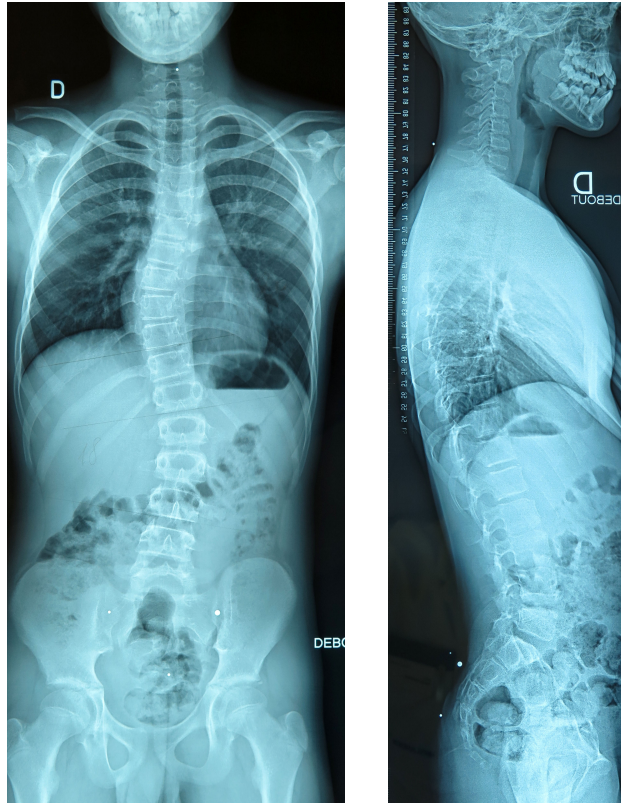
Convex to the right

- Localization
- thoracic
 - thoraco-lumbar
 - lumbar



Spinal deformities

Adolescent idiopathic scoliosis (AIS)



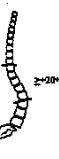
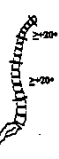
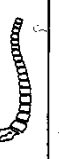
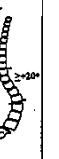
PM, male 13y

Radiographic assessment: (whole spine standing RX)

- localization
- magnitude
- major/compensatory
- side convexity
- end vertebrae (upper/lower)
- apical vertebra
- balance (frontal/sagittal)
- pelvic obliquity
- skeletal maturity (Risser)
- vertebral rotation

Spinal deformities

Adolescent idiopathic scoliosis (AIS)

<u>Lumbar Spine Modifier</u>	<u>Curve Type (1 - 6)</u>					
	Type 1 (Mild Thoracic)	Type 2 (Double Thoracic)	Type 3 (Double Major)	Type 4 (Triple Major)	Type 5 (TL/L)	Type 6 (TL/L- MT)
A (No to Minimal Curve)	 1A*	 2A*	 3A*	 4A*		
B (Moderate Curve)	 1B*	 2B*	 3B*	 4B*		
C (Large Curve)	 1C*	 2C*	 3C*	 4C*	 5C*	 6C*
Possible Sagittal structural criteria (To determine specific curve type)	 Normal	 PT Kyphosis	 TL Kyphosis	 PT + TL Kyphosis	 Normal	 TL Kyphosis

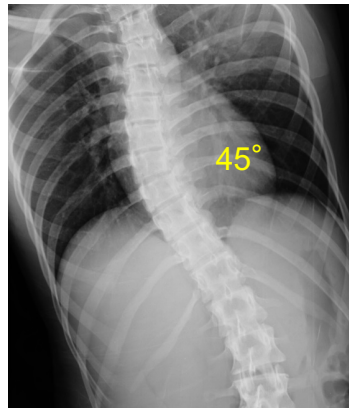
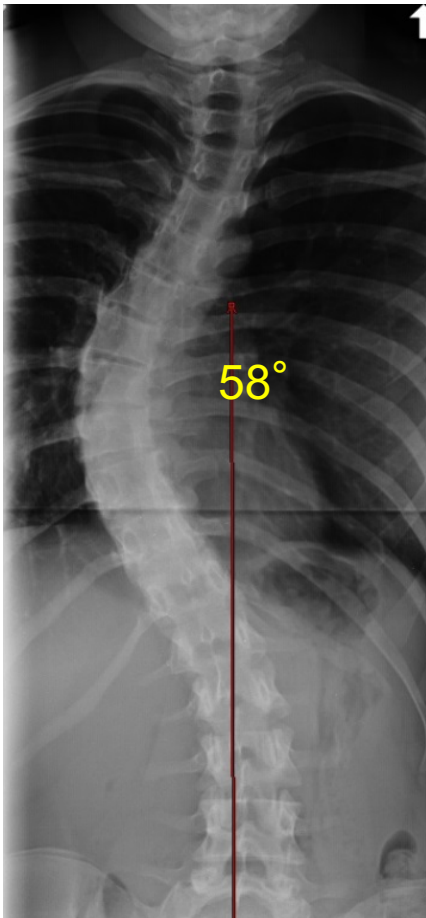
* T5-T12 sagittal alignment modifier: -, N, or +
- : <10°
N : 10-40°
+ : >40°

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Spinal deformities

Adolescent idiopathic scoliosis (AIS)

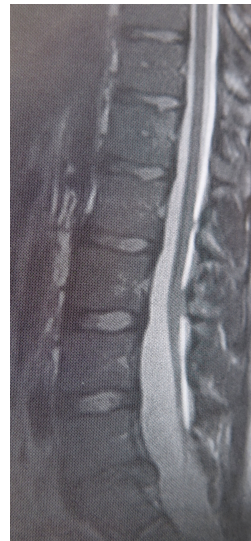
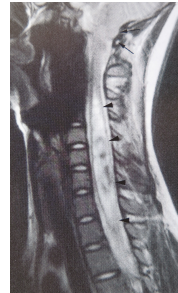
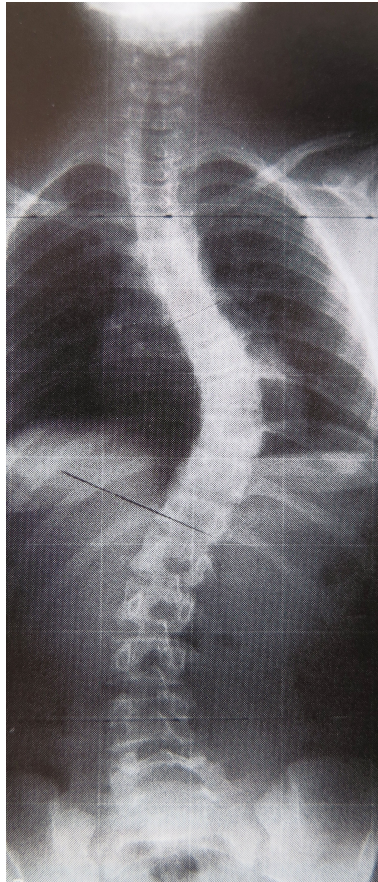


Radiographic assessment:

- side bending views
- MRI atypical scoliosis
 - infantile or juvenile onset
 - painful scoliosis
 - left convex thoracic curves
 - neurol. abnormalities
- syringomyelia
- Arnold-Chiari
- tethered cord
- tumors

Spinal deformities

Adolescent idiopathic scoliosis (AIS)



Radiographic assessment:

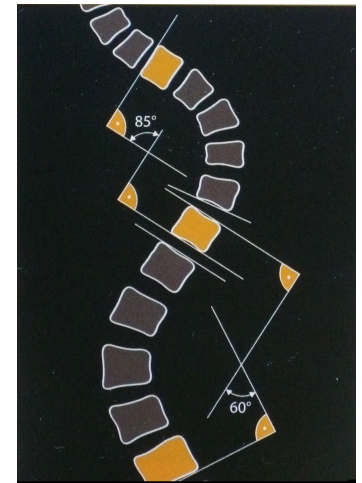
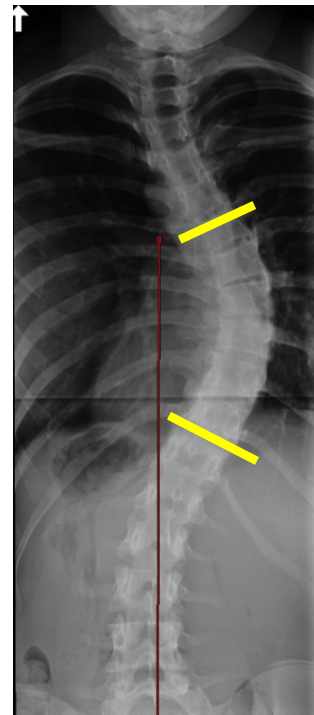
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Adolescent idiopathic scoliosis (AIS)

Treatment Principles

Factors

- * Curve magnitude (Cobb angle)
- * State of growth (Risser)
- * Cosmesis
- * Patient's desire

