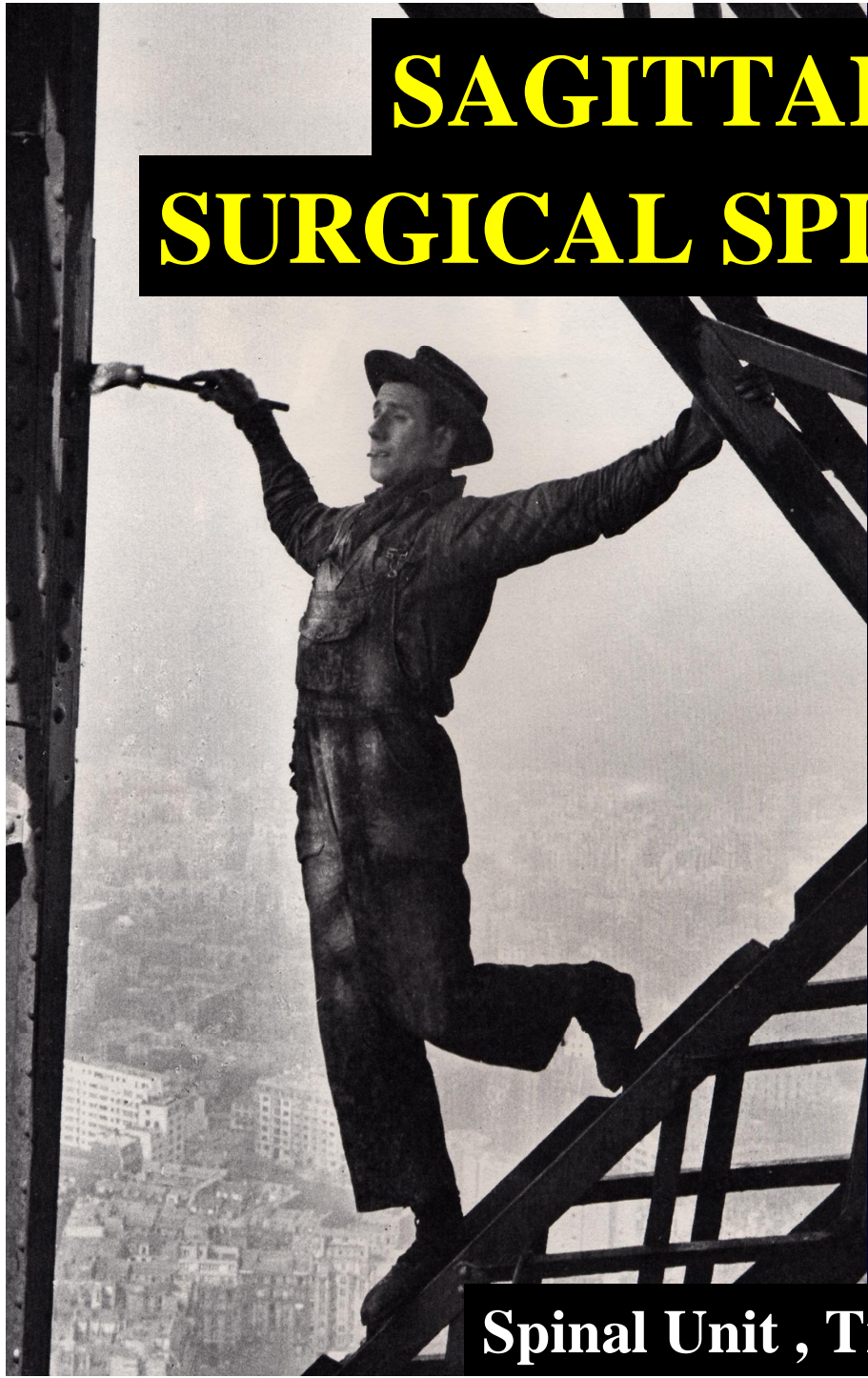


SAGITTAL BALANCE & SURGICAL SPINAL DISORDERS



J. M. VITAL

Spinal Unit , Tripode , Bordeaux , FRANCE



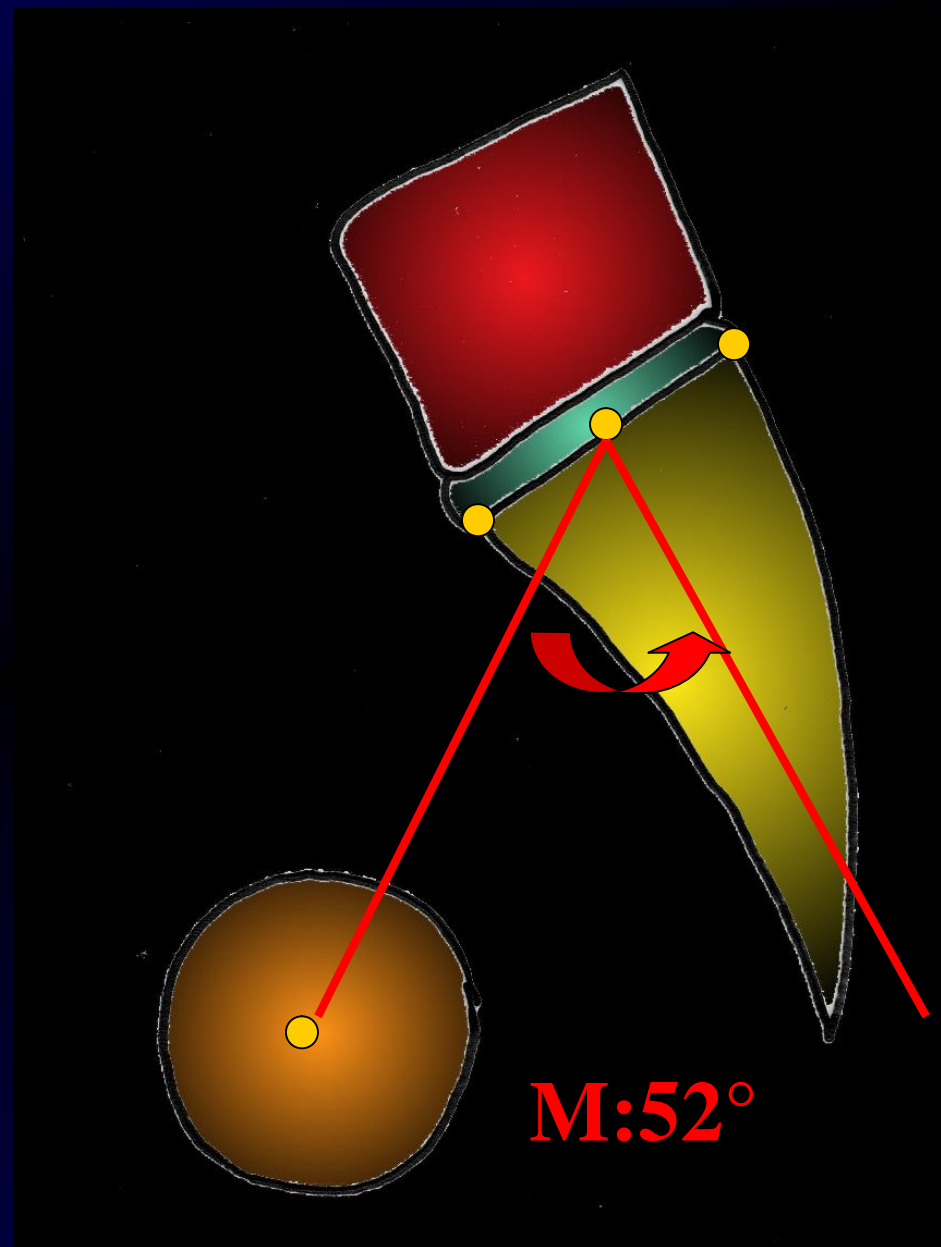
LUMBAR SPINE

QuickTime et un
décodeur de vidéo
sont requis pour visionner cette image.

« PELVIC
VERTEBRA »

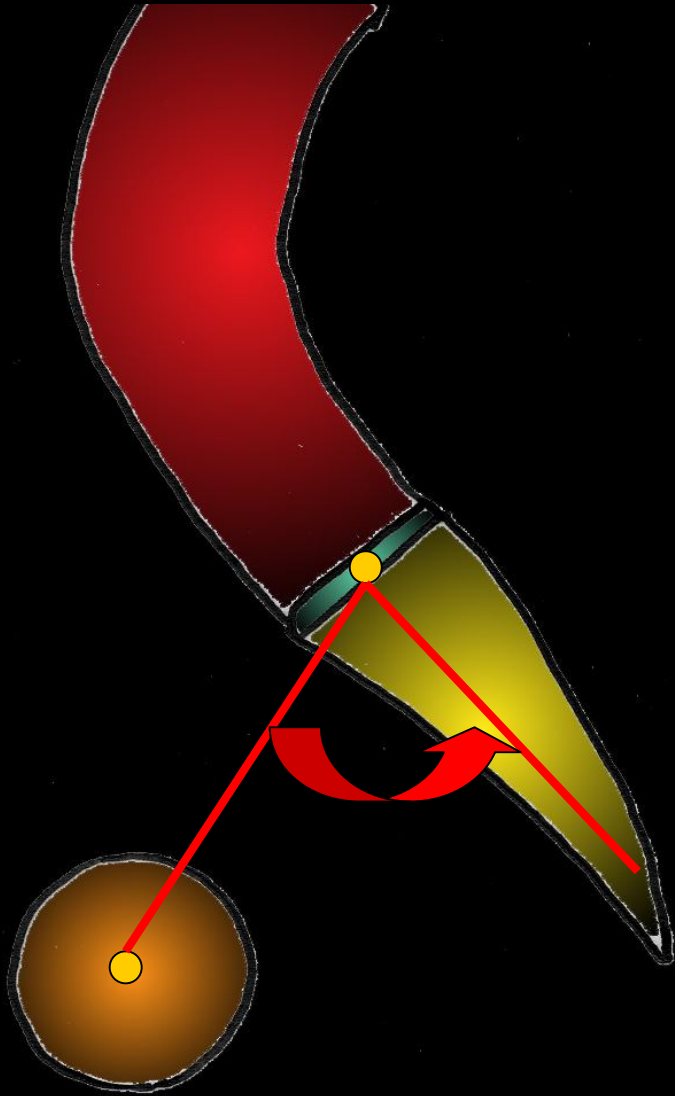
DURING

PELVIC INCIDENCE

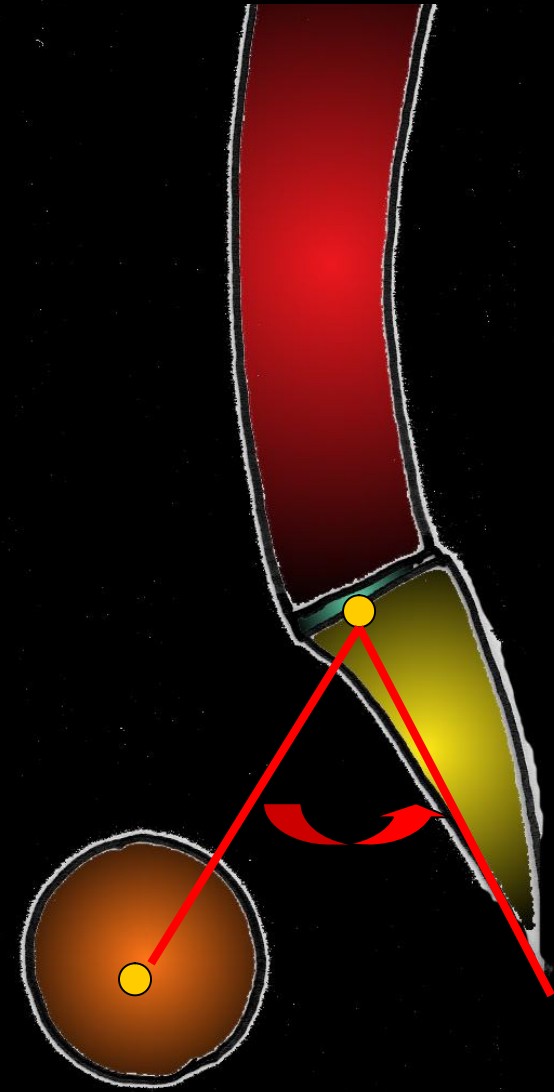


DUVAL-BEAUPERE

DYNAMIC



STATIC



PELVIC VERSION

Mean : 12°

QuickTime™ et un
décompresseur Vidéo
sont requis pour visionner cette image.

SAGITTAL LIST

IN T9

Mean : 11°

QuickTime™ et un
décompresseur Vidéo
sont requis pour visionner cette image.

FEMORO TIBIAL ANGLE

Normal: 0°



C7 PLUMBLINE



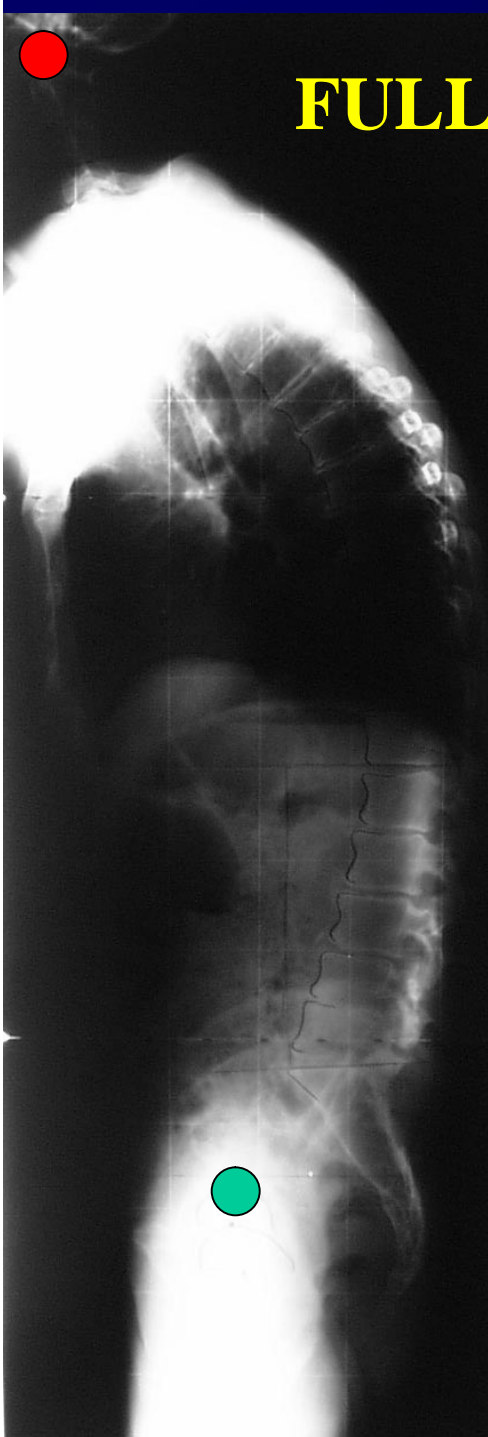
« CRANIAL VERTEBRA »

EAC-FH DISTANCE



3 SAGITTAL POSITIONS



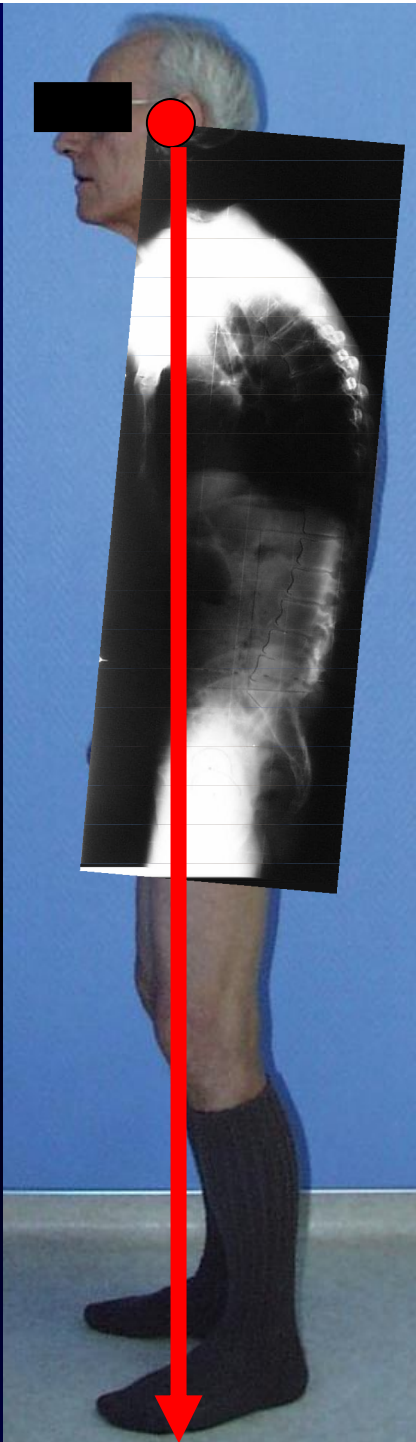


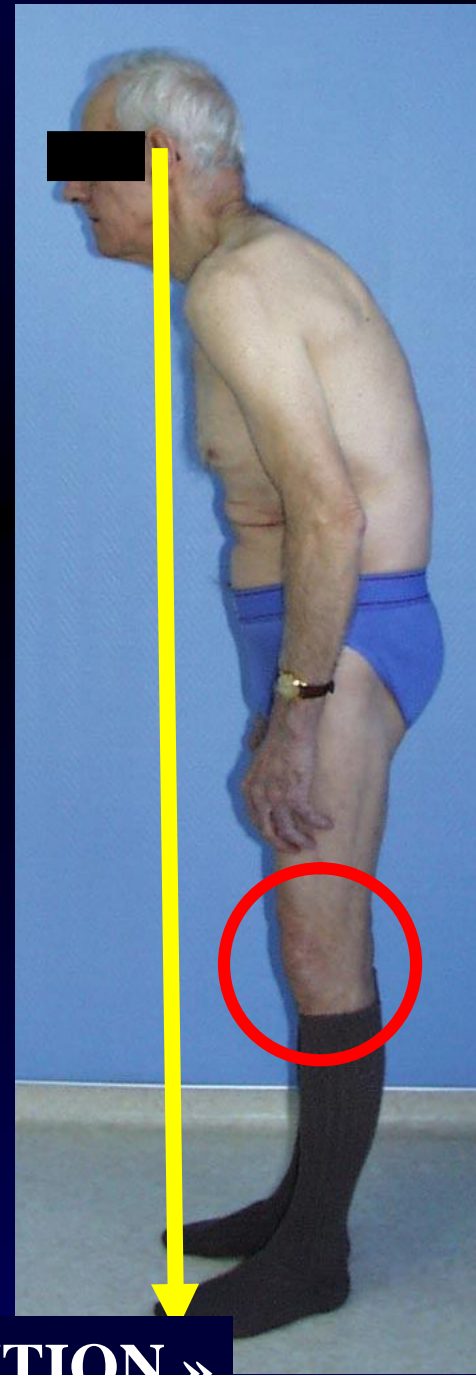
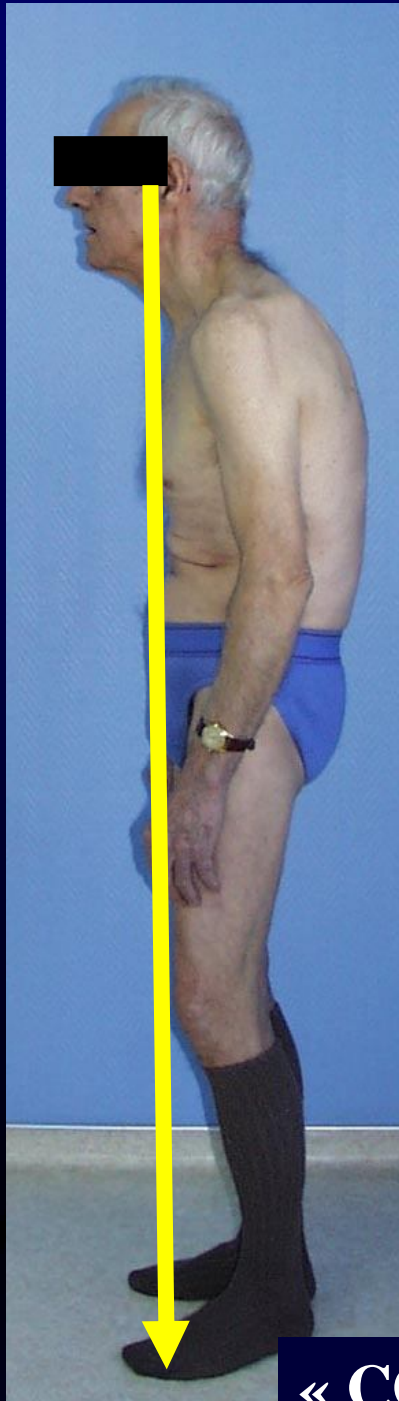
FULL SPINE