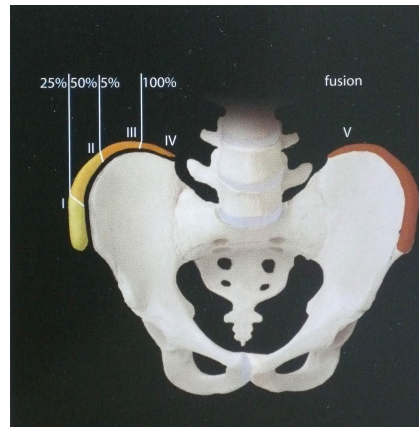


Adolescent idiopathic scoliosis (AIS)

Treatment Principles

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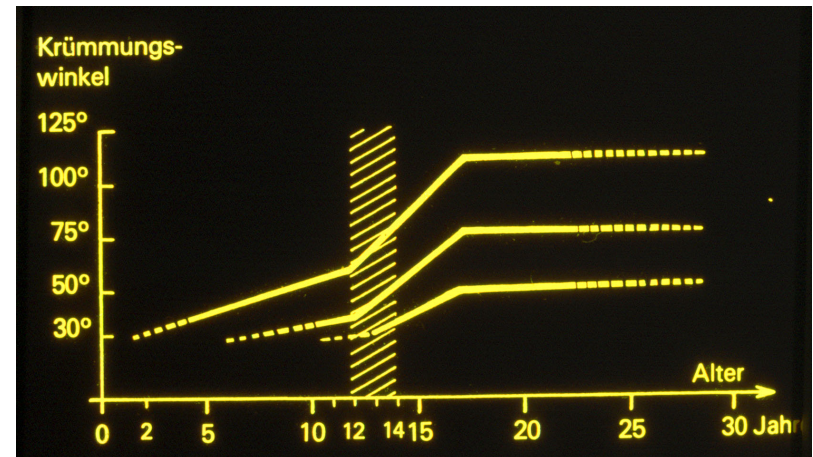
HE, female 15Y

Adolescent idiopathic scoliosis (AIS)

Decision Making

Factors

- * Curve magnitude (COBB)
- * State of growth
- * Cosmesis
- * Patient's desire



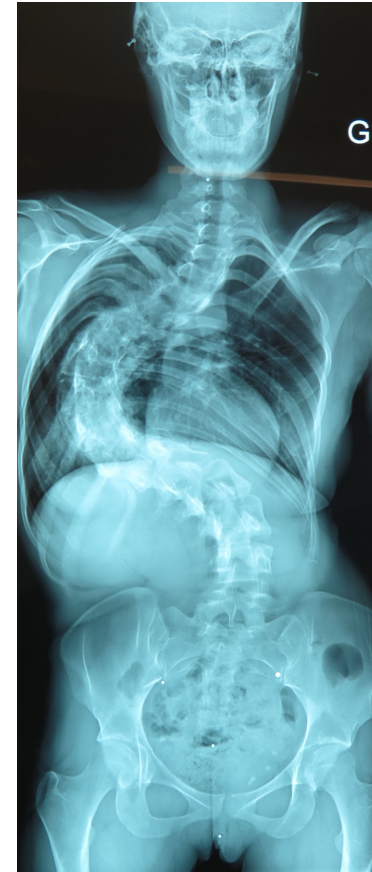
Risk factors

- young age at onset
- premenarchal status
- physical immaturity
- large curves

Adolescent idiopathic scoliosis (AIS)

Aims of Scoliosis Treatment

- * Prevent curve progression
- * Stabilise the spine (spinal fusion)
- * 3D-Correction (coronal, axial, sagittal)
- * Maintain or correct balance
- * Maintain mobility (save segments)
- * Allow for further spine growth
- * Avoid complications



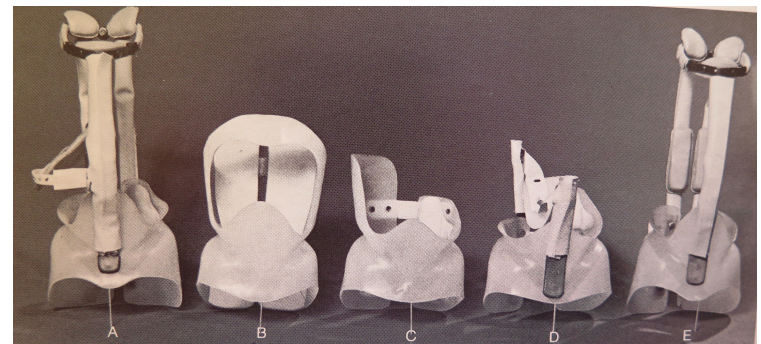
Adolescent idiopathic scoliosis (AIS)

Treatment Principles

During Growth

- < 25° □ Observation
 Physiotherapy
- 25 – 40° □ Bracing
 Physiotherapy
 Electrostimulation
- > 50° □ Operation

40 - 50° “gray zone”



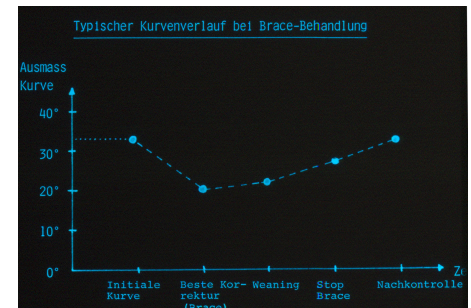
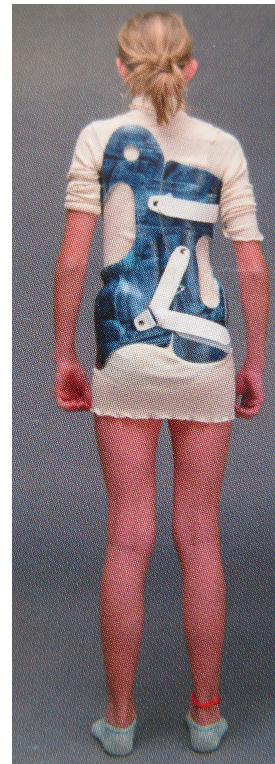
Adolescent idiopathic scoliosis (AIS)

Treatment Principles

During Growth

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|----------|---|--|
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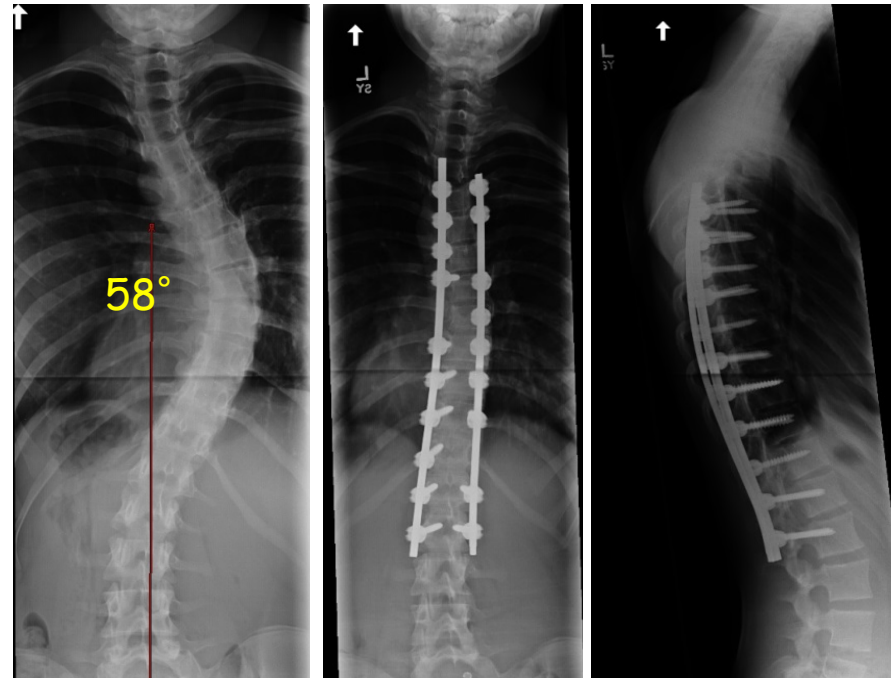


Adolescent idiopathic scoliosis (AIS)