« NATURAL POSITION »

FULL LIMBS



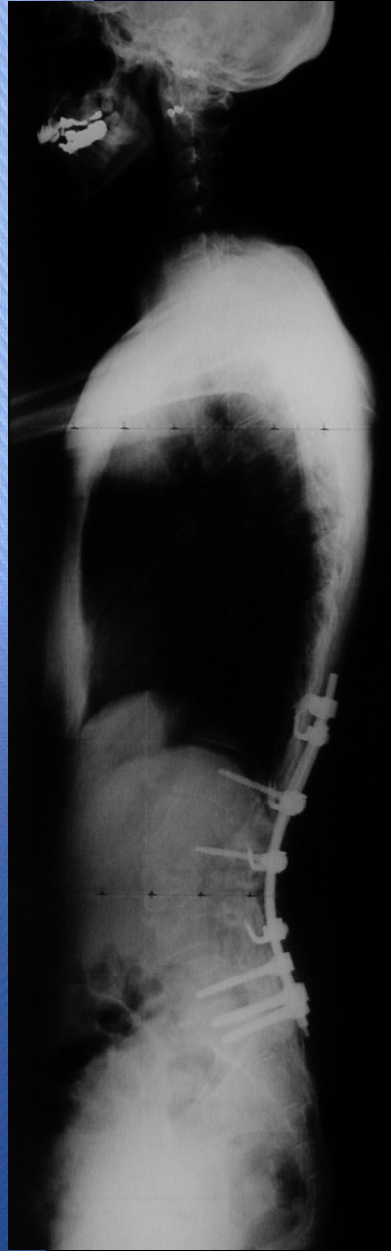




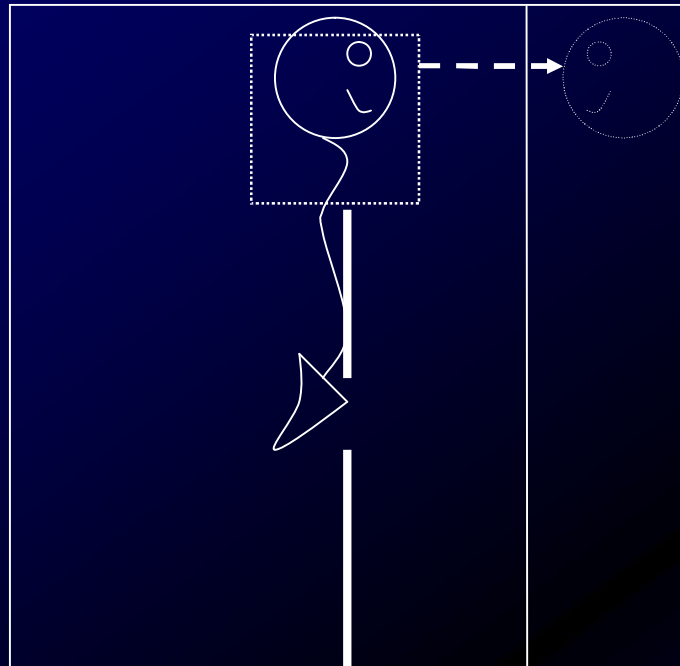
« CORRECTED POSITION »



PREOP



POSTOP



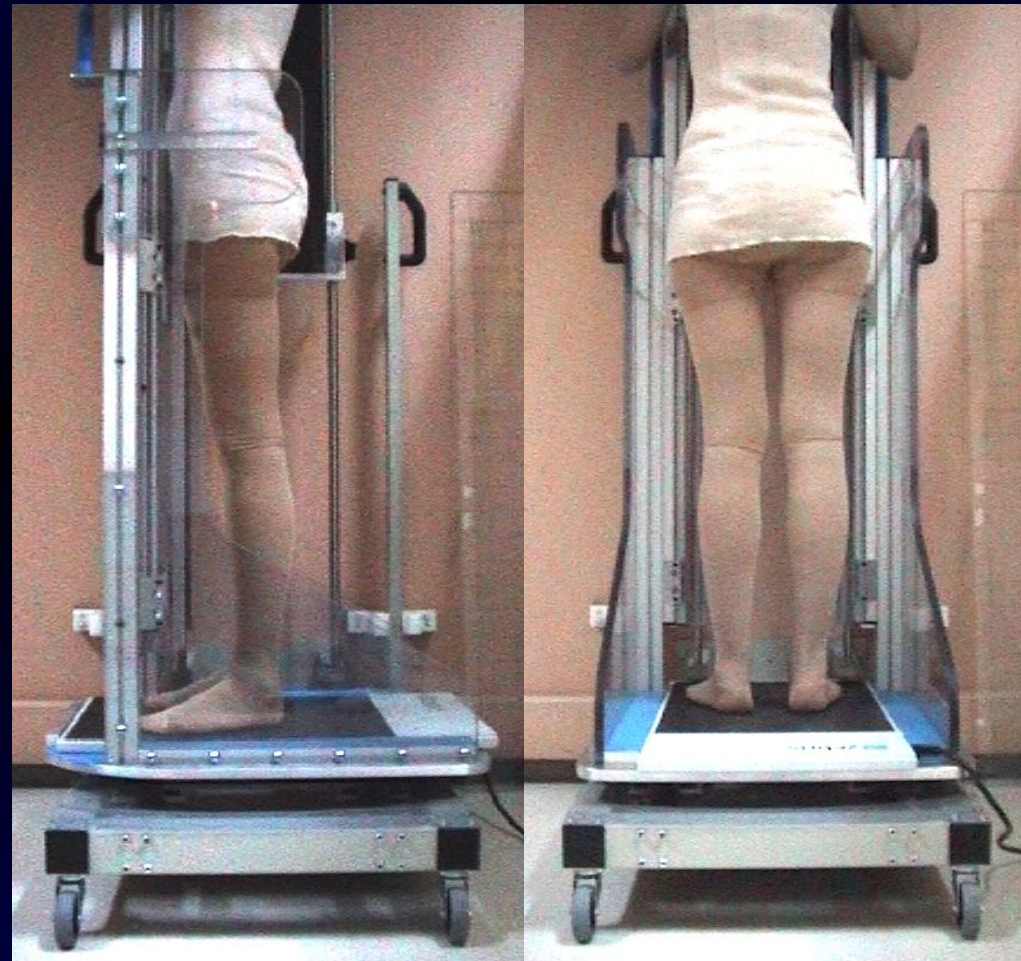
Peng L, Cooke MS. Fifteen-year reproducibility of natural head posture: A longitudinal study. Am J Orthod Dentofacial Orthop 1999;116:82-5.

Solow B, Tallgren A. Natural head position in standing subjects. Acta Odontol Scand 1971;29:591-607.

STEREORADIOGRAPHY



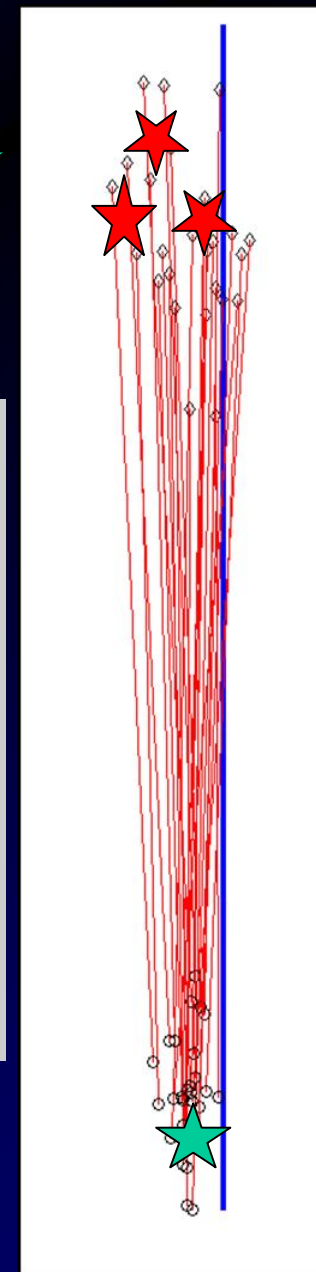
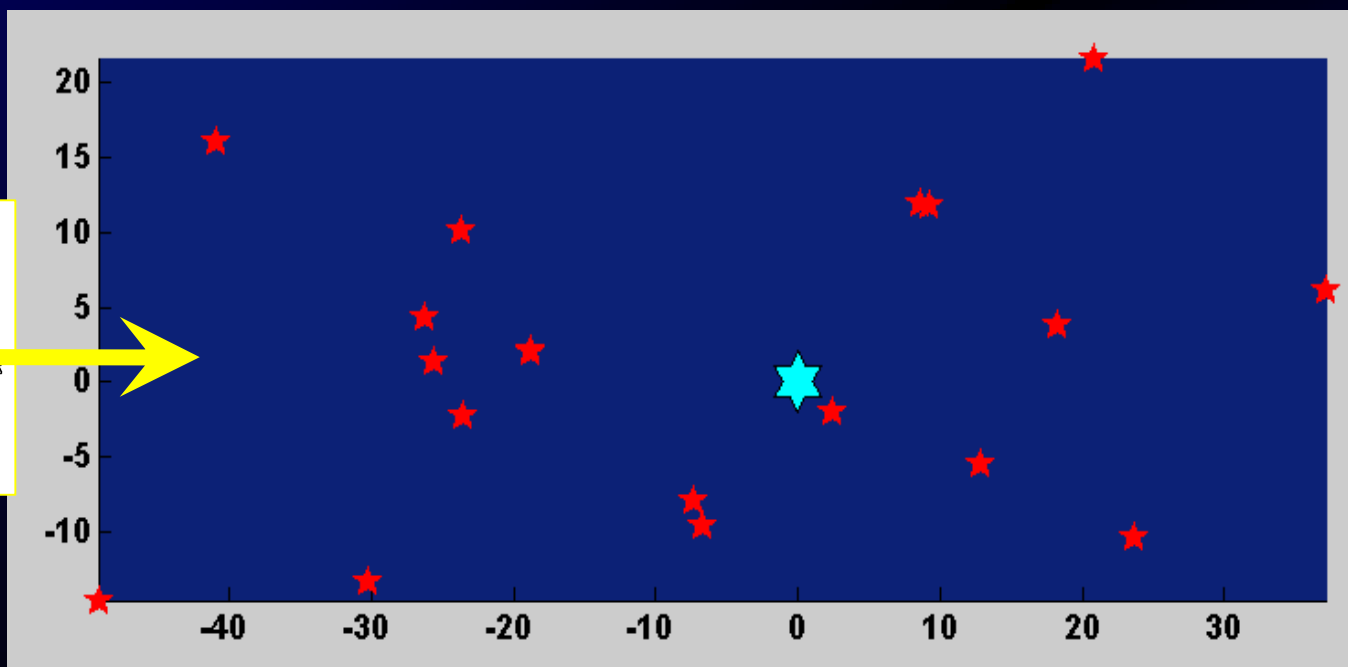
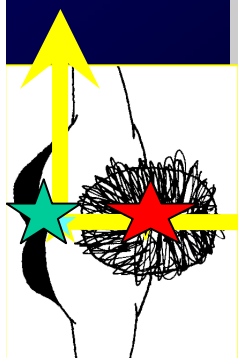
Gravity platform



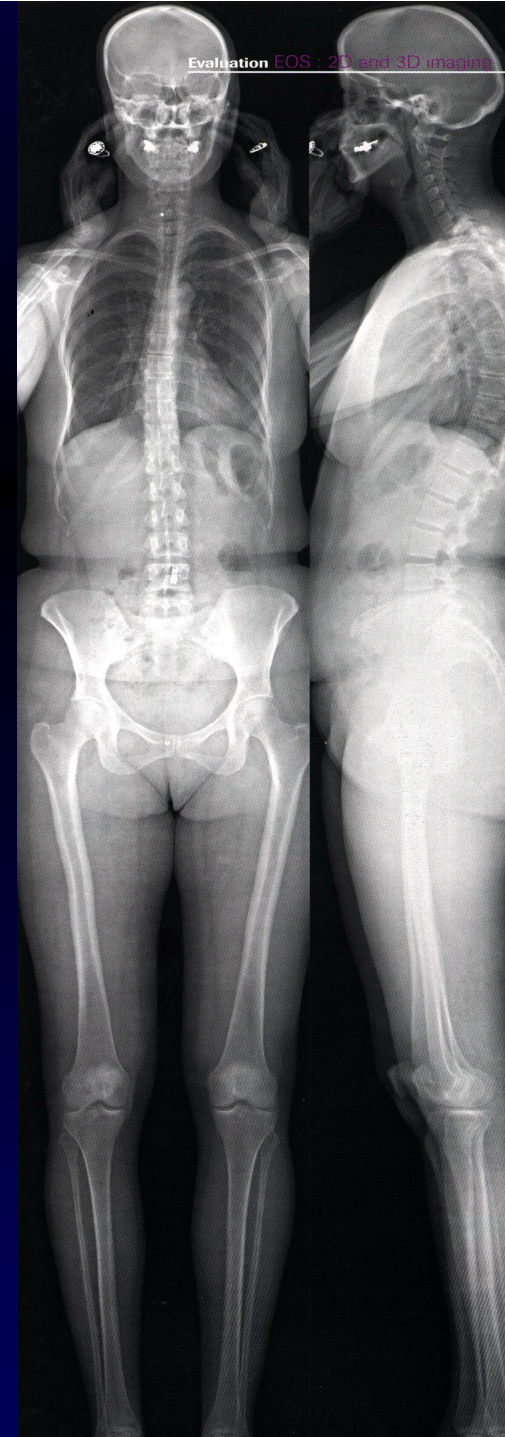
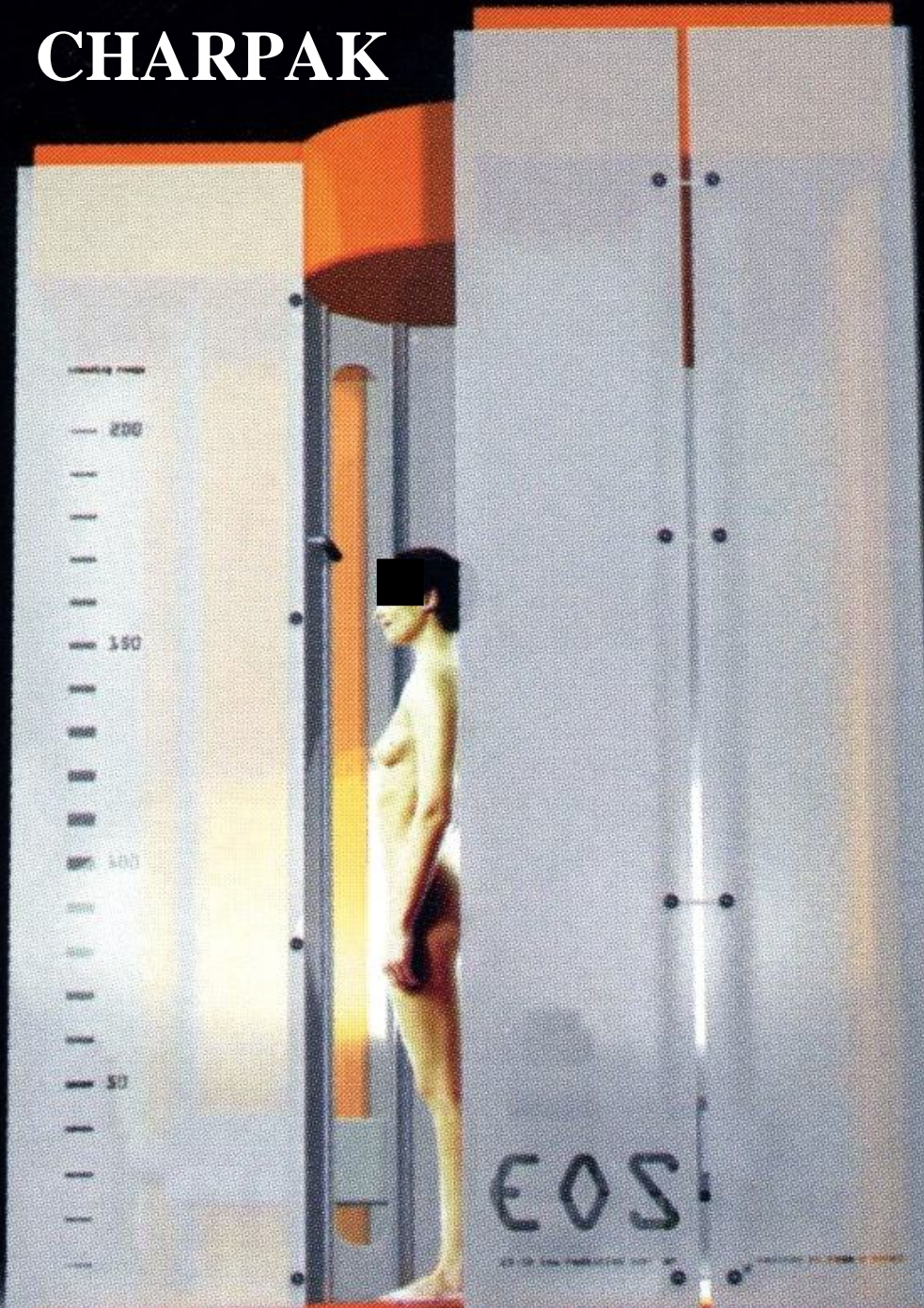
External Auditive Duct projection



Femoral Head centers



CHARPAK





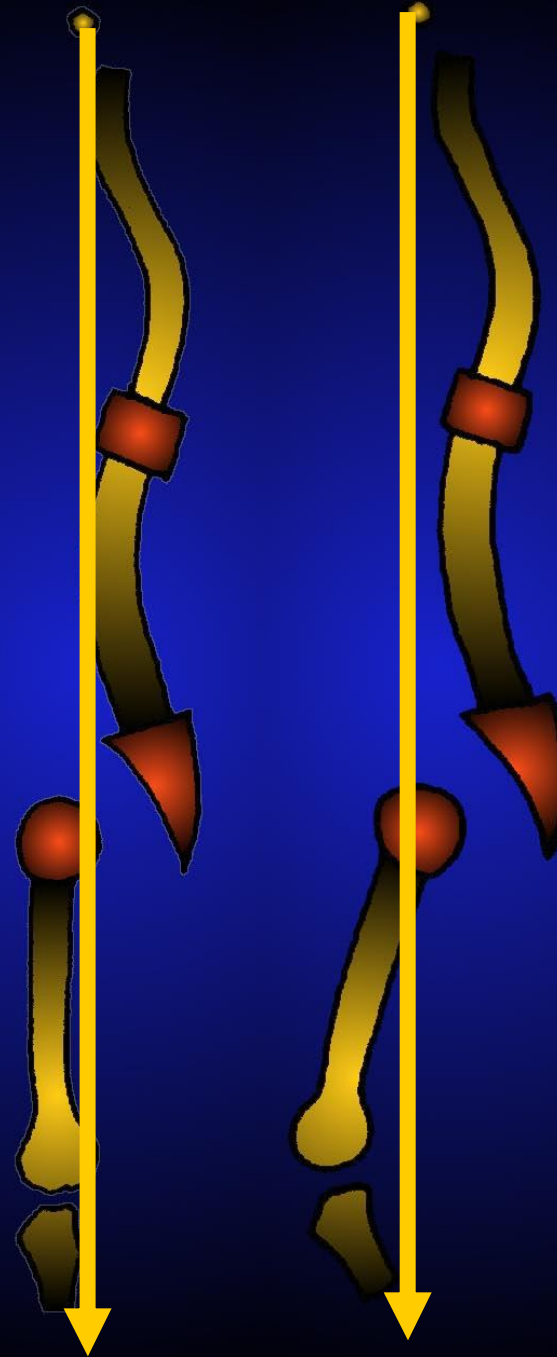
IDEAL OR ECONOMIC BALANCE

COMPENSATED BALANCE

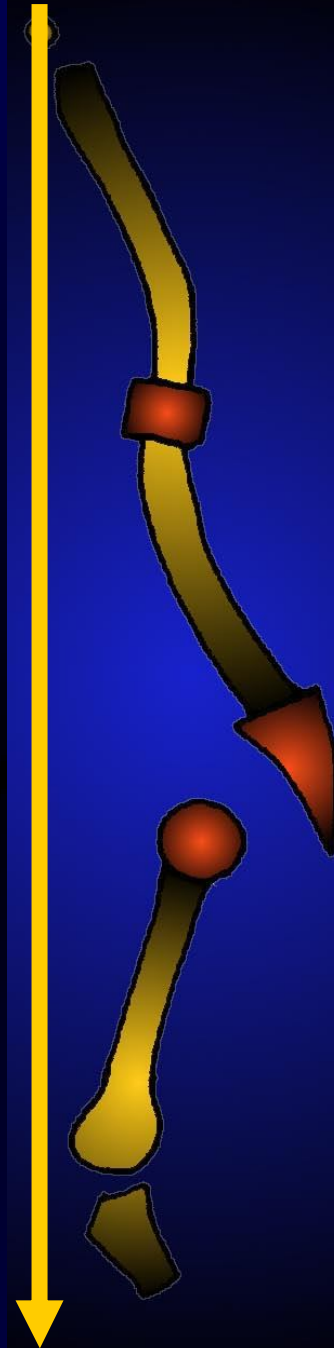
by

Pelvic Retroversion

+Knees Flexion



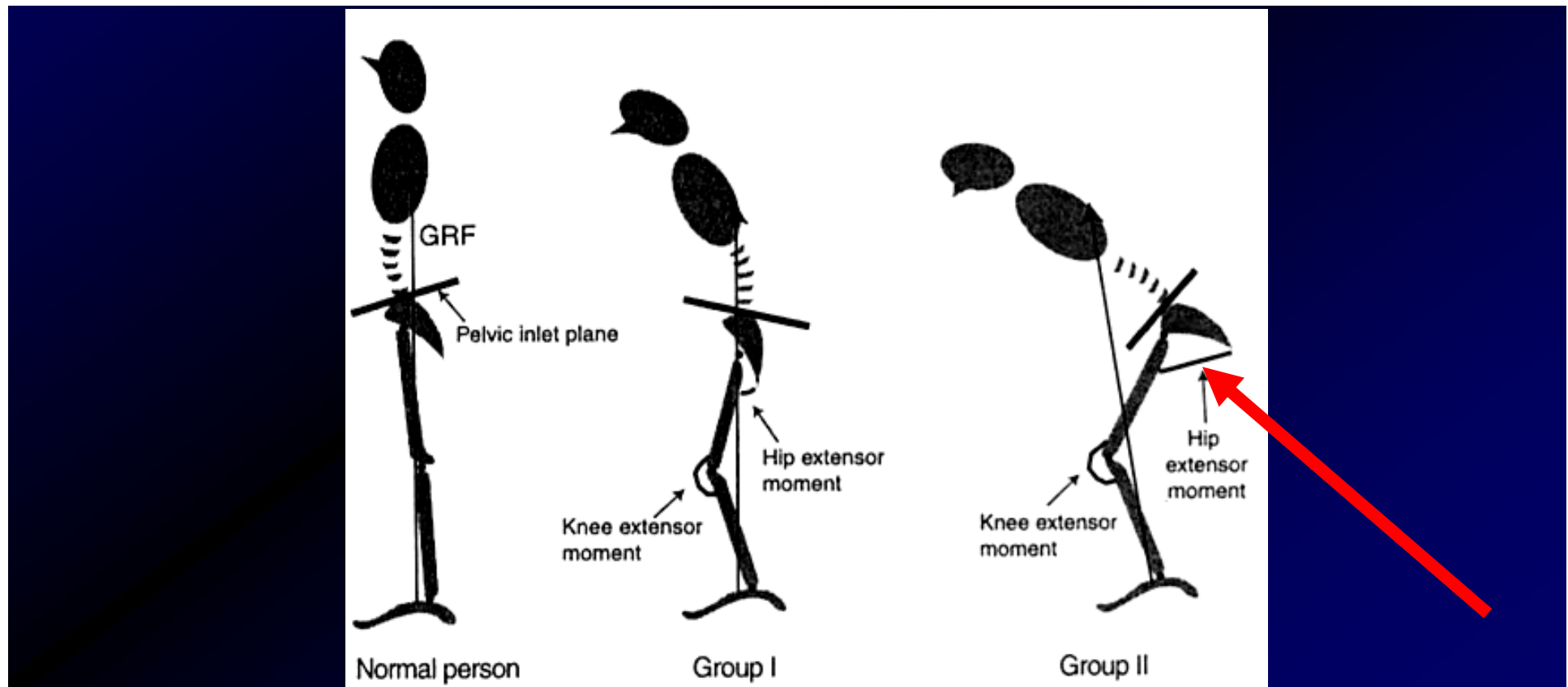
ANTERIOR IMBALANCE

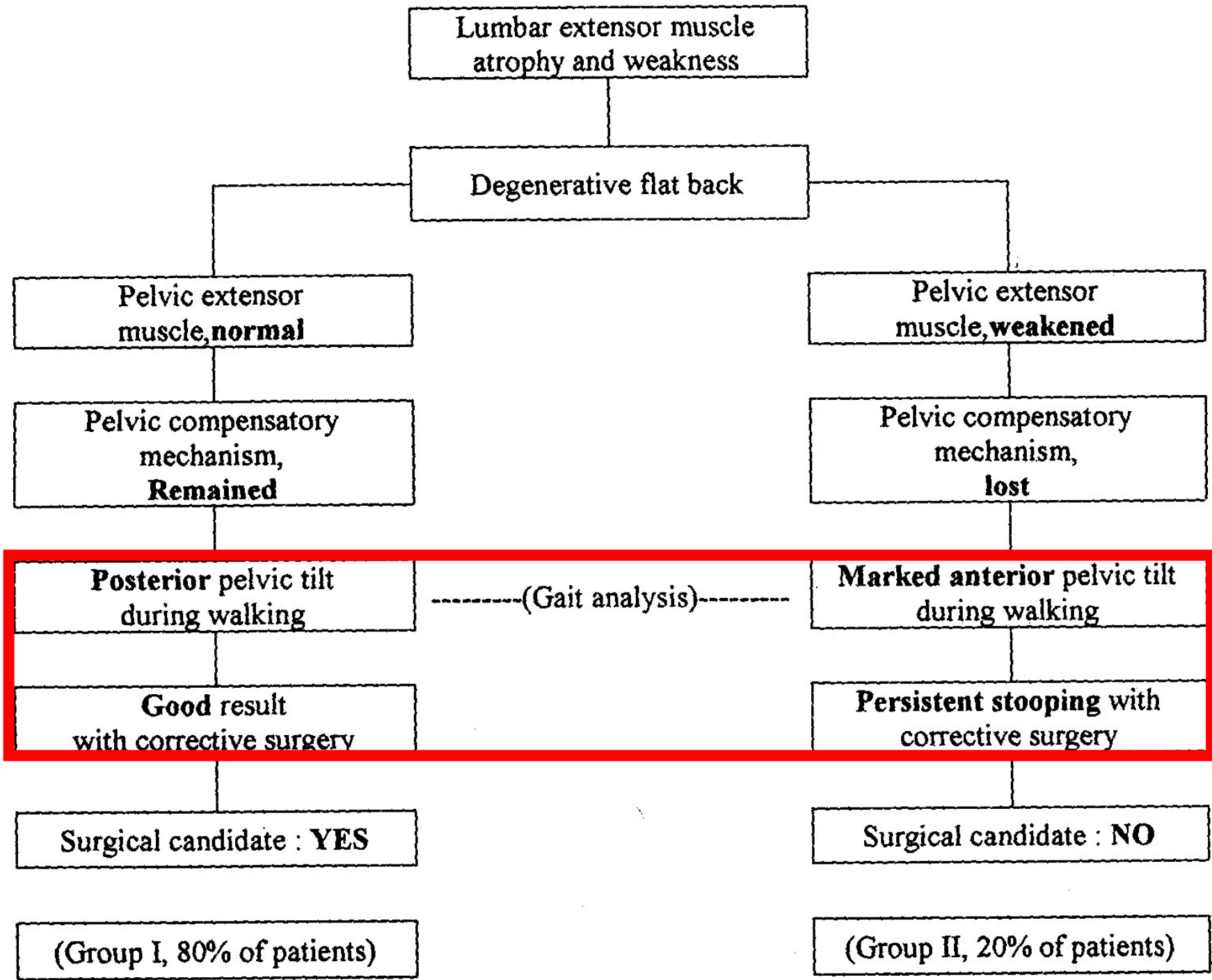


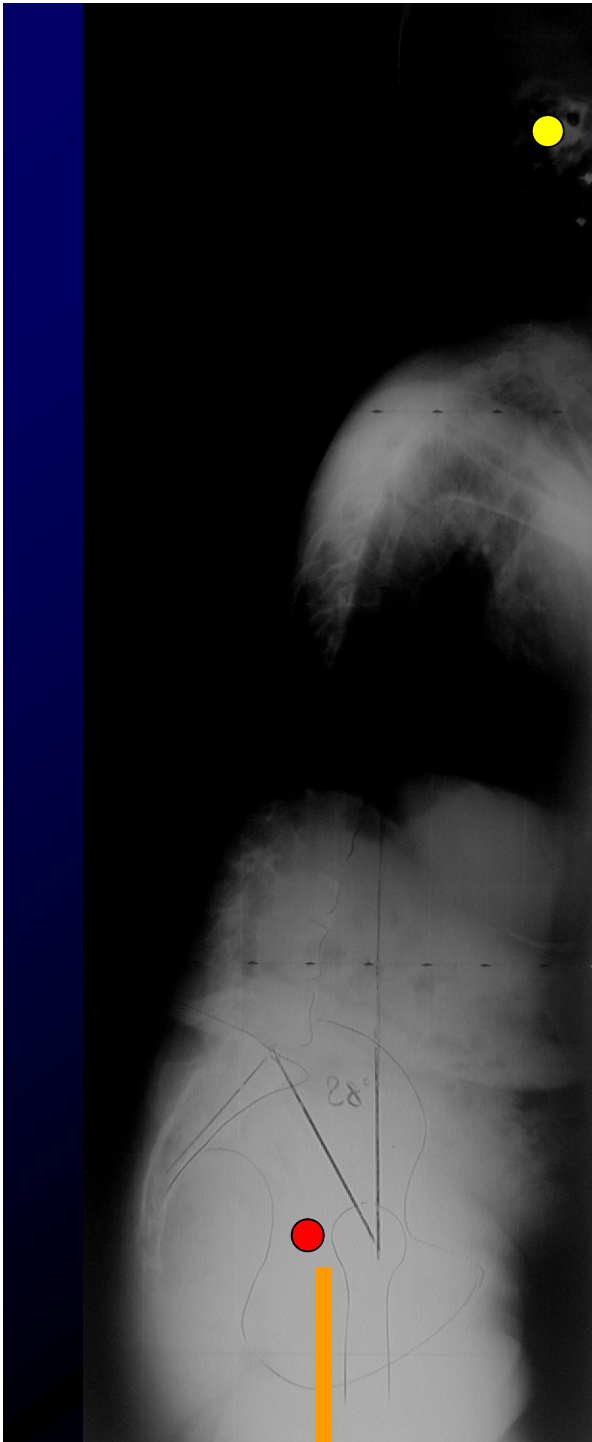
Dynamic Sagittal Imbalance of the Spine in Degenerative Flat Back

Significance of Pelvic Tilt in Surgical Treatment

Choon-Sung Lee, MD,* Choon-Ki Lee, MD,† Yung-Tae Kim, MD,* Young-Mi Hong, MD,‡ and Jeong-Hyun Yoo, MD*