Decision Making

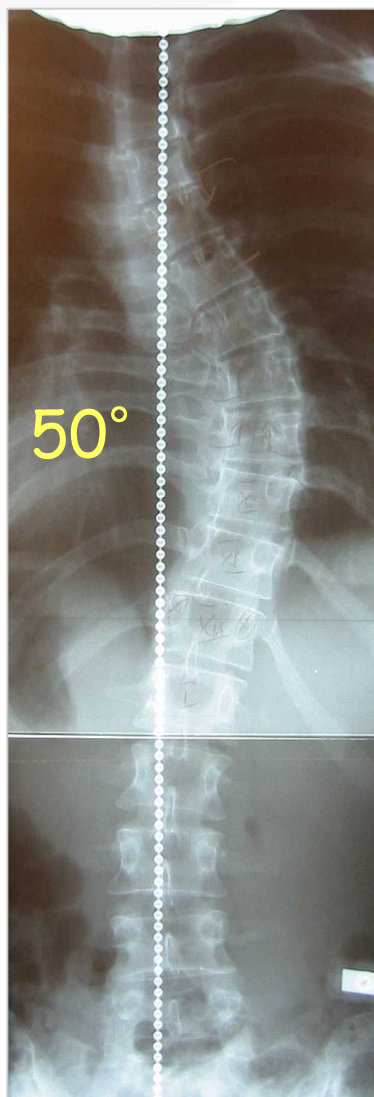
Factors

- * Curve magnitude (Cobb)
- * State of growth
- * Cosmesis
- * Patient's desire



FE, 13 y / fem

Keep in mind:
the natural history is benign

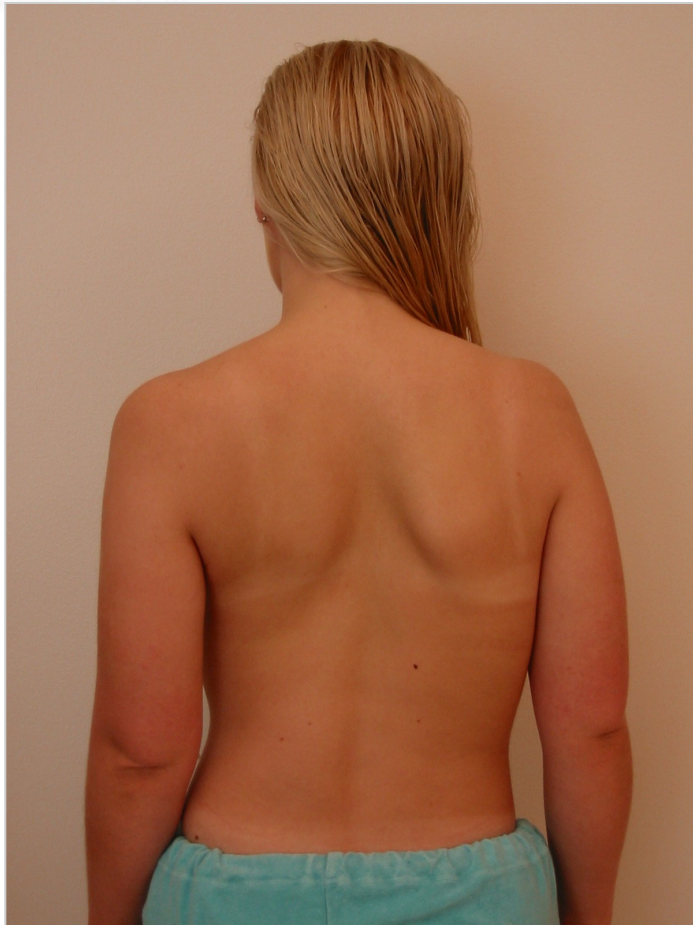


Result ?

26 y / fem



2 y p.op

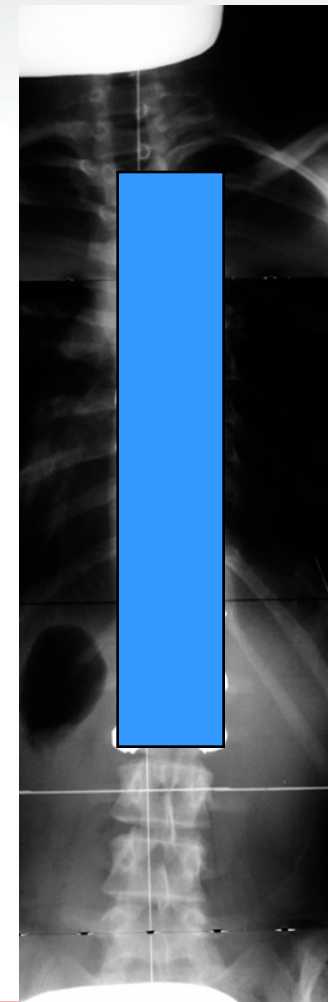


26 y / fem



2 y p.op

Goals of surgery



**spinal balance (AP and sagittal)
preservation of a maximum of mobile vertebral levels
stable over time (no further extension surgeries)**

How much correction ?

”The straighter is NOT the better”

Goal ?

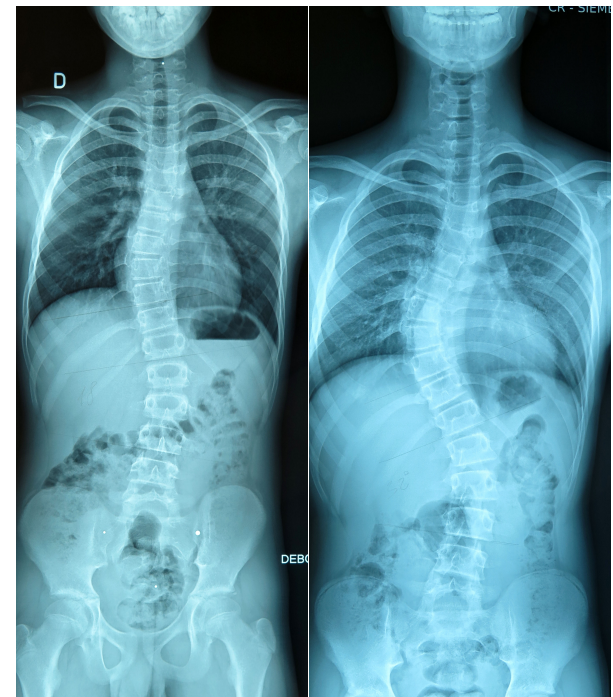
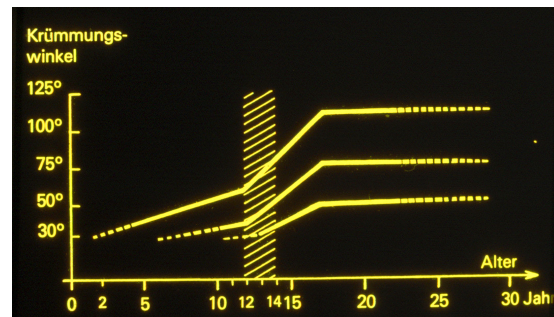
Balanced spine with levelled (horizontal) shoulders

Adolescent idiopathic scoliosis (AIS)

Operative treatment

indications depend on:

- risk for progression
- skeletal maturity
- curve type
- curve magnitude
- cosmetic appearance
- failure of conservative ttt



PM, male 13y

14.5y

Adolescent idiopathic scoliosis (AIS)

Operative treatment

approach:

- posterior
 - anterior
 - combined ant/post
-
- curve type and size
 - curve rigidity
 - skeletal maturity
 - spinal instrumentation
 - surgical skills

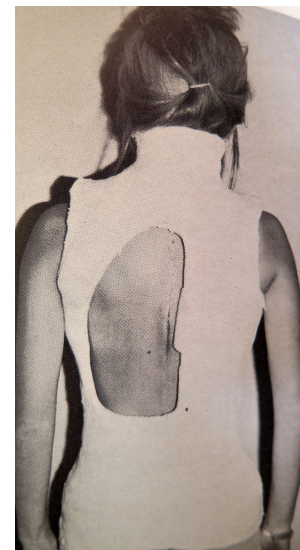
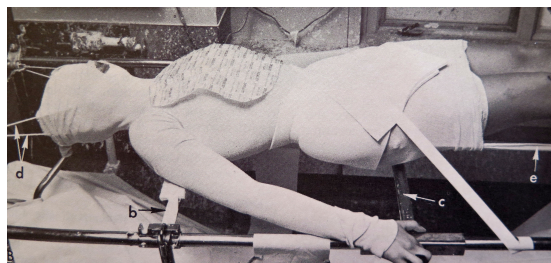
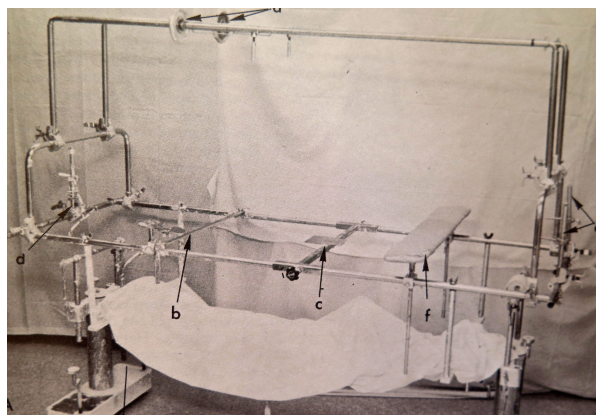
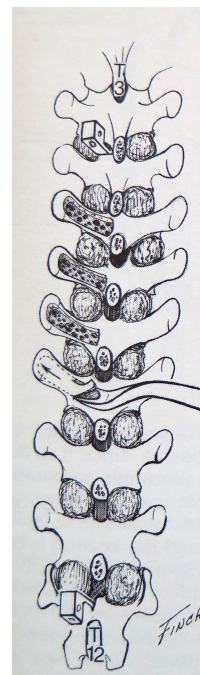