2. SPINAL DISORDERS

DEGENERATIVE KYPHOSIS

SPONDYLOLISTHESIS

**OSTEOTOMIES in
P.O. FLAT BACK**



2.1.DEGENERATIVE KYPHOSIS



25 CASES





P.I.:56°

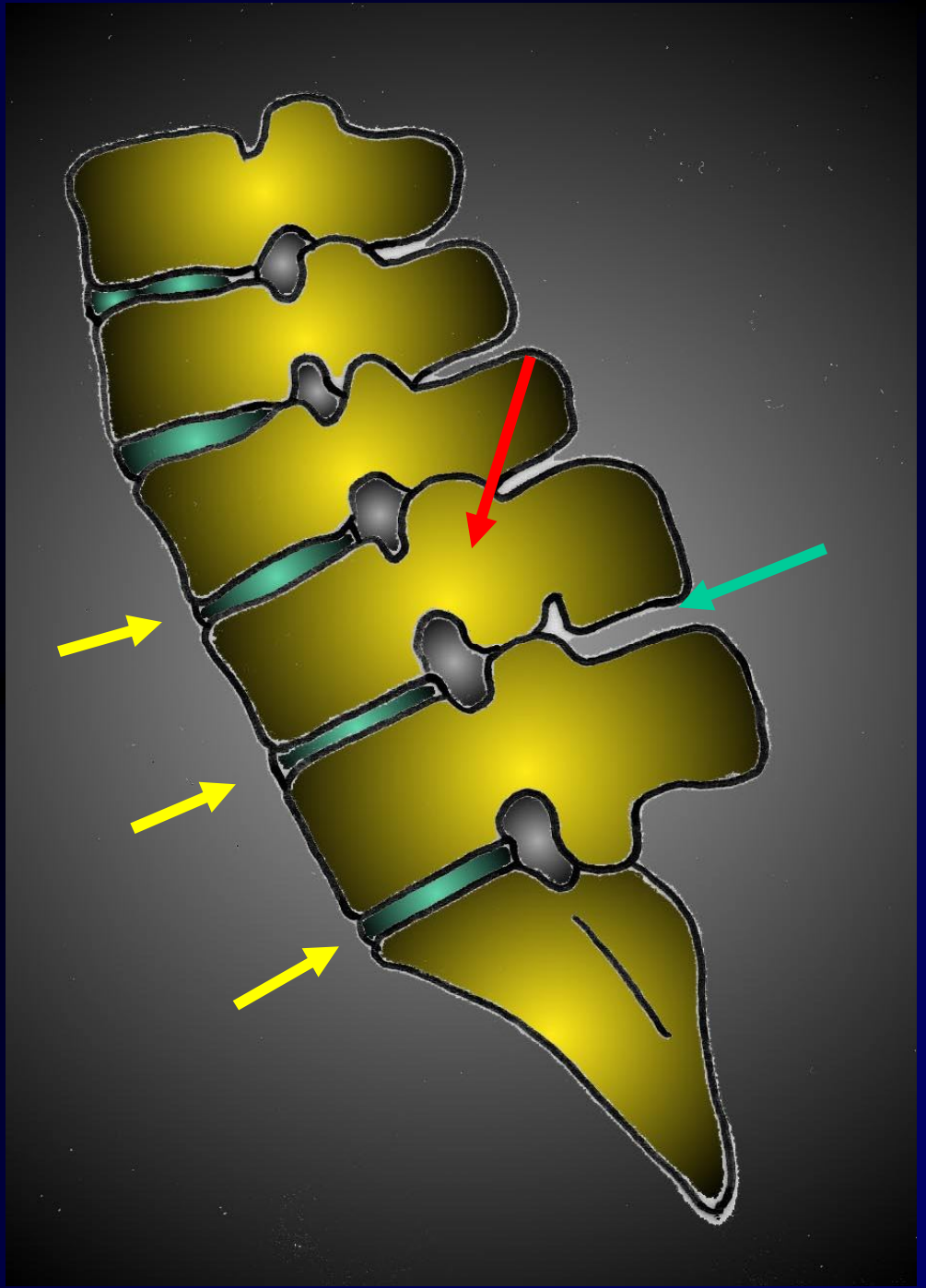
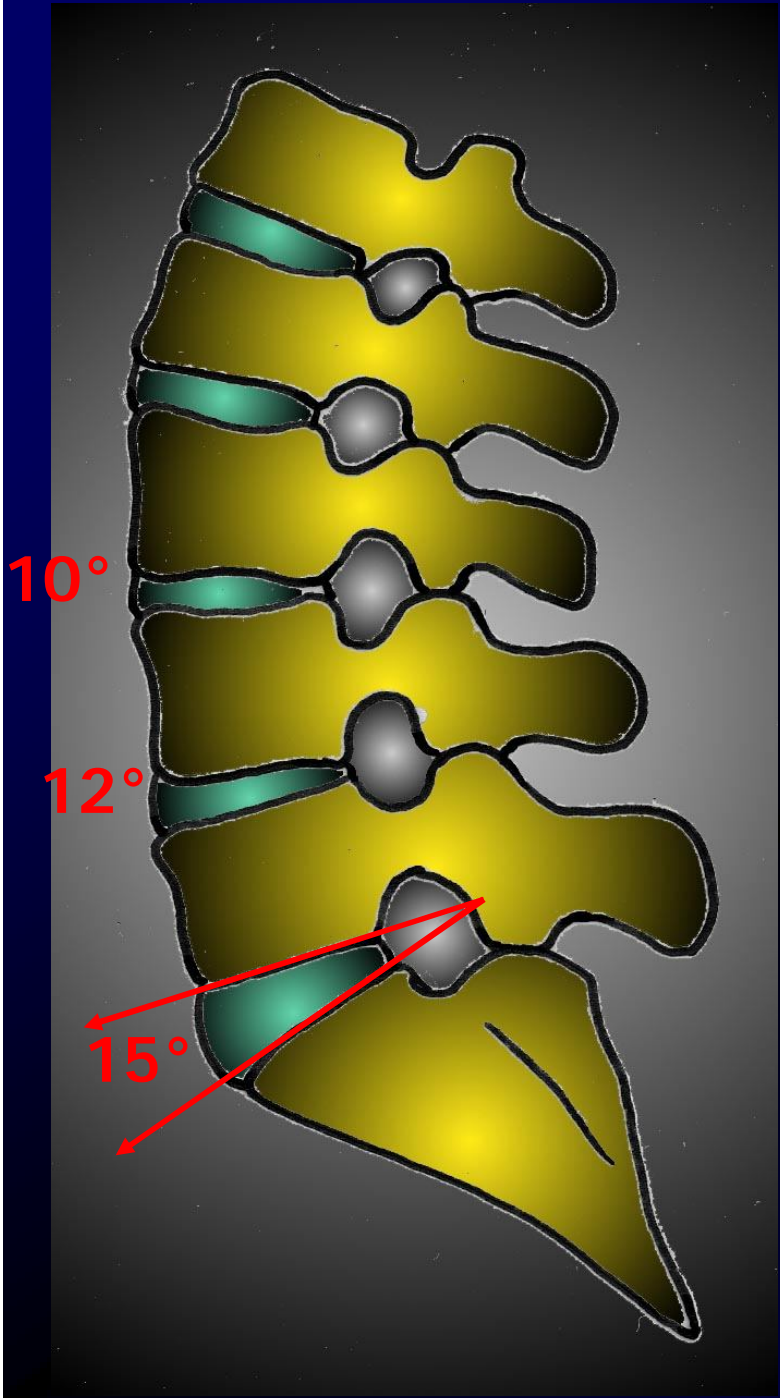
P.V.:29°

T.K.:38°

L.L. :36°





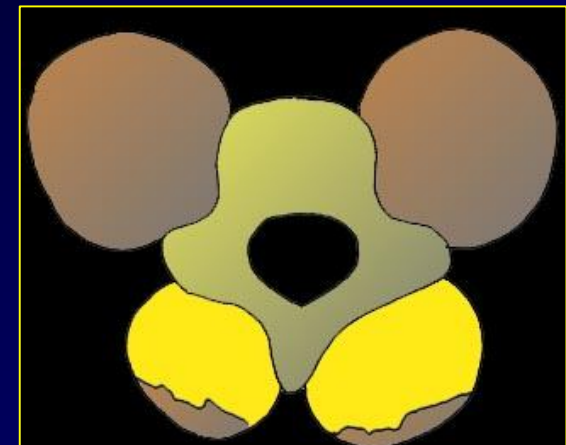
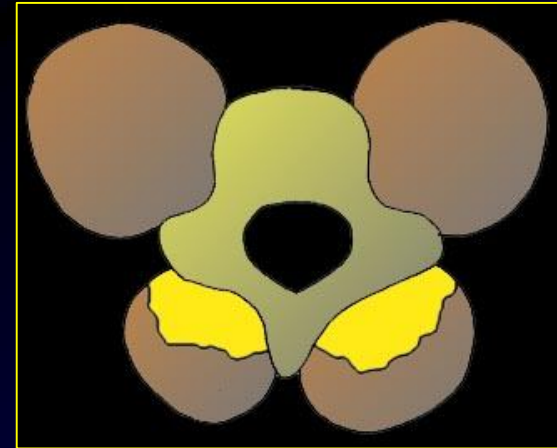
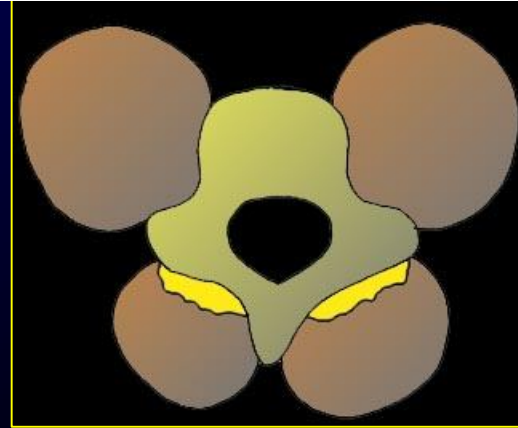


PROFESSIONNAL FACTORS:12/25

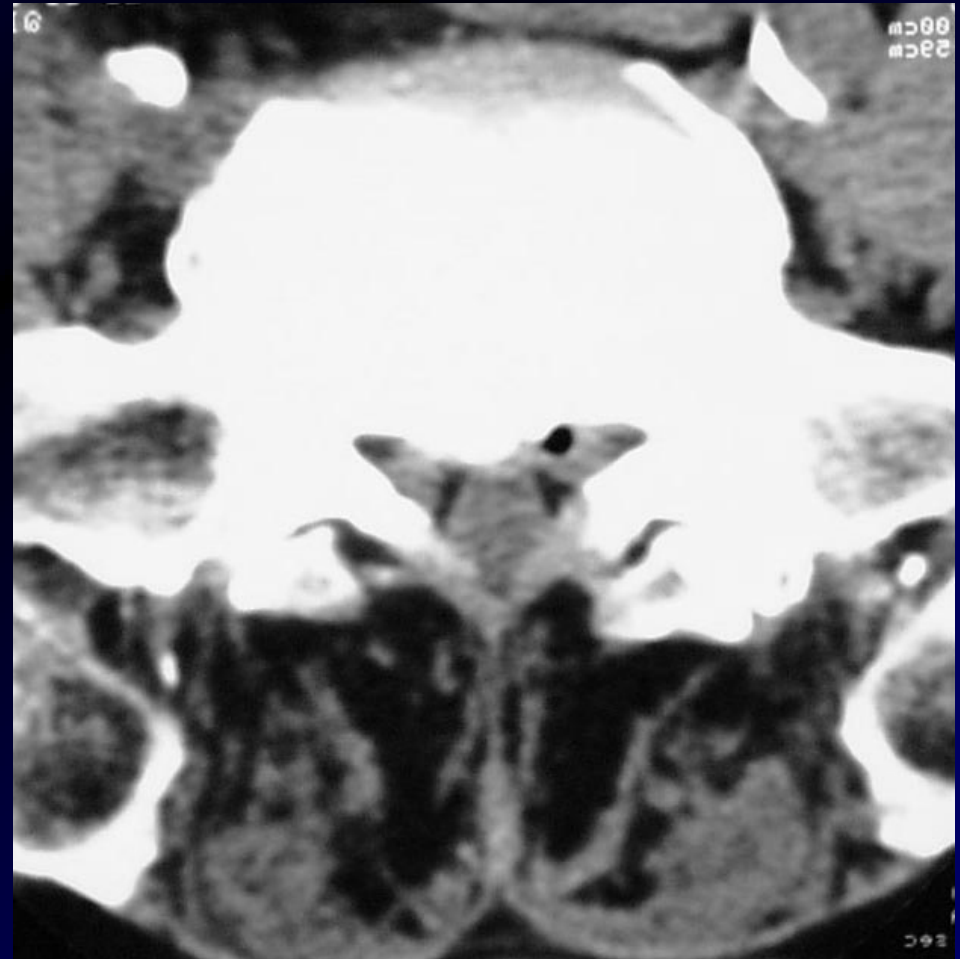


TAKEMITSU, 1988

FAT DEGENERATION

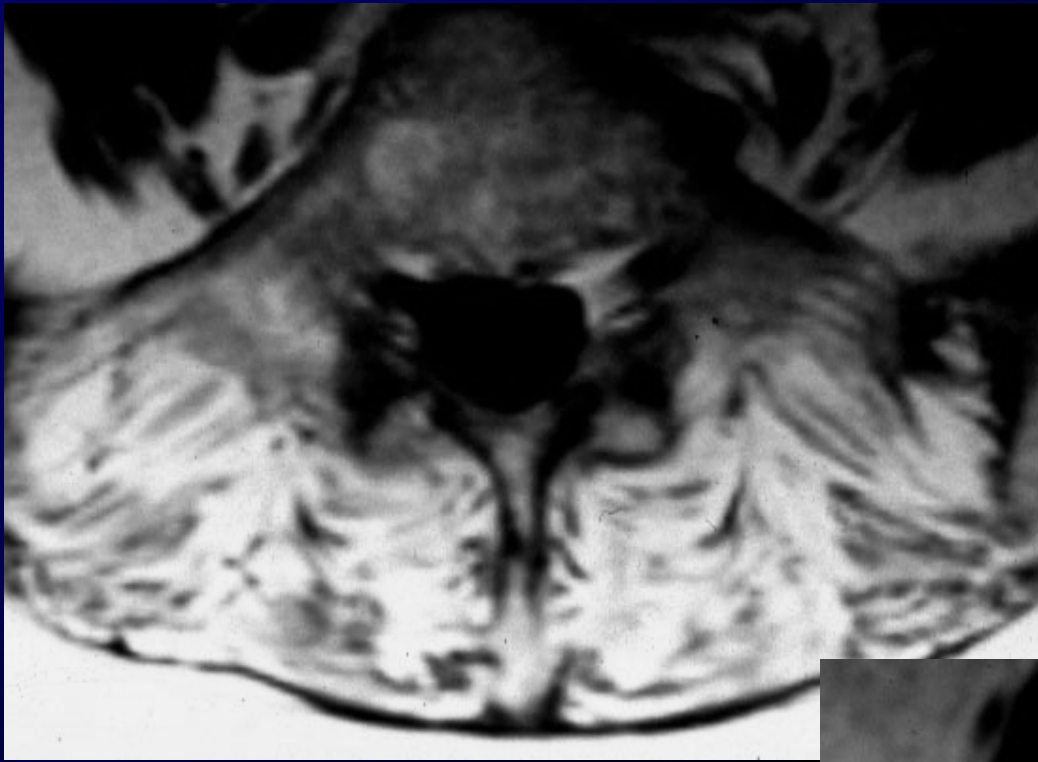


HADAR (1989) □



HADAR 2

HADAR 3



THORACOLUMBAR A

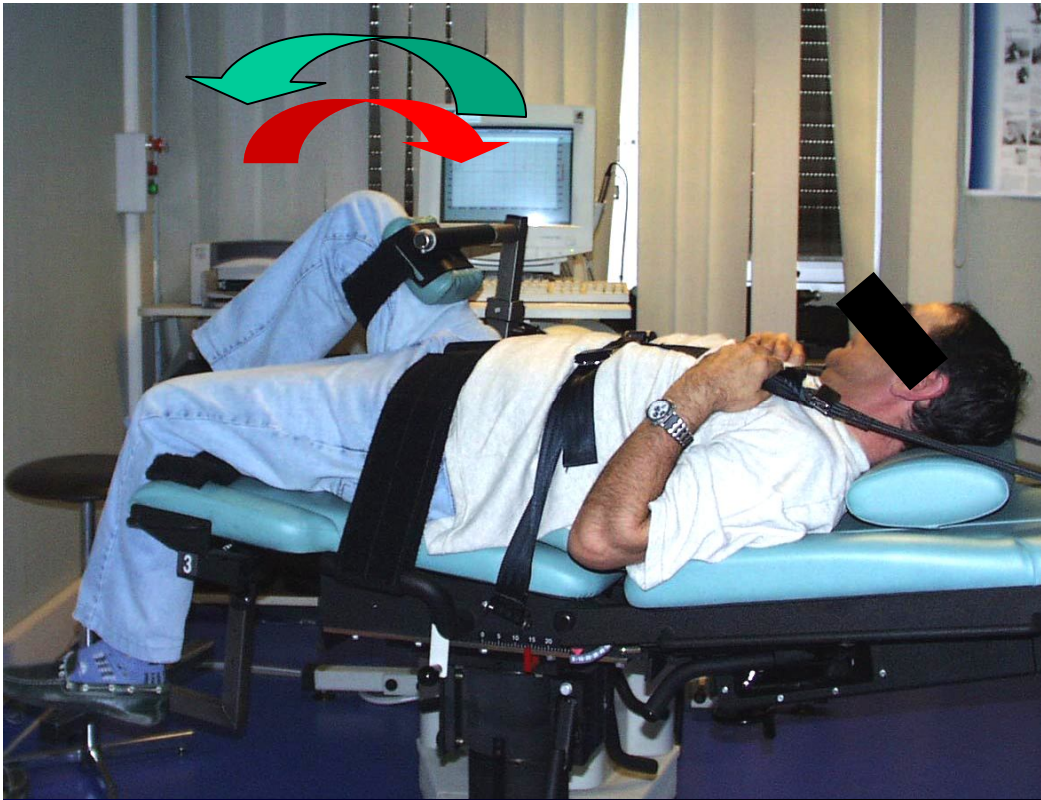
TRUNK EXT.



TRUNK FLEX



ISOCINETISM 60°/sec. □



PSOAS/GLUTEUS MAX.



QUADRICEPS/ISCHIO-TIBIALIS

ARTHROGENIC KYPHOSIS : 10 CASES

	SERIES (10 CASES)	NORMAL SUBJECTS Mean age : 30 Y.O.	
Ratio <u>Spine Flexors</u> Spine Extensors	149%	63%	S
Ratio <u>Psoas</u> Gluteus maximus	110%	60%	S
Ratio <u>Ischio-jambiers</u> Quadriceps	56%	71%	NS

2.2.SPONDYLOLISTHESIS



SPONDYLOLISTHESIS CLASSIFICATION

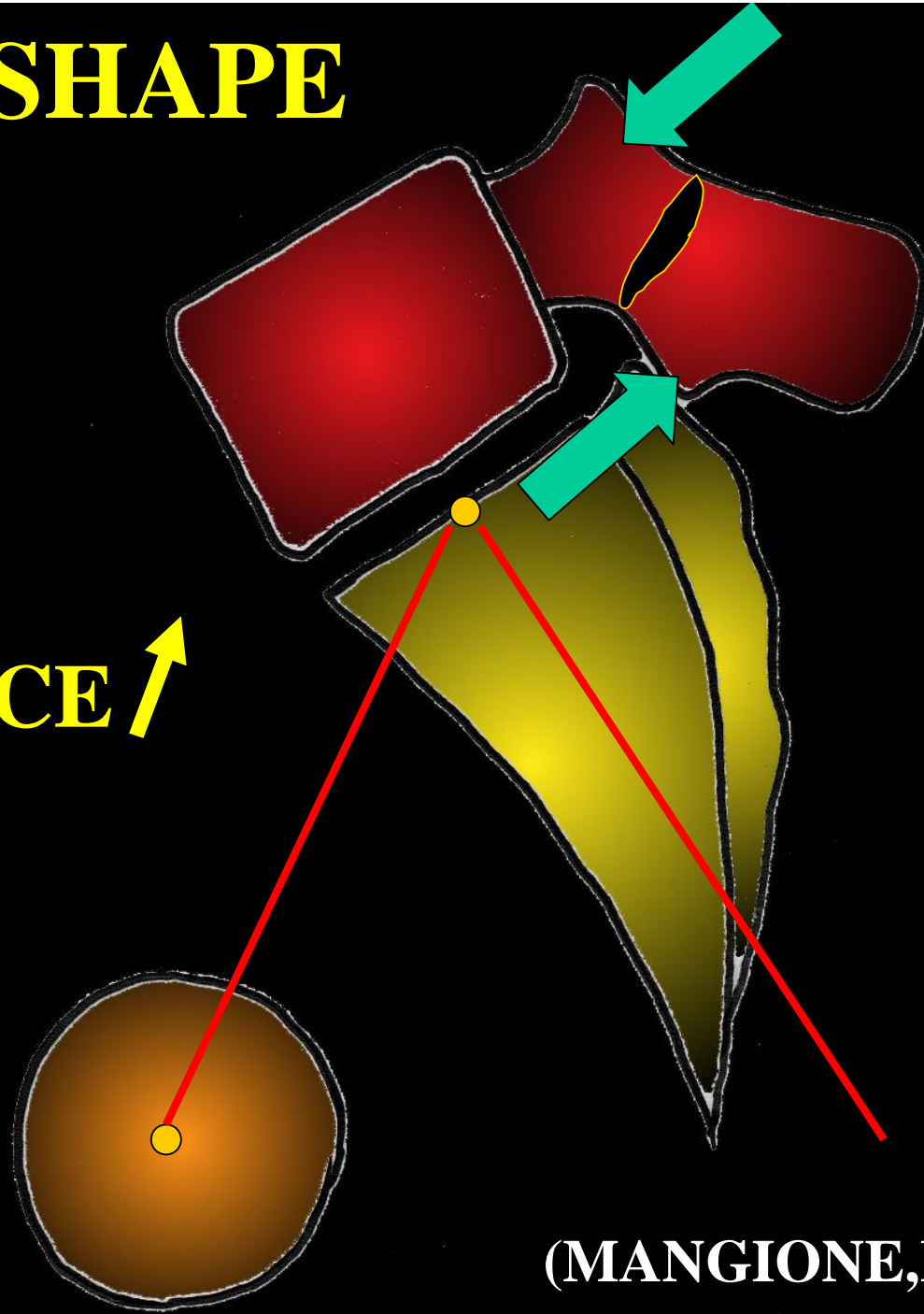
(MARCHETTI, 1997)

- DYSPLASTIC or CONGENITAL SPL**
- ISTHMIC LYTIC SPL**
- DEGENERATIVE SPL**
- TRAUMATIC SPL**
- TUMORAL SPL**
- IATROGENIC SPL**



PELVIC SHAPE

INCIDENCE ↗



(MANGIONE, ROUSSOULY)

PELVIC POSITION

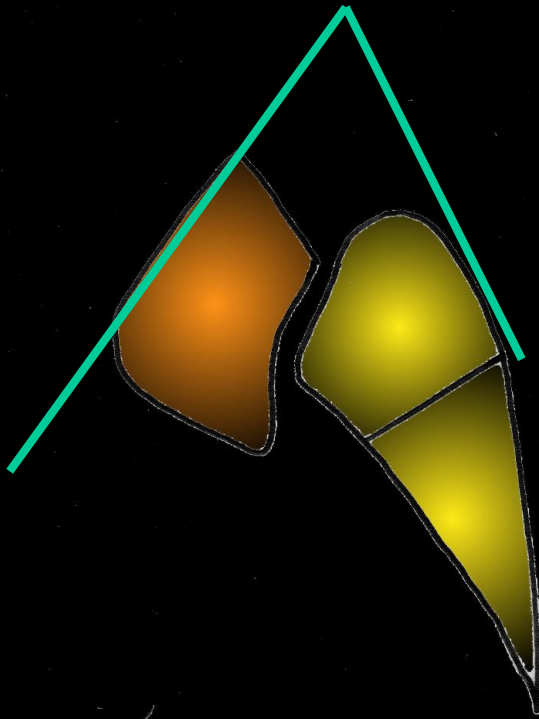
- LOMBOSACRAL KYPHOSIS

- PELVIC VERSION



LOMBOSACRAL ANGLE

(BRADFORD, DUBOUSSET)



**PELVIC TILT
INCREASING**

More than 90°



TRUNK POSITION. □

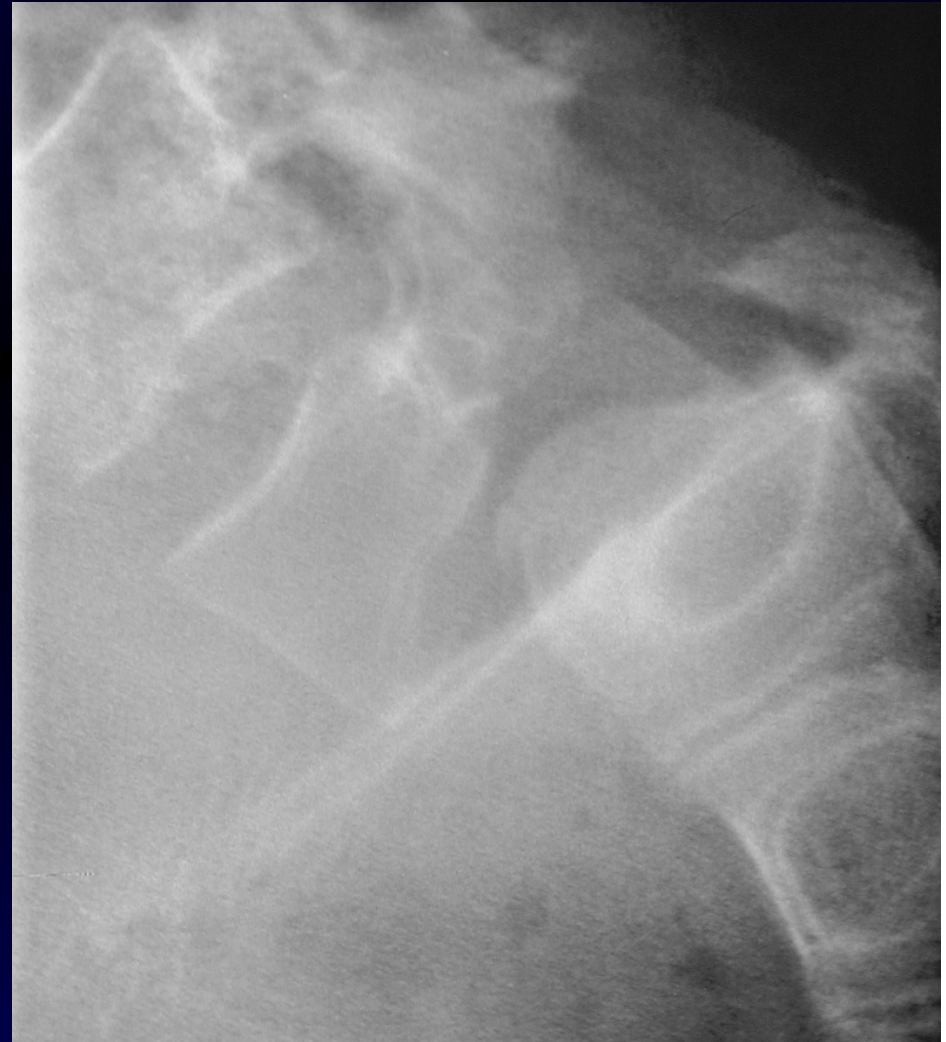
- T9 SAGITTAL LIST
- THORACIC KYPHOSIS
- LUMBAR LORDOSIS



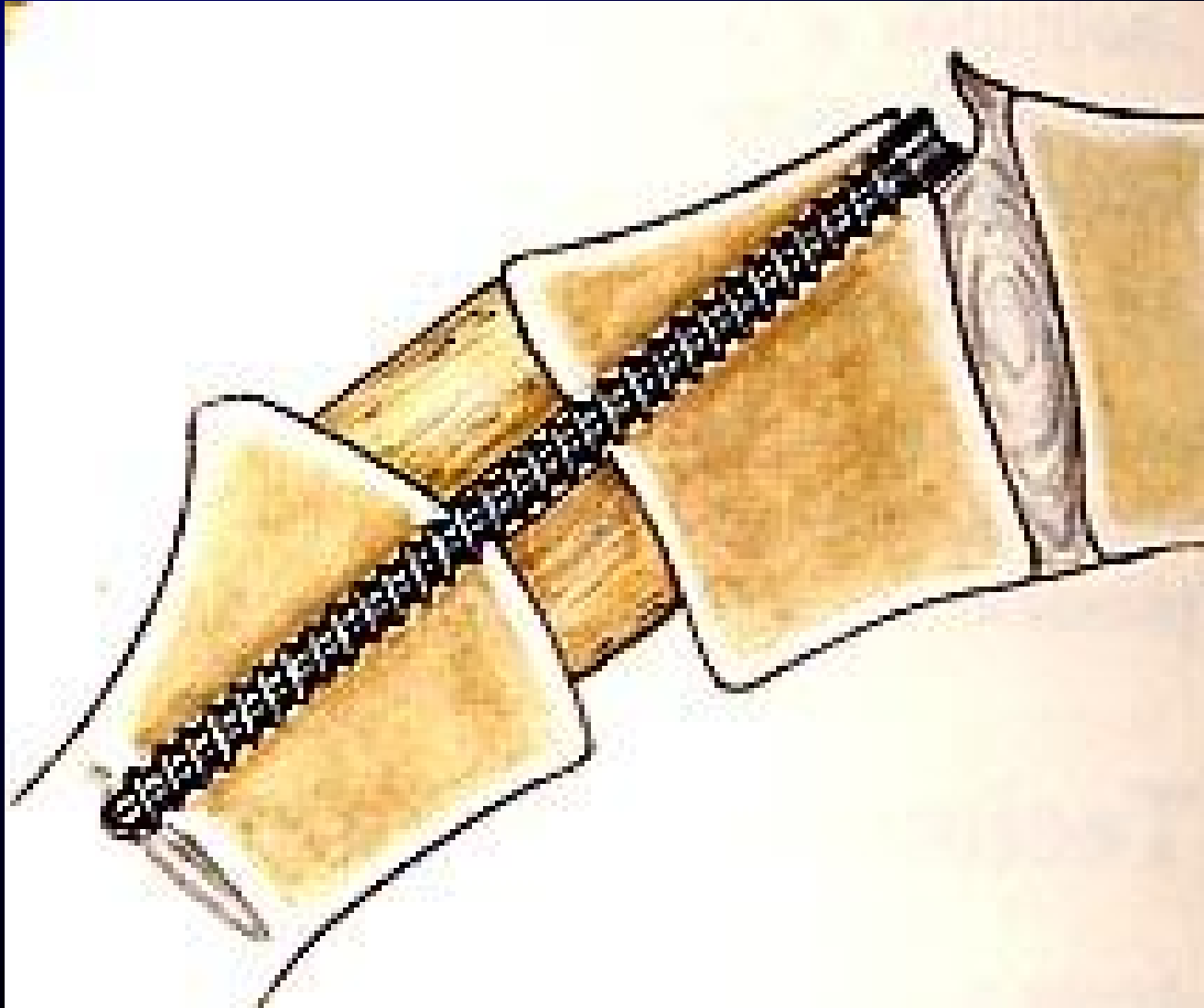
QuickTime™ et un décompresseur
Video sont requis pour visualiser
cette image.

QuickTime™ et un
décompresseur Video
sont requis pour visualiser cette image.

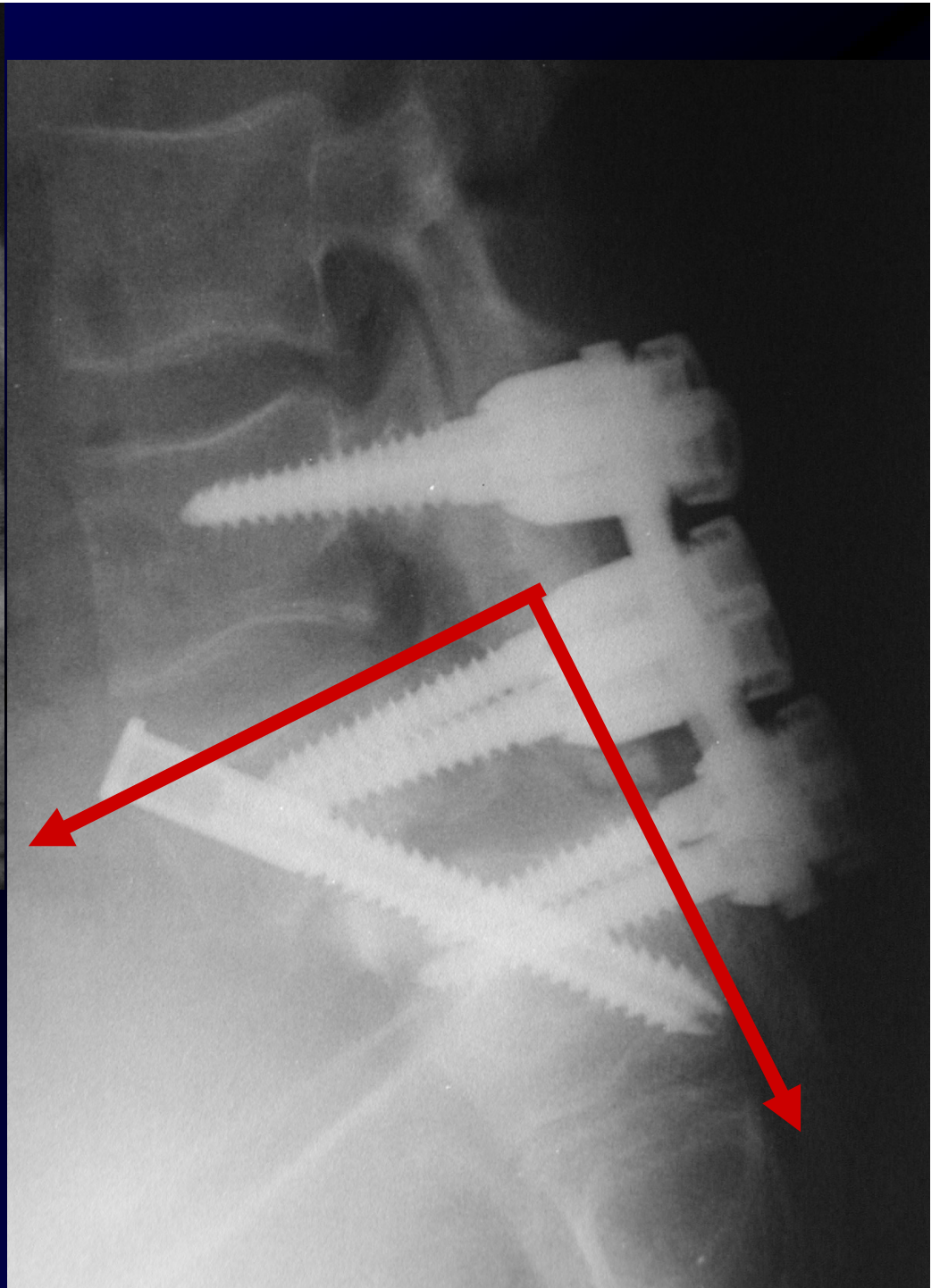
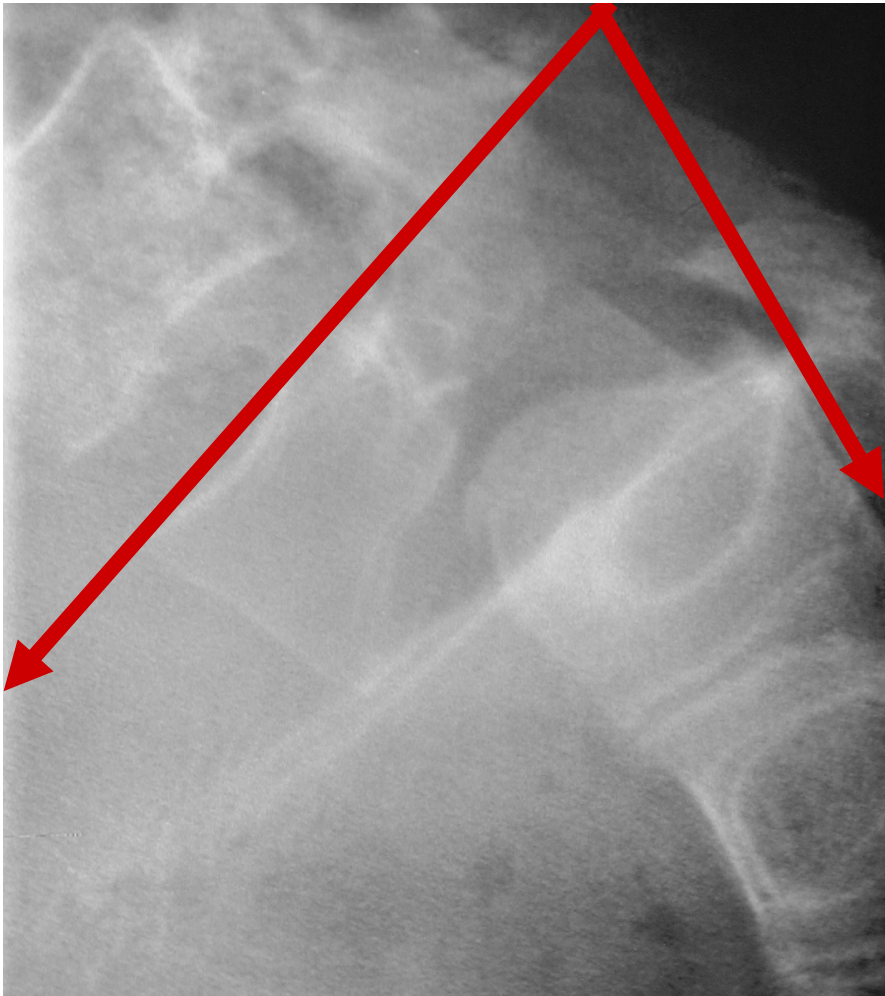
SURGICAL TREATMENT of SEVERE DYSPLASTIC SPL



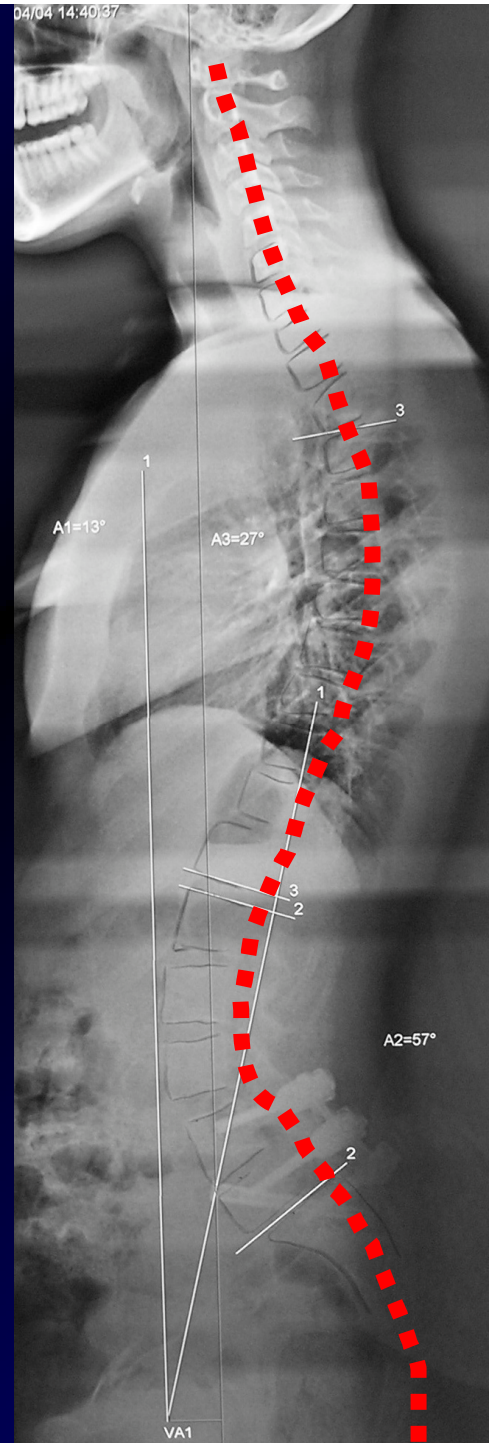
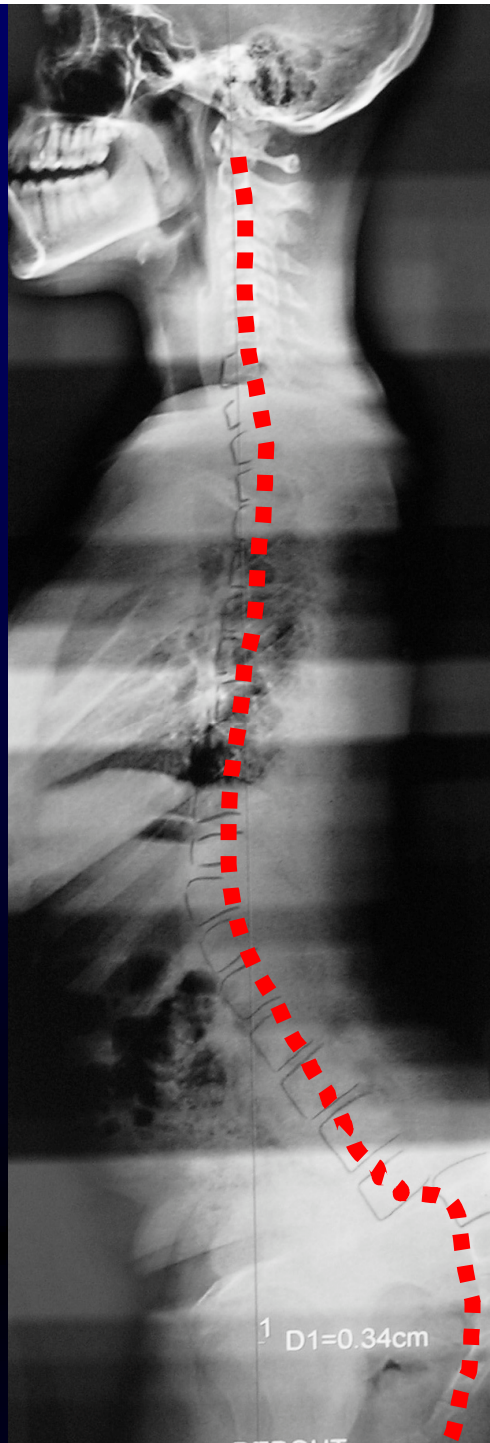
FIRST : ANTERIOR ARTHRODESIS