Adolescent idiopathic scoliosis (AIS)

Operative treatment

posterior approach:

- posterior fusion (Hibbs 1914)
to avoid progression
with correcting cast

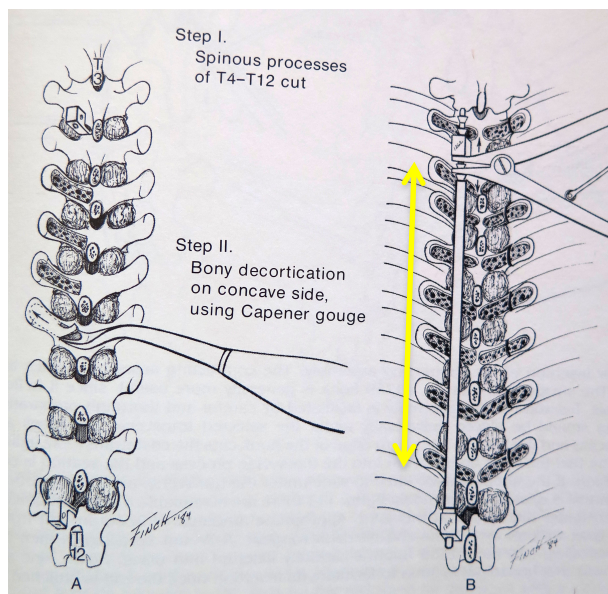


Adolescent idiopathic scoliosis (AIS)

Operative treatment

posterior approach:

- Harrington instrumentation (> 1960s)

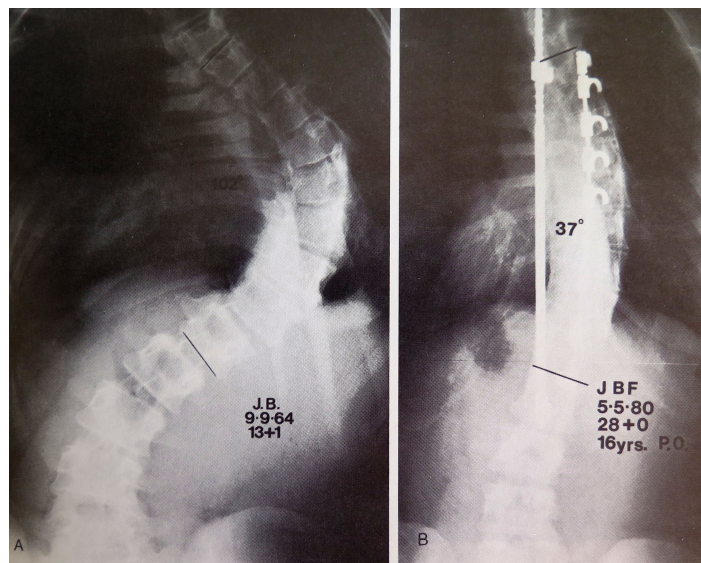
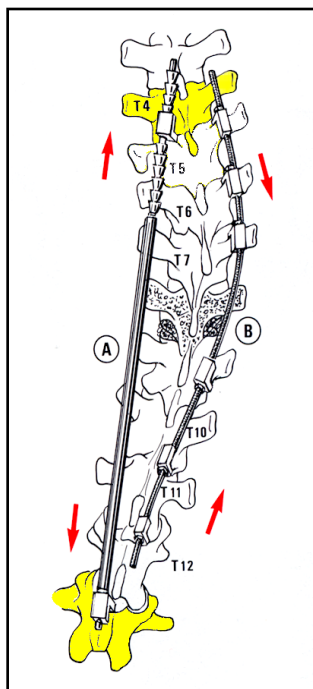


Adolescent idiopathic scoliosis (AIS)

Operative treatment

posterior approach:

- Harrington instrumentation (> 1960s)



convexity compression rod
concavity distraction rod

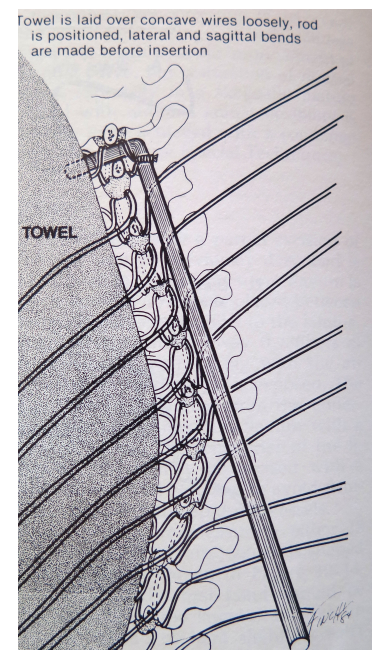
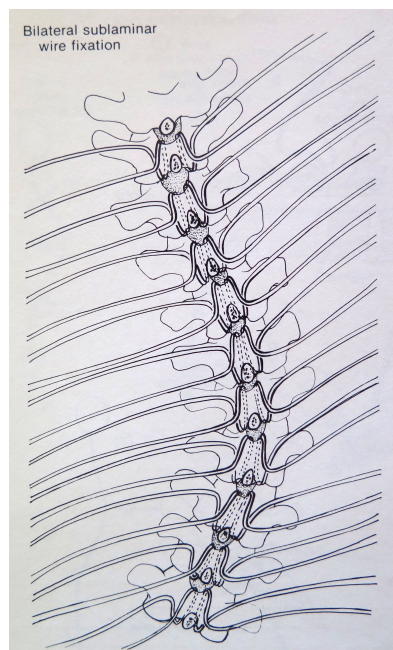
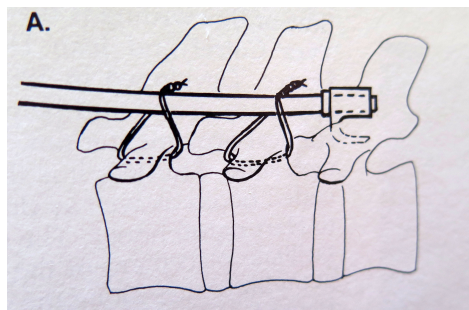
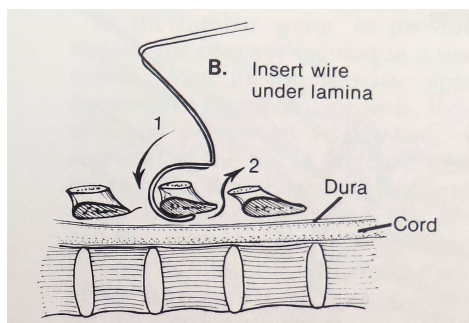
need for
postop. cast

Adolescent idiopathic scoliosis (AIS)

Operative treatment

posterior approach:

- Luque instrumentation (> 1970s) segmental instrumentation



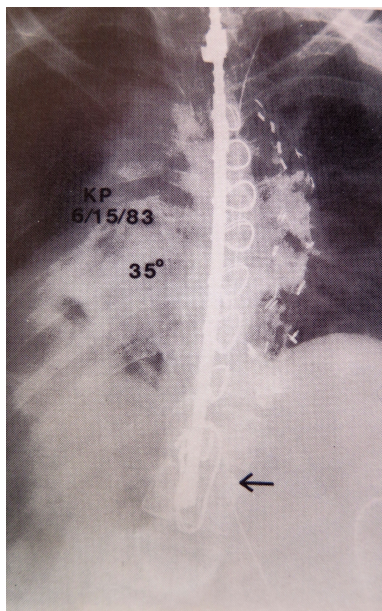
improved correction and postop. stabilisation

Adolescent idiopathic scoliosis (AIS)

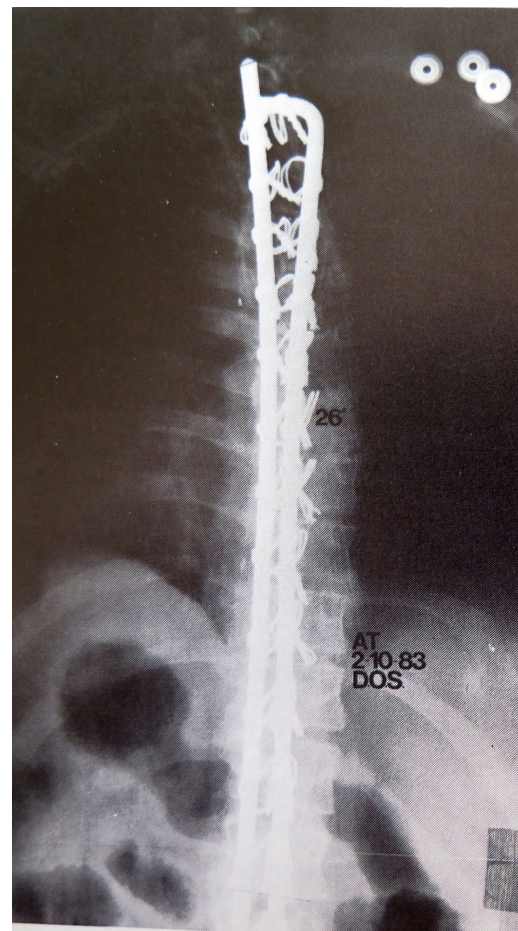
Operative treatment

posterior approach:

- Luque instrumentation (> 1970s)



improved correction and postop. stabilisation

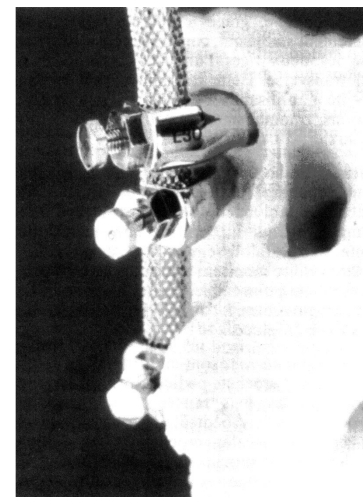
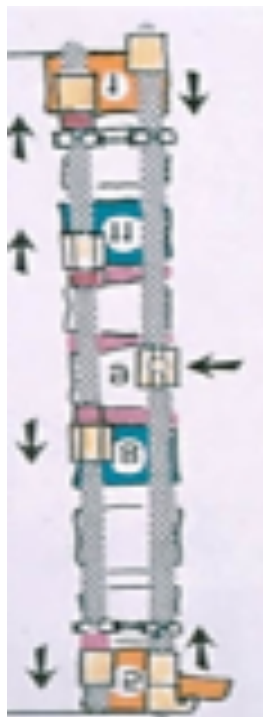
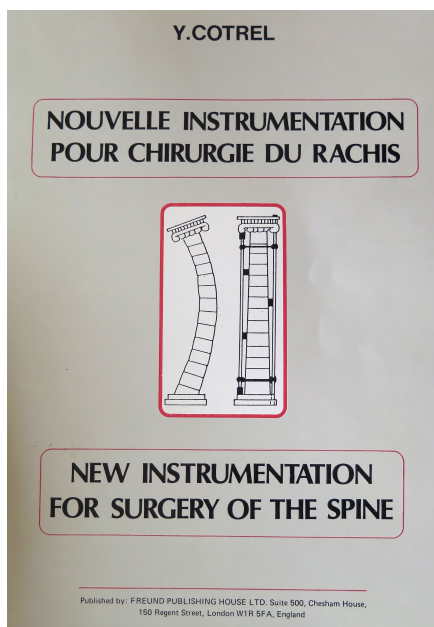


Adolescent idiopathic scoliosis (AIS)

Operative treatment

posterior approach:

- Cotrel Dubousset (> 1980s)



Adolescent idiopathic scoliosis (AIS)

Operative treatment

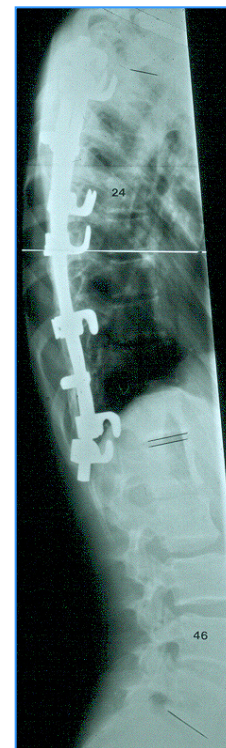
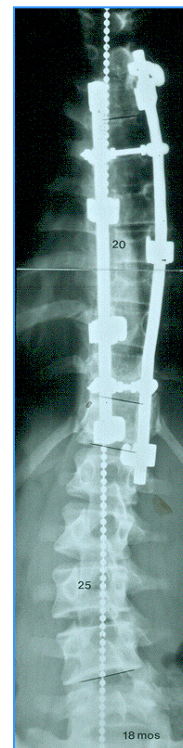
posterior approach:

- Cotrel Dubousset (> 1980s)

shorter fusion

preservation lower lumbar
motion segments

more stable (no postop cast)

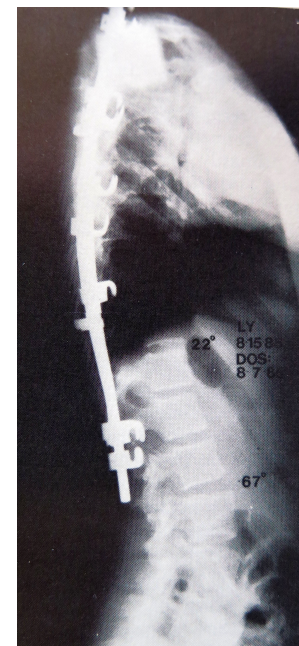
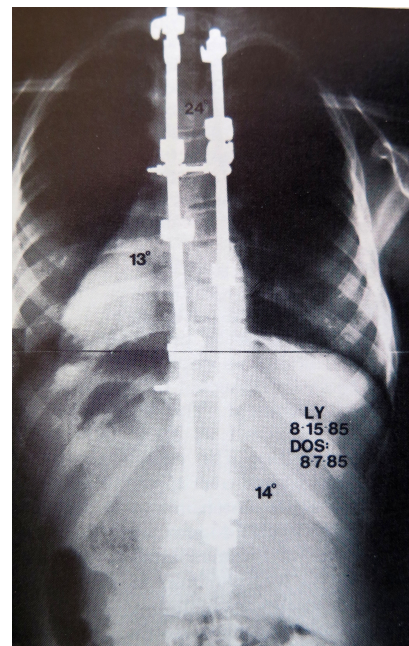
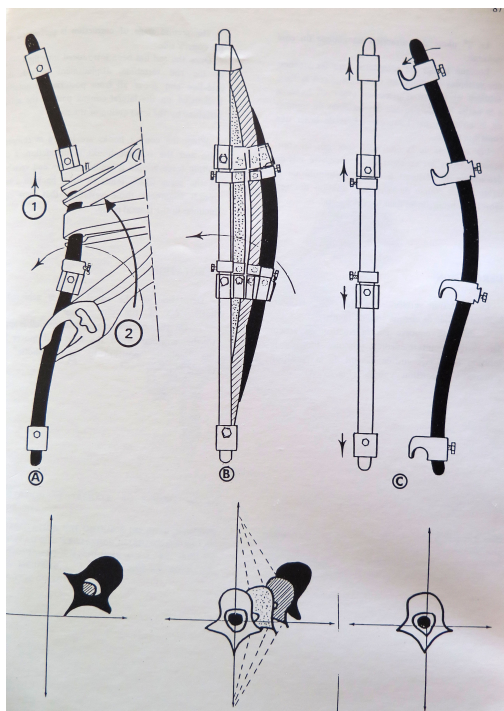


Adolescent idiopathic scoliosis (AIS)

Operative treatment

posterior approach:

- Cotrel Dubousset (> 1980s)



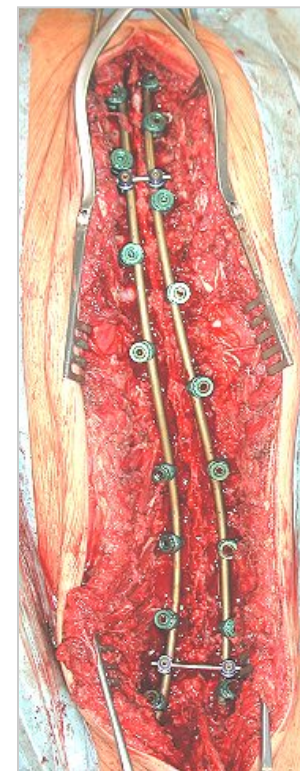
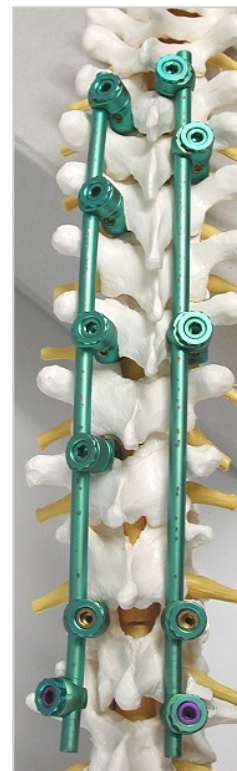
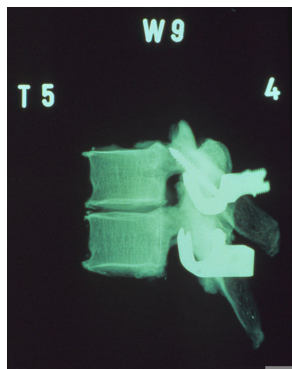
“en bloc” derotation
preservation lower lumbar motion segments

Adolescent idiopathic scoliosis (AIS)