SECOND : POSTERIEUR ARTHRODESIS



LOMBOSACRAL ANGLE



2. HOW TO PREVENT ?

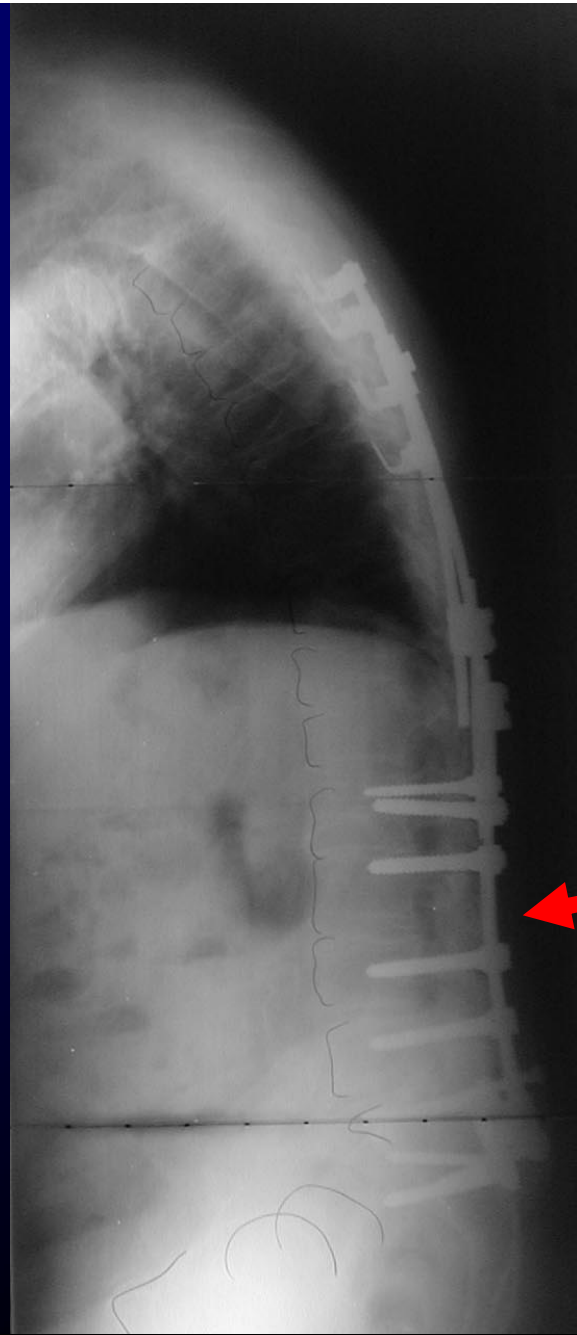
SAGITTAL IMBALANCE

POSTERIOR SURGERY

MUSCULAR LESIONS

INSTRUMENTATION

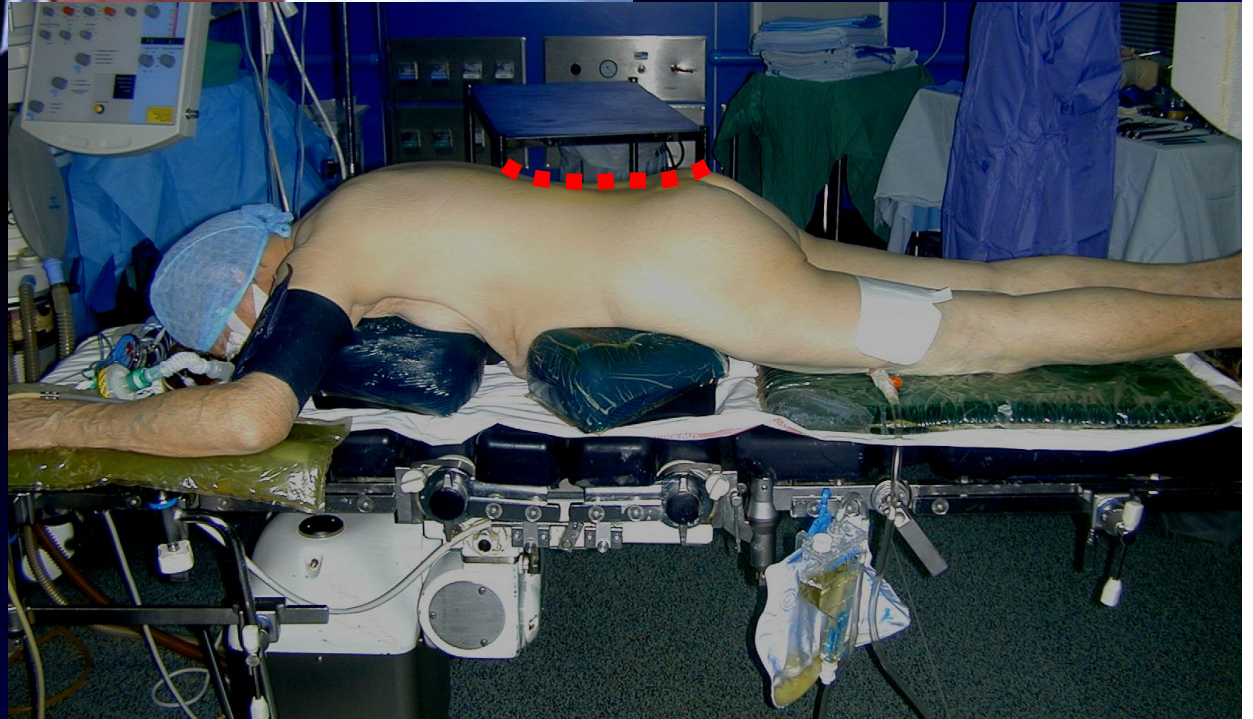
INTRAOPERATIVE POSITION



P.O. FLAT BACK

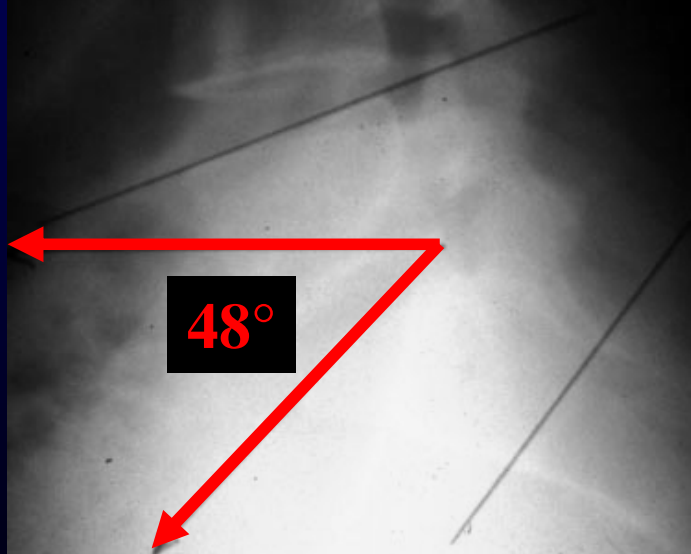
I.O. POSITION





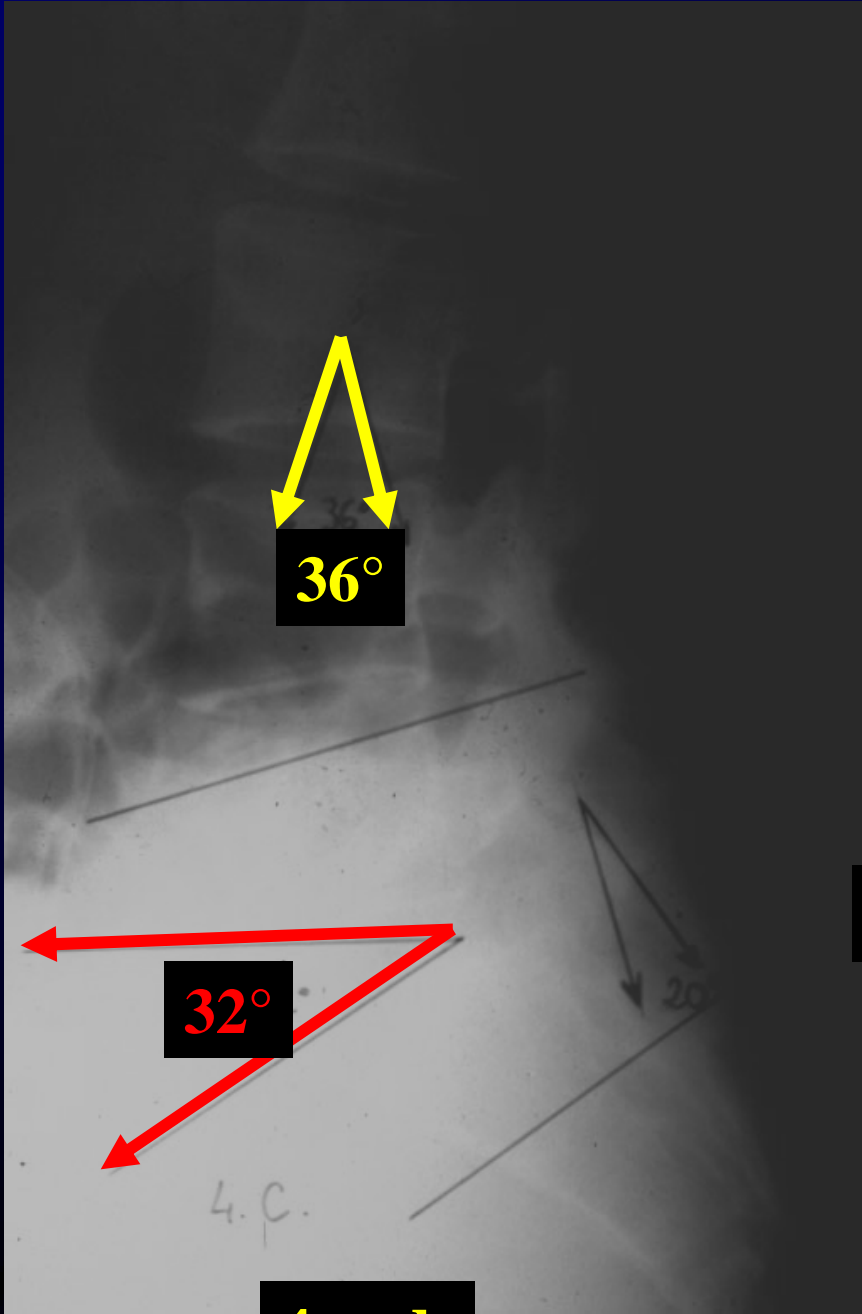
POSITION

STANDING / SEATED / 4 PADS / G. P.

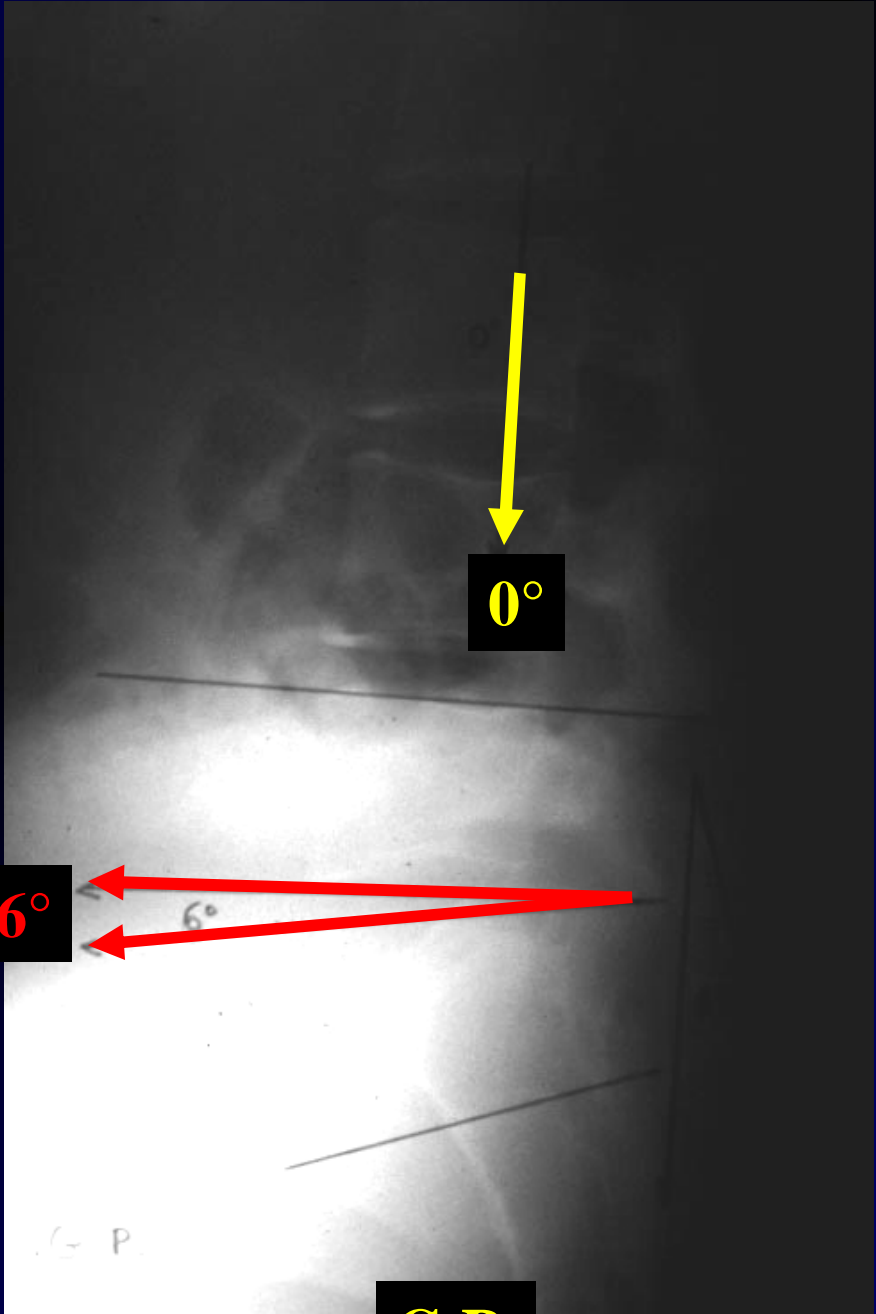


standing

seated



4 pads



G.P.