Operative treatment

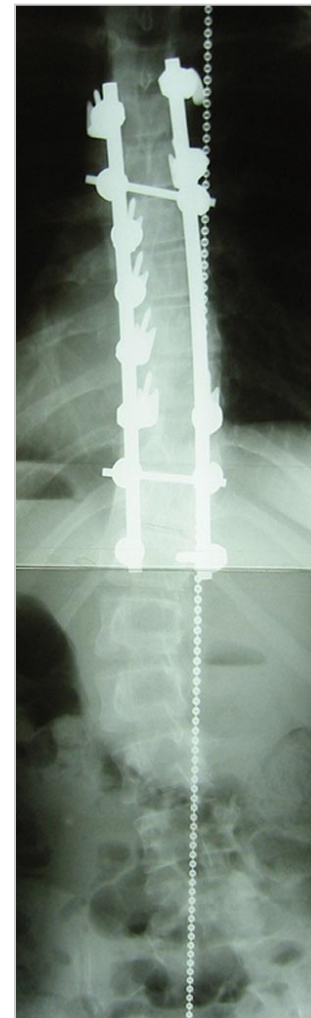
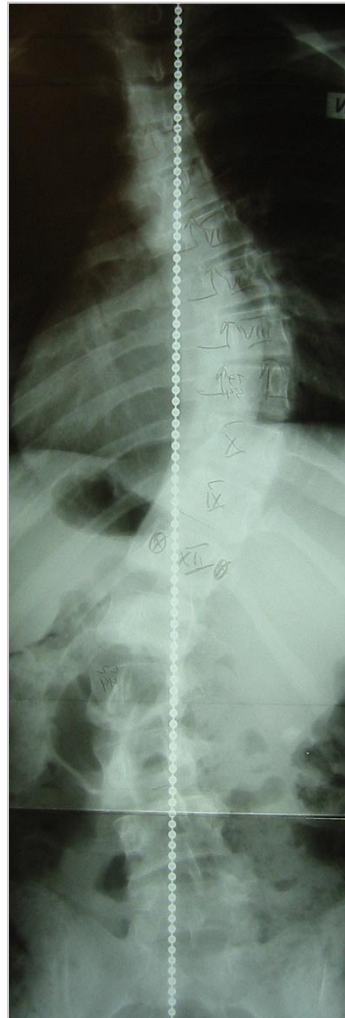
posterior approach:

- Cotrel Dubousset (> 1980s)
- TSRH, ISOLA, USS,



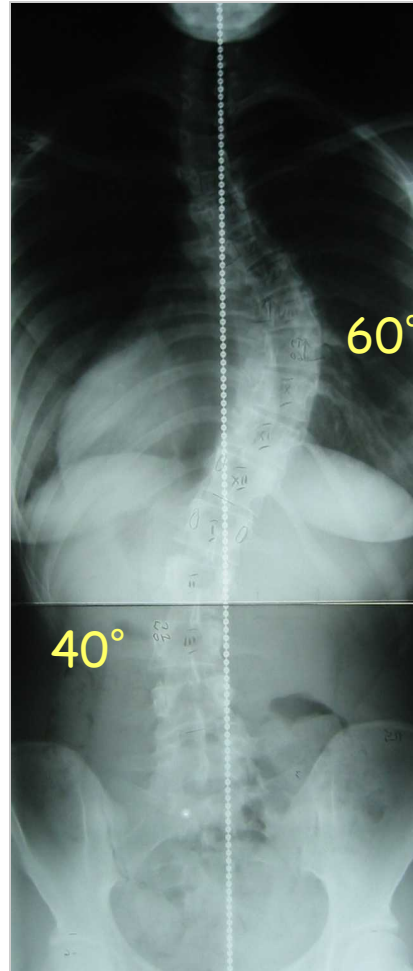
- problem:
- vertebral derotation is limited
 - “crankshaft phenomenon”
 - flat back

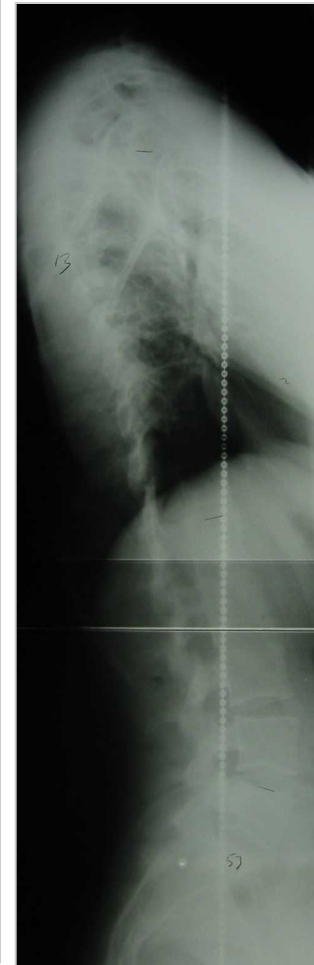
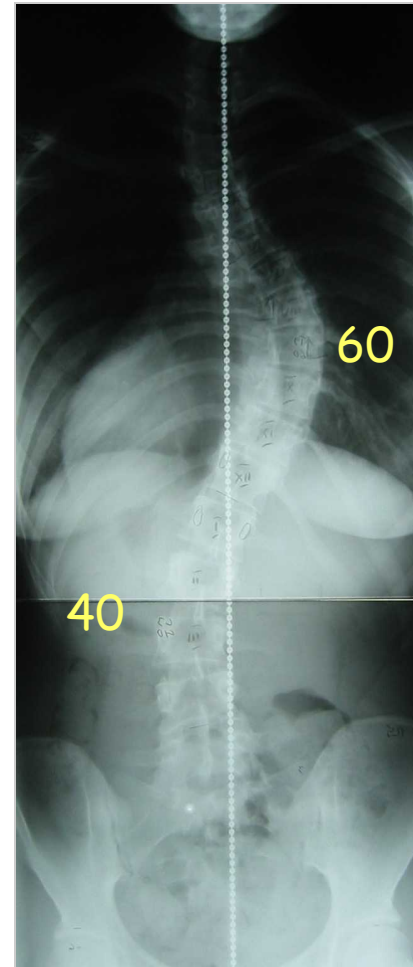
14y/fem; King 2





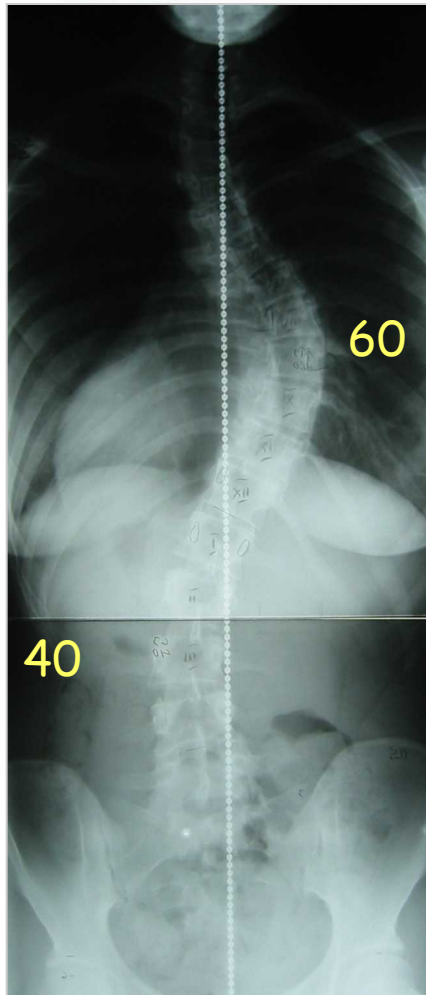
20y/female; King 3





20y/female; King 3

20y/female; King 3



20y/female; King 3

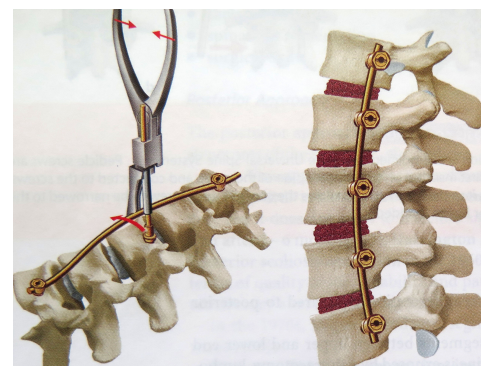
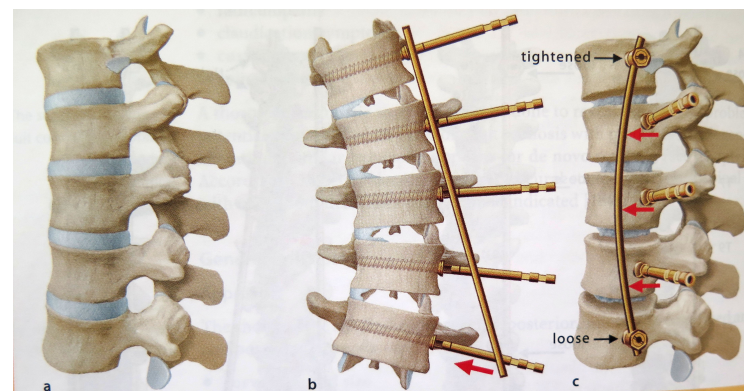
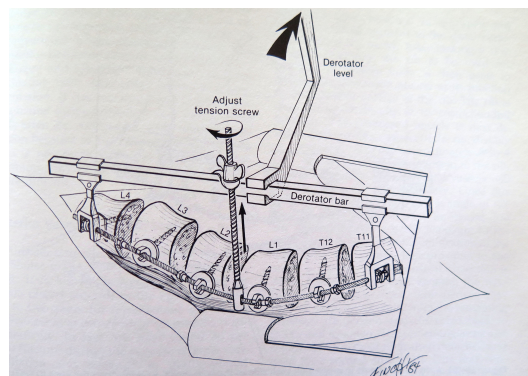


Adolescent idiopathic scoliosis (AIS)

Operative treatment

anterior approach:

- Dwyer (1969)
- Zielke (>1970s)



ant. derotation + IB fusion
more demanding surgery (thoracotomy/thoraco-lumbotomy)

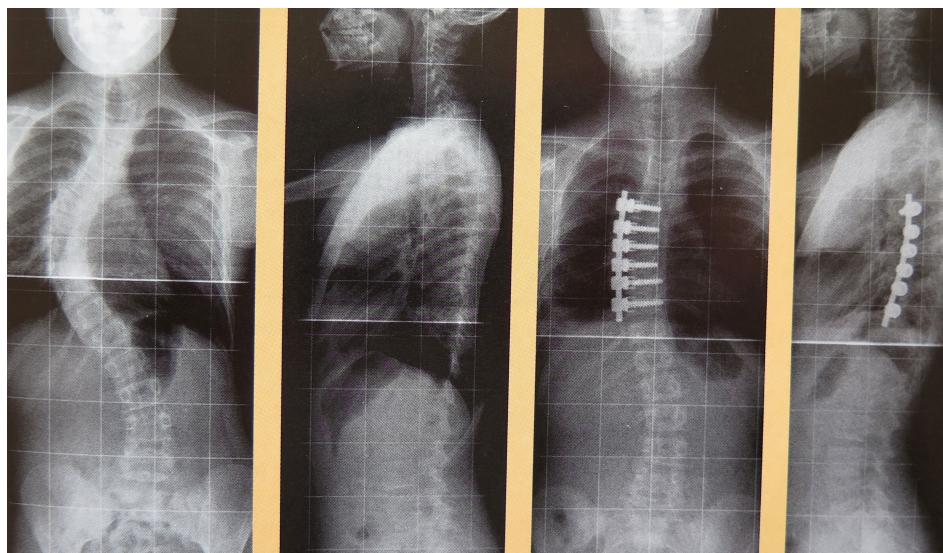
thoracoscopic procedures

Adolescent idiopathic scoliosis (AIS)

Operative treatment

anterior approach:

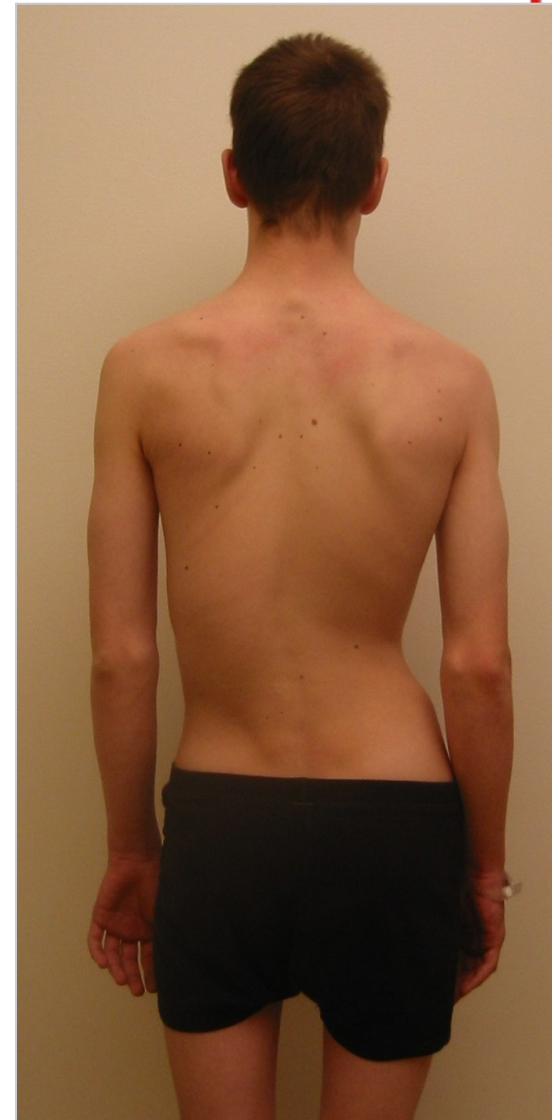
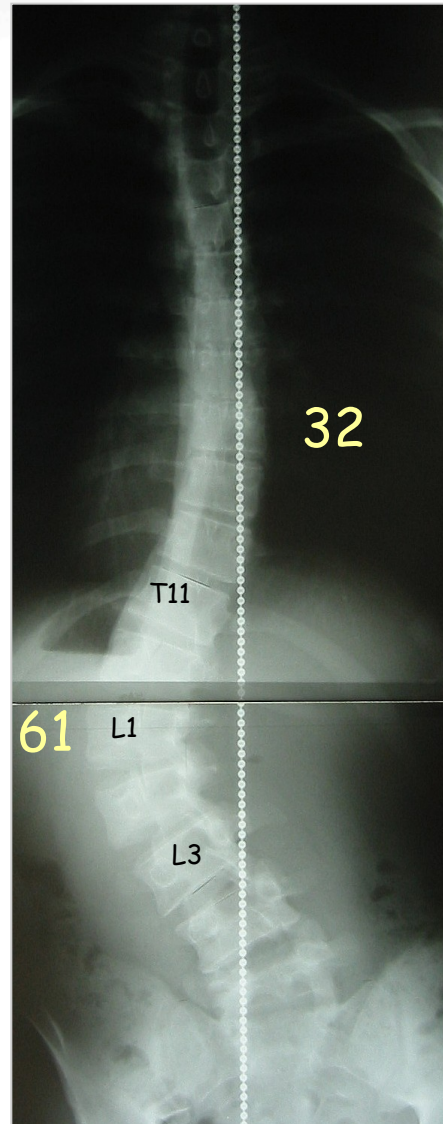
- Dwyer (1969)
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ant. derotation + IB fusion
more demanding surgery (thoracotomy/thoraco-lumbotomy)

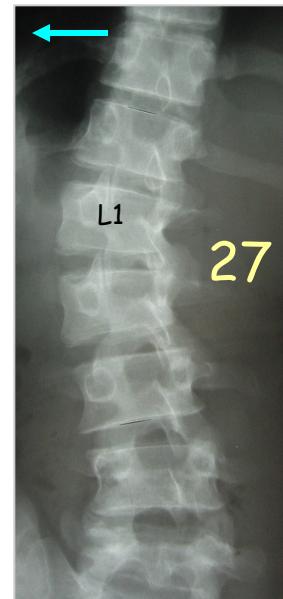
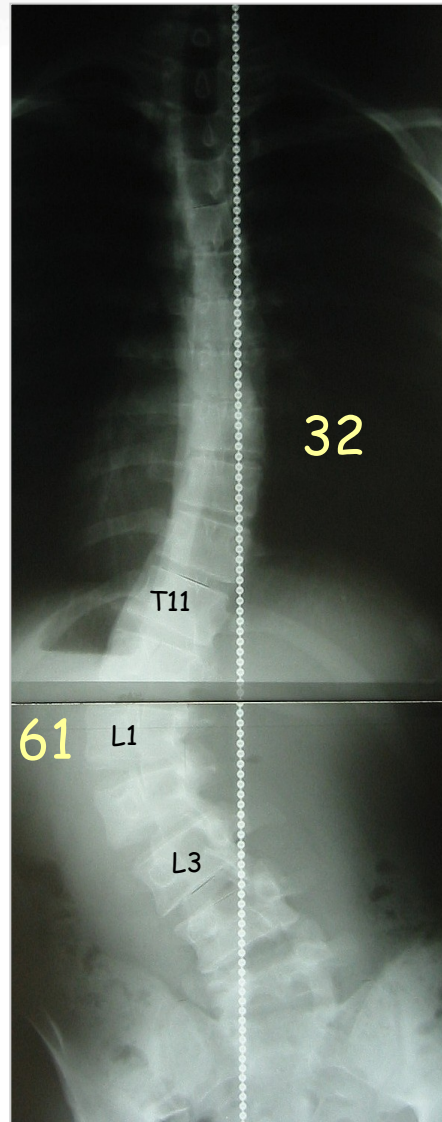
thoracoscopic procedures