GENU PECTORAL



SEATED

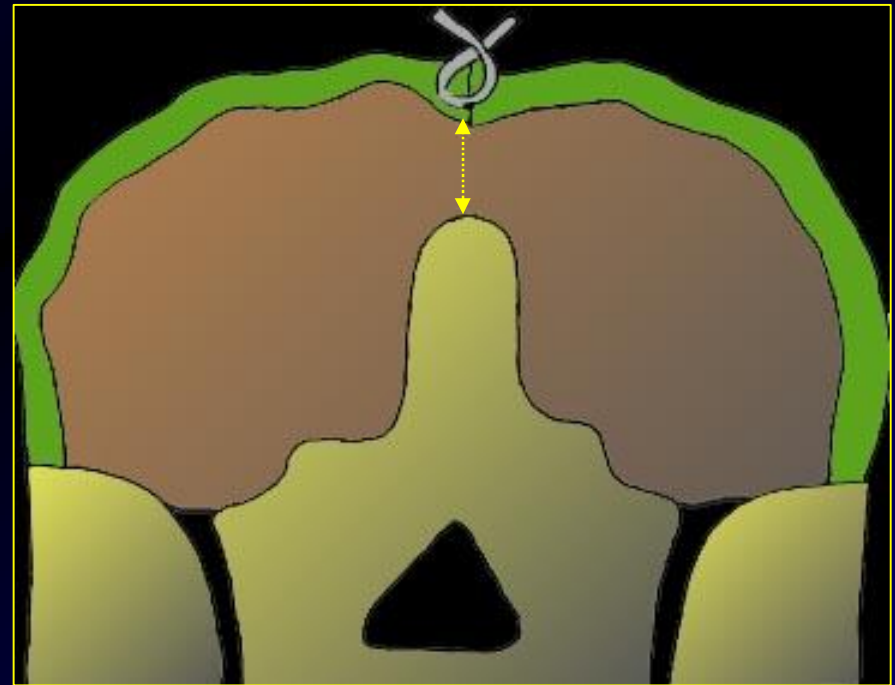
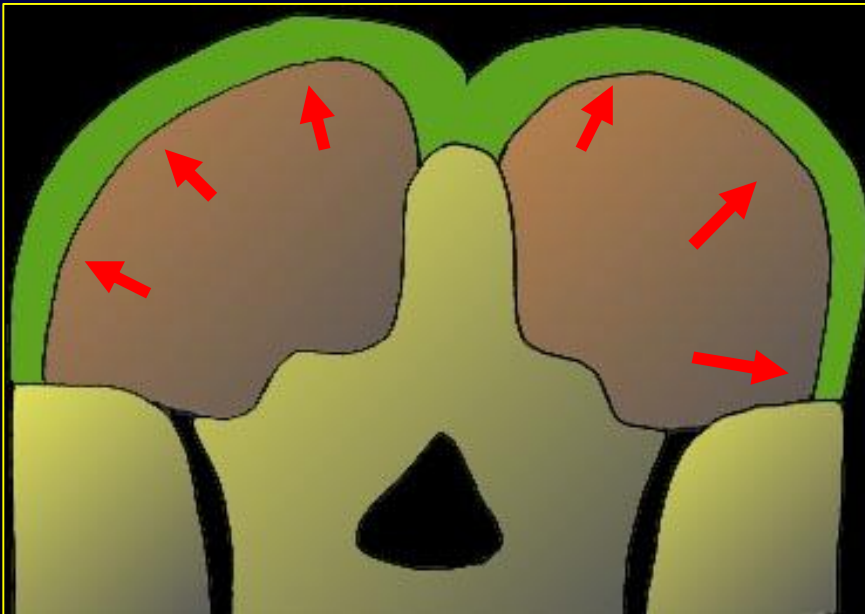


4 PADS



STANDING

MUSCULAR LESIONS □



2. TREATMENT

SAGITTAL IMBALANCE

2.3. SPINAL OSTEOTOMIES in POSTOPERATIVE FLAT BACK

LUMBAR POSTERIOR (PETERSEN)

**LUMBAR PEDICLE SUBTRACTION
(CLOSE WEDGING , EGG SHELL)**

LUMBAR MULTILEVEL POSTERIOR

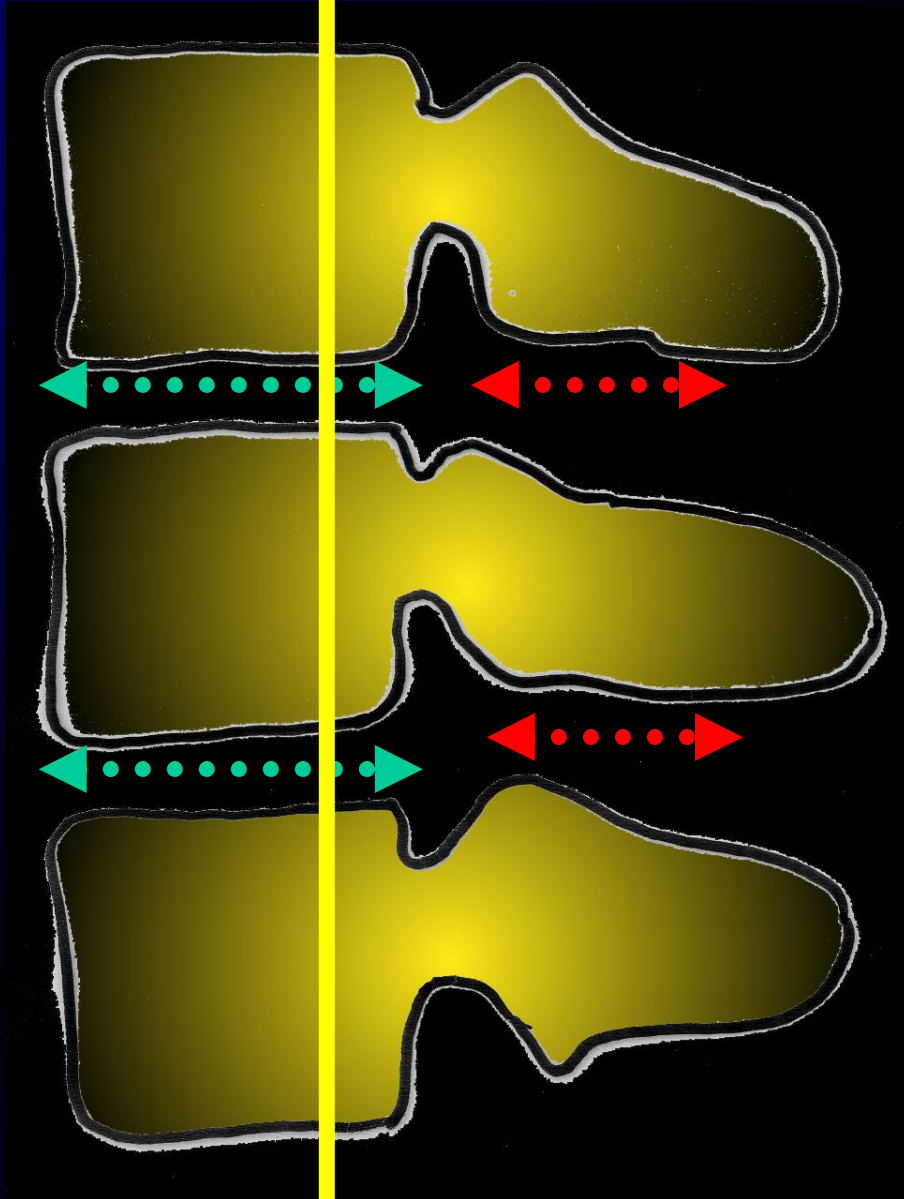
PELVIC



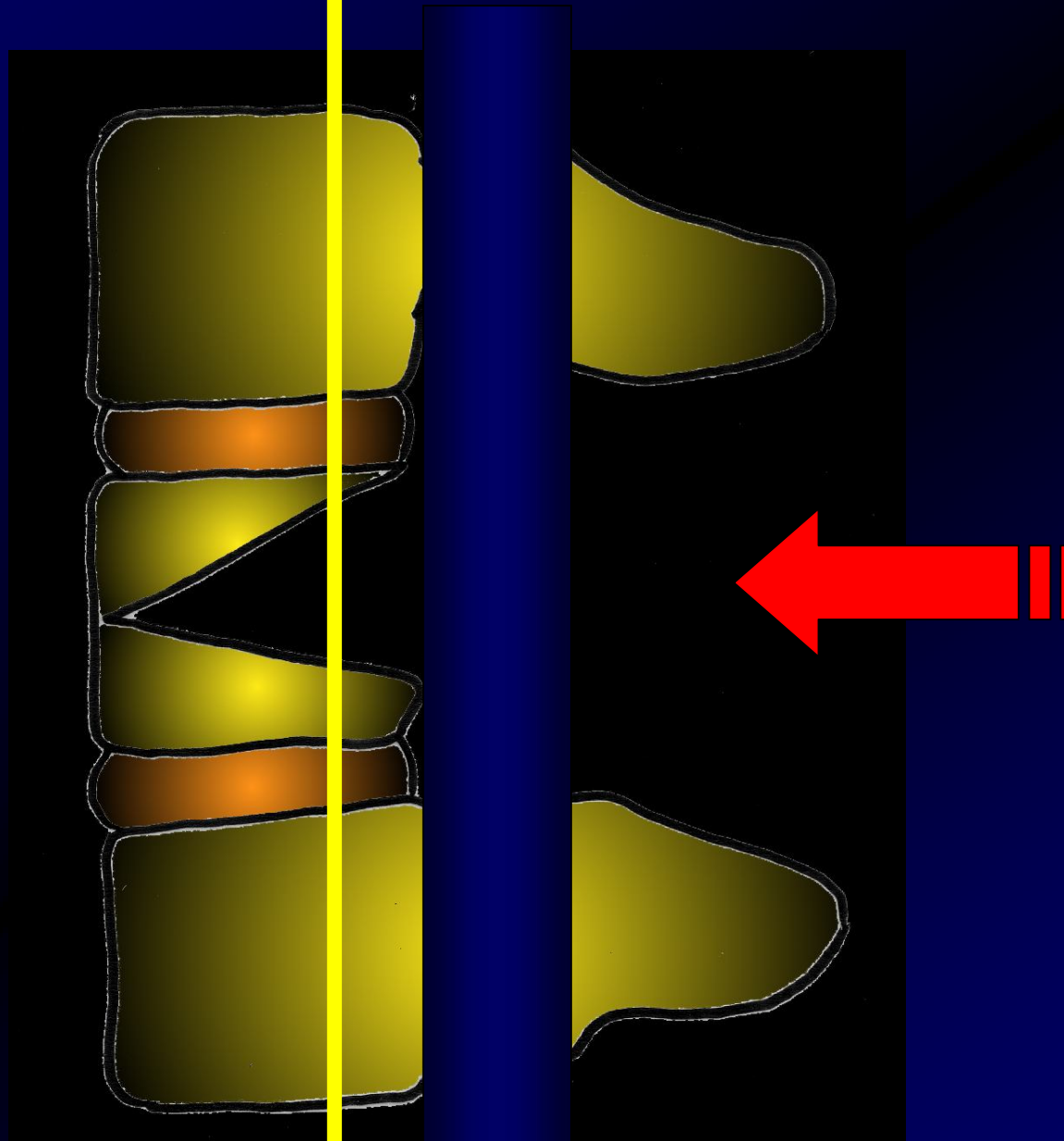
TABLE III Osteotomies for Correction of Flatback Deformity and Fixed Sagittal Imbalance

Type of Osteotomy	Correction per Segment	Benefits	Drawbacks	Relative Contraindications
Smith-Petersen	5°-20°, or 1°/mm of resection	Familiarity to surgeon; optimum for posterior-only approach when disc height maintained	Lengthens anterior column; frequent need for anterior release/fusion/osteotomy; higher reported pseudarthrosis rates	Ankylosing spondylitis; calcification of great vessels; or anterior instrumentation at same level
Pedicle subtraction	25°-35°	Sagittal and coronal correction possible; high union rates; posterior only	Greater blood loss; technically demanding; theoretical risk of devastating neurologic injury	Anterior pseudarthrosis or instrumentation at same level
Polysegmental posterior	9°-10°	Harmonious, sloping correction; posterior only	Multiple levels required for substantial correction; potential for loss of correction	Local stenosis; substantial single-level deformity; or anterior instrumentation at same level
Vertebral column resection	Variable	Greatest potential correction; sagittal and coronal correction possible; shortens spinal column, relieving neurovascular tension	Technically demanding; anterior procedure required; increased complication rates	

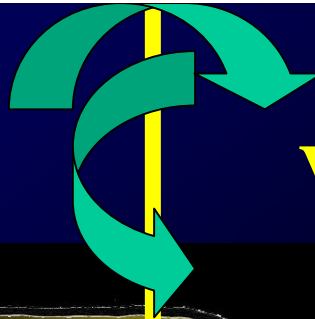
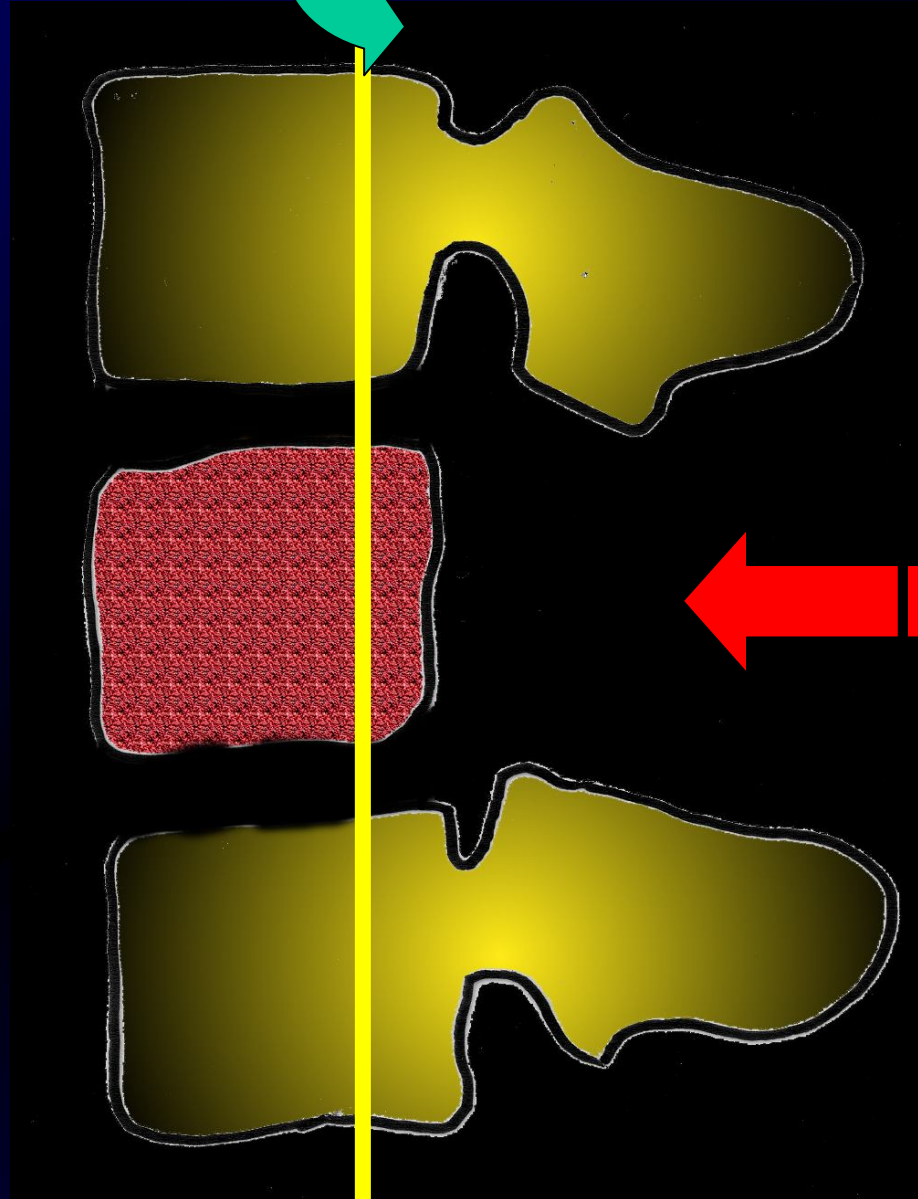
**MULTILEVEL POST. O.
+/-DISCAL RELEASE+/- CAGES**



TRANSPEDICULAR O. (TPO)



VERTEBRAL RESECTION

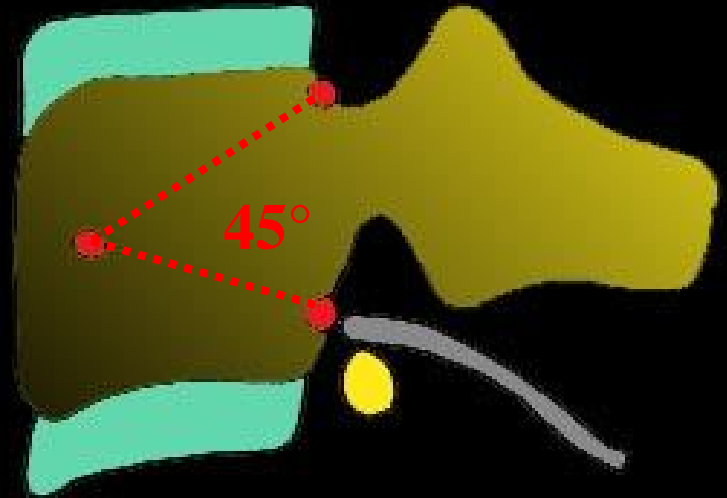
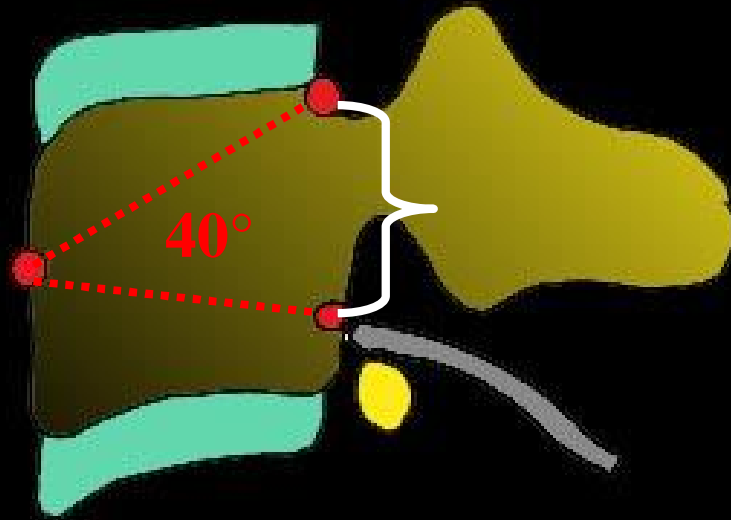