17y/m, King 1

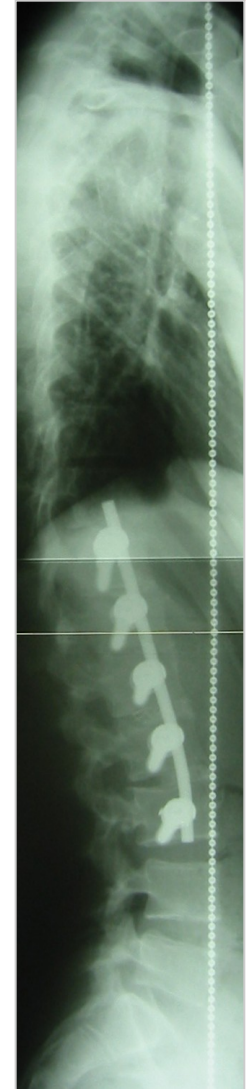
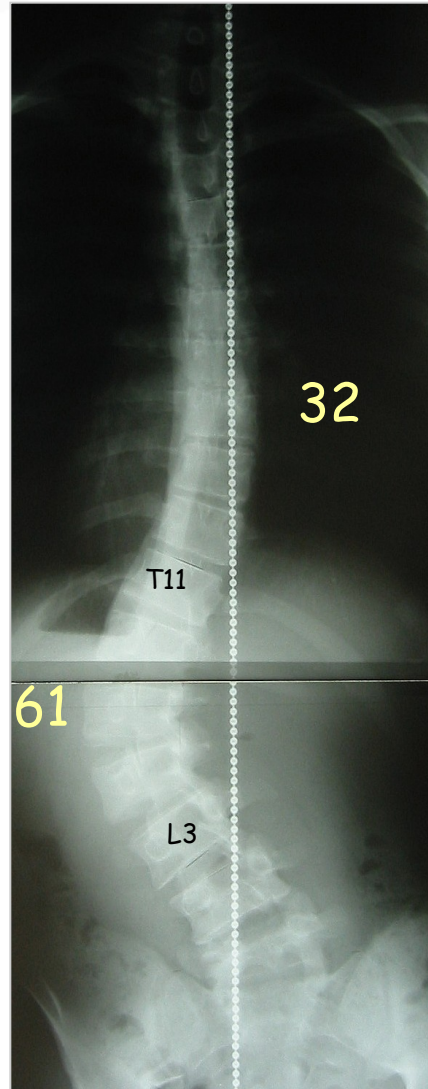


17y/m, King 1

MEDICOL 



17y/m; King 1



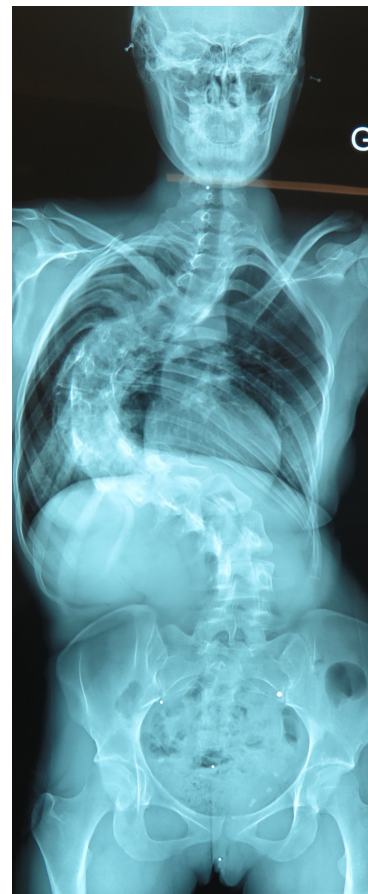
Adolescent idiopathic scoliosis (AIS)

Operative treatment

combined ant/post approach:

indication: - immature patients
- severe curvatures
- rigid curve

- open ant. release
- thoracoscopic

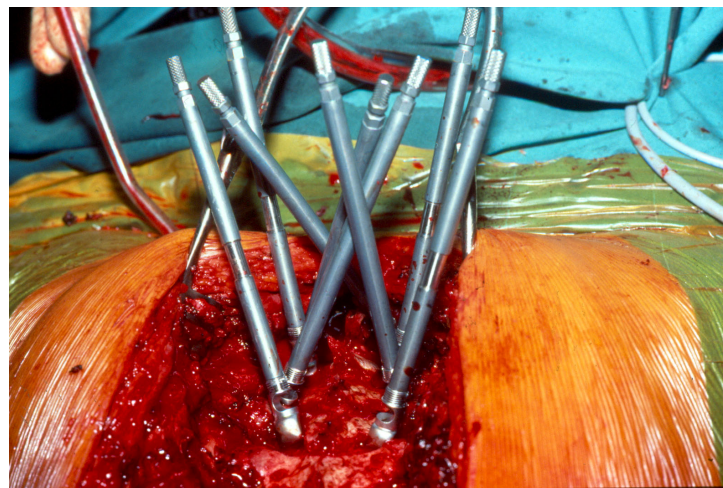
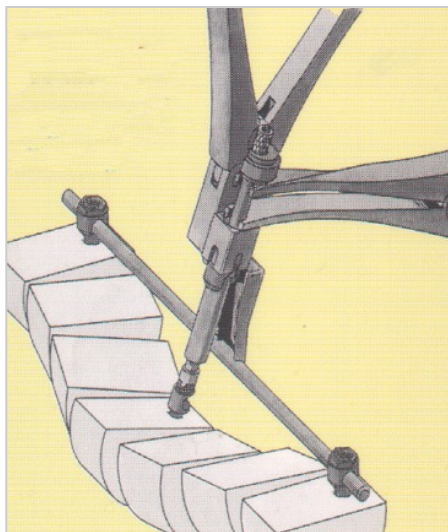
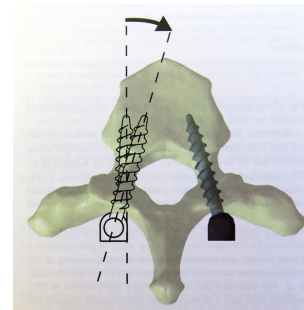


Adolescent idiopathic scoliosis (AIS)

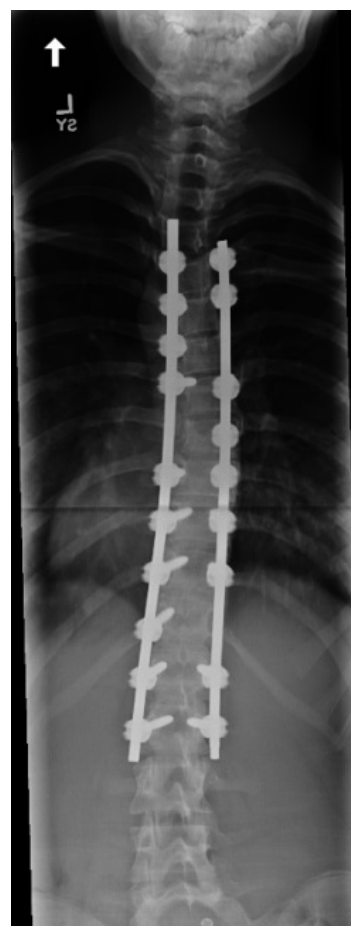
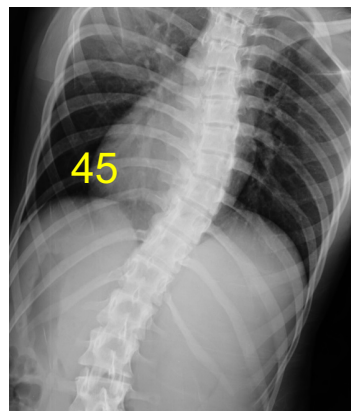
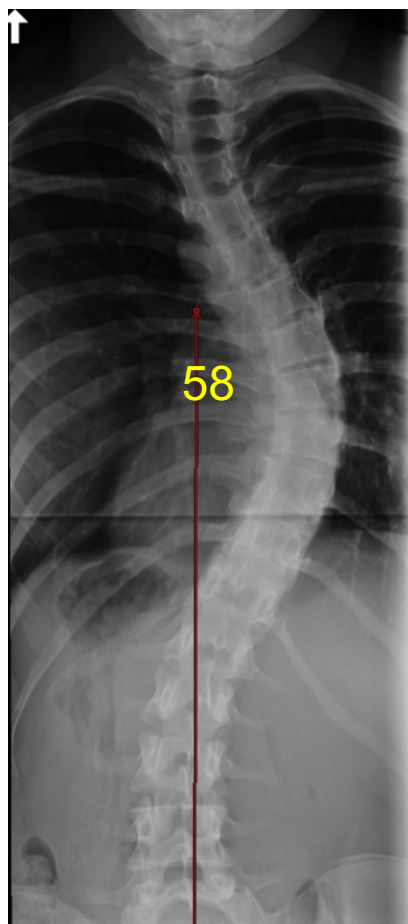
Operative treatment

posterior approach:

- multilevel pedicle screws (> 2000s)
- segmental vertebral derotation



Last generation instrumentation



Adolescent idiopathic scoliosis (AIS)

Operative treatment

thoracoplasty:



Spinal deformities

surgical strategies

- low / high density instrumentation
- correction manoeuvres
- instrumentation extension
- sacro-pelvic fixation
- osteotomies