PREOPERATIVE CALCULATION

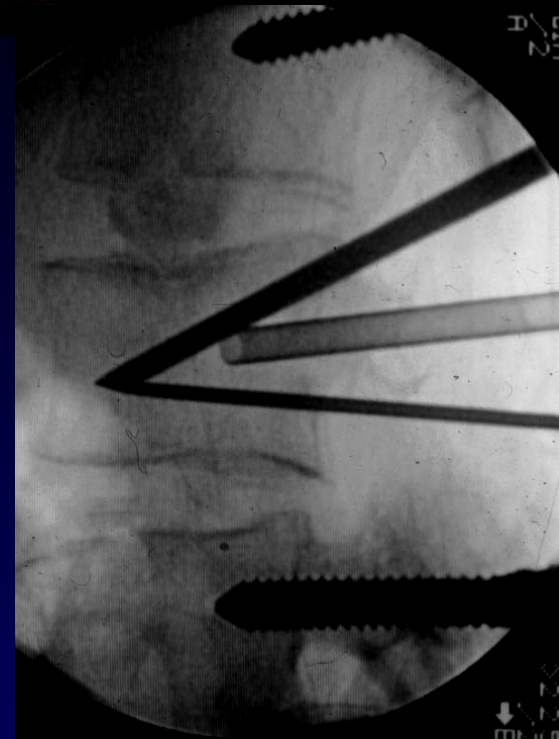
in the LUMBAR OSTEOTOMIES



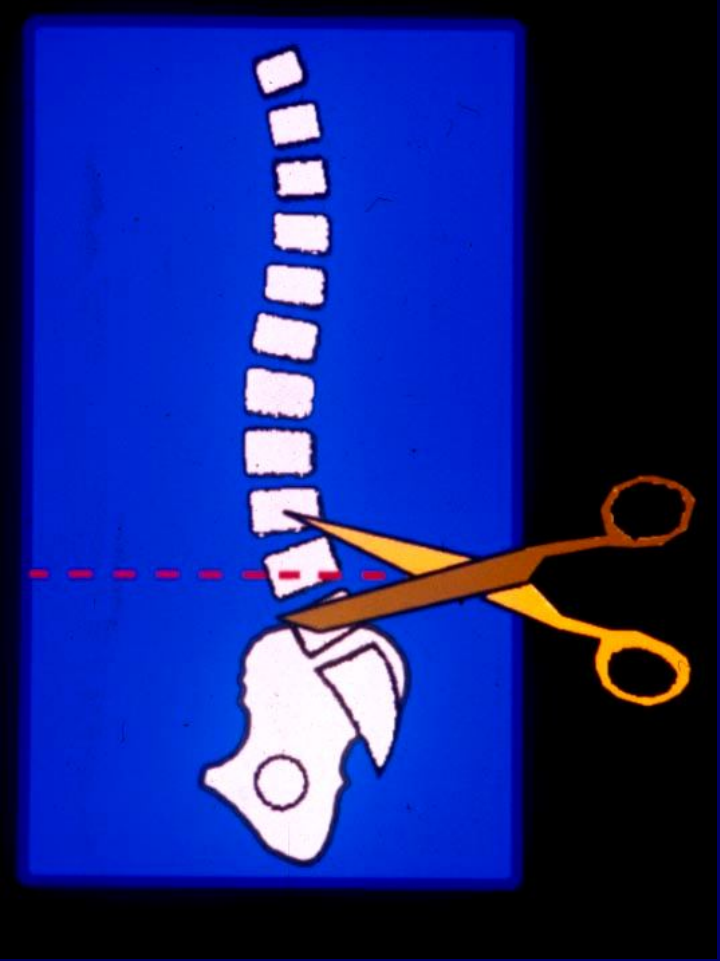
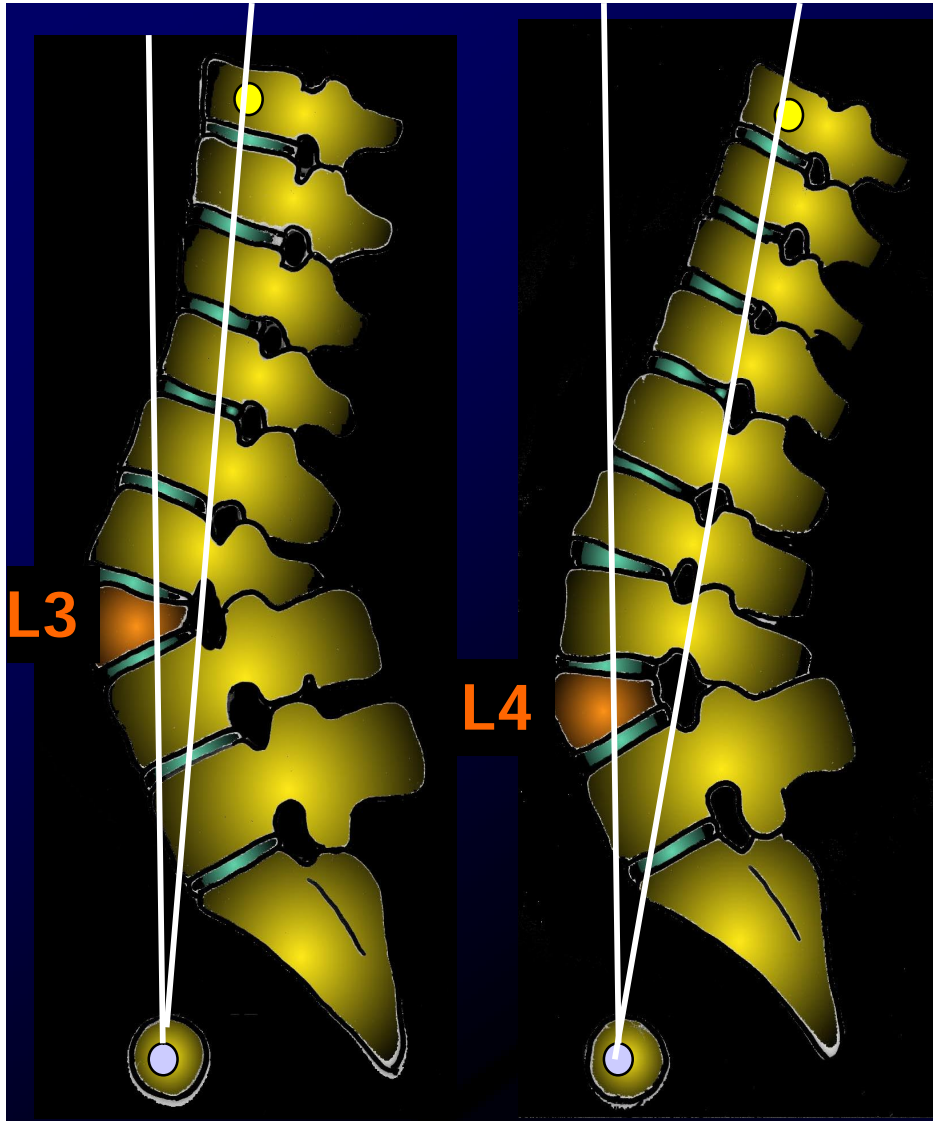
LUMBAR PEDICLE SUBTRACTION



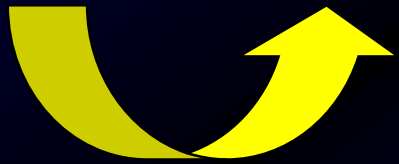
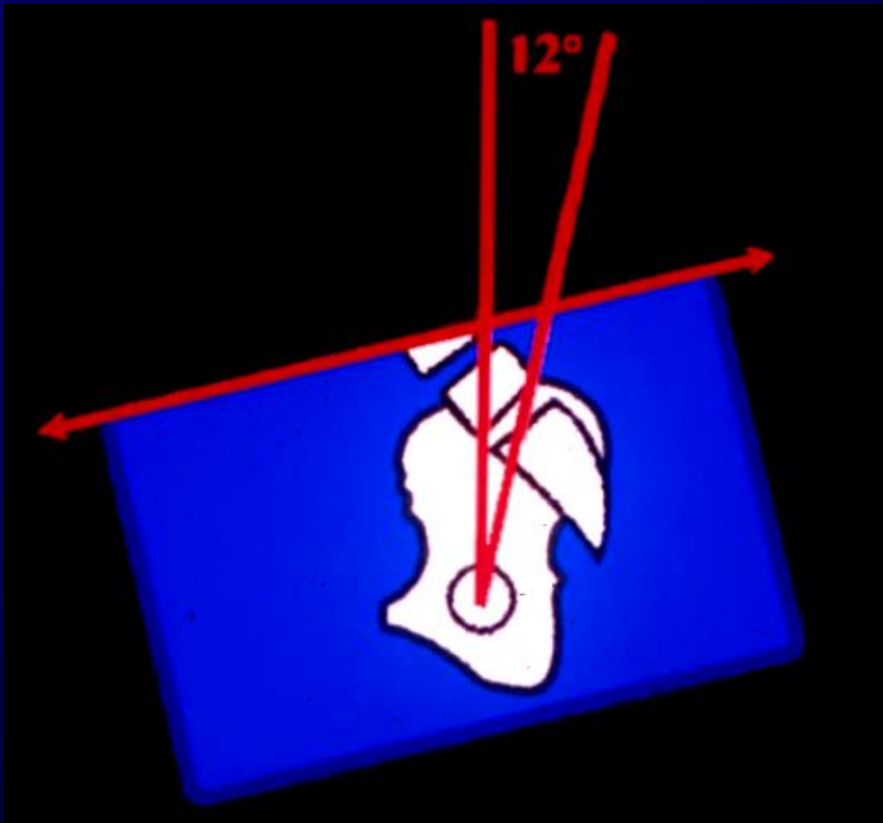
MAXIMUM ANGLE



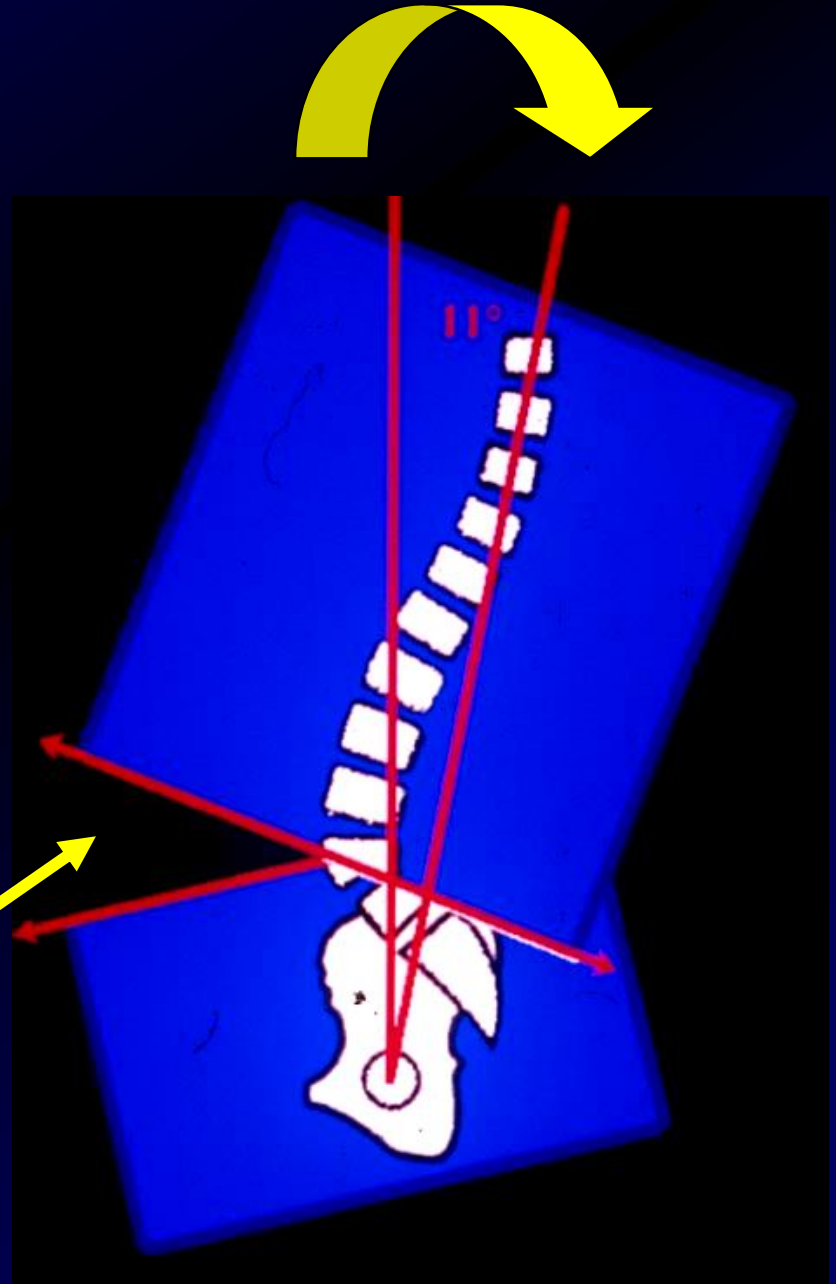
LEVEL (VAN ROYEN)

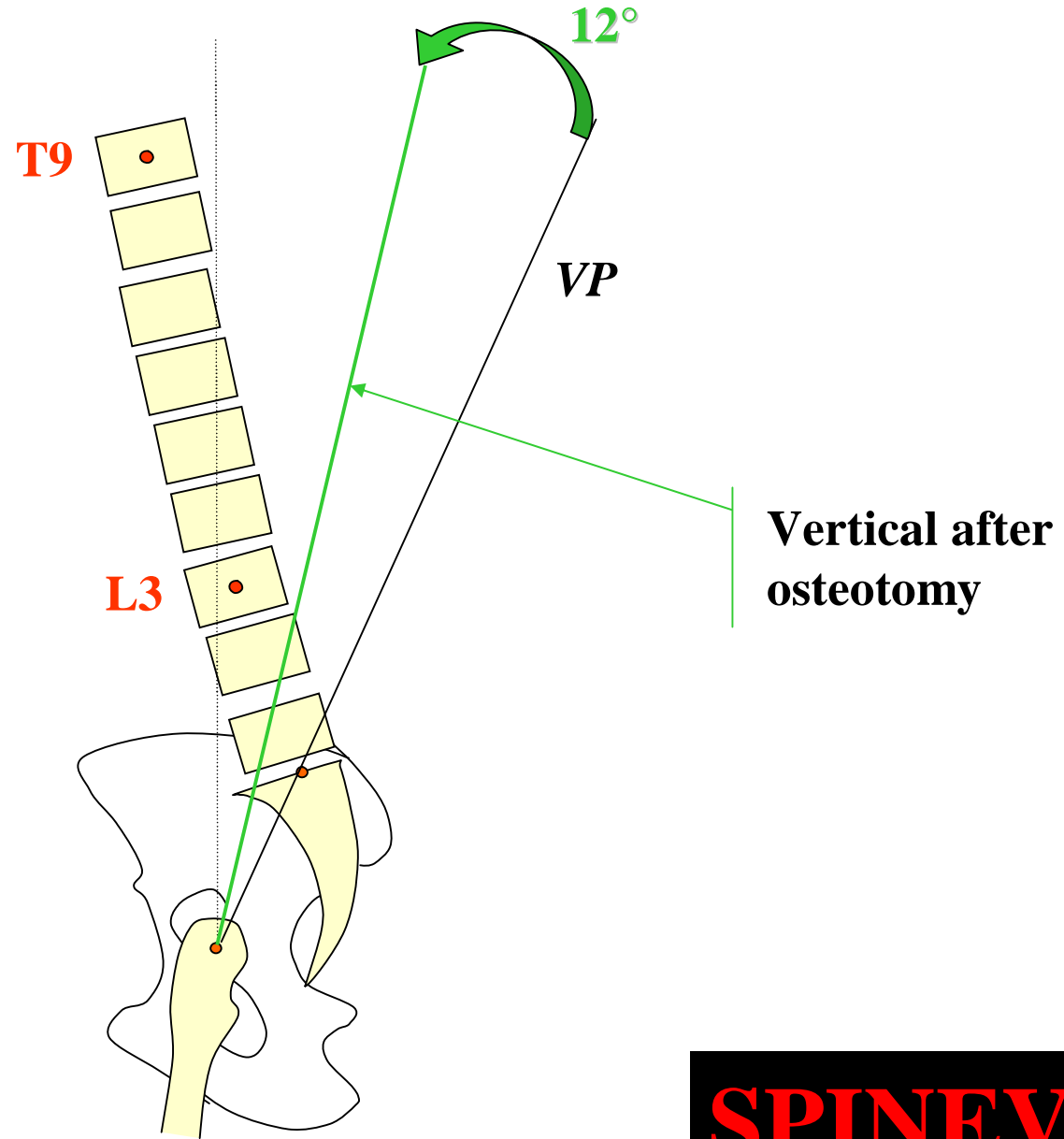


TRACINGS (MANGIONE)

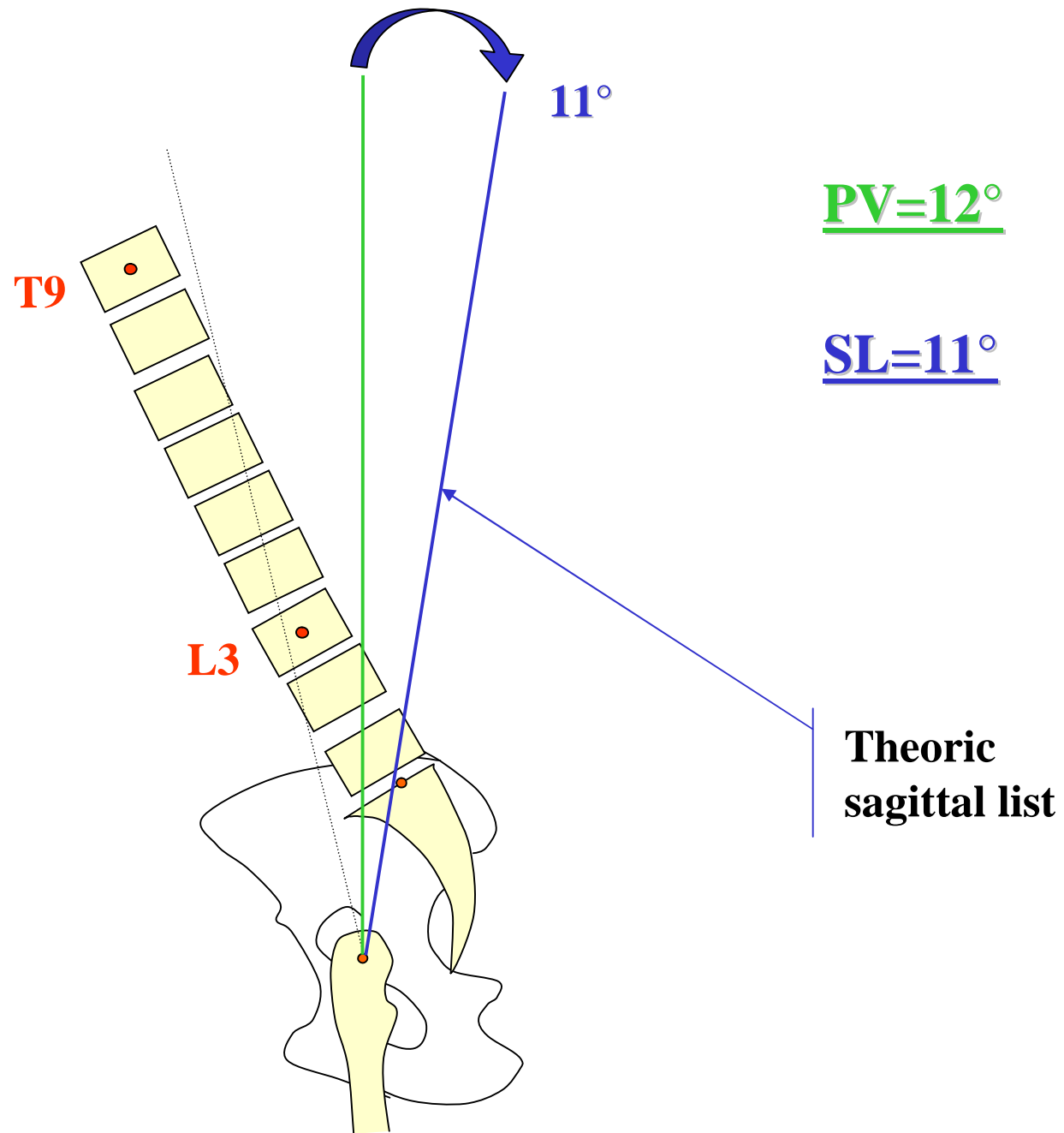


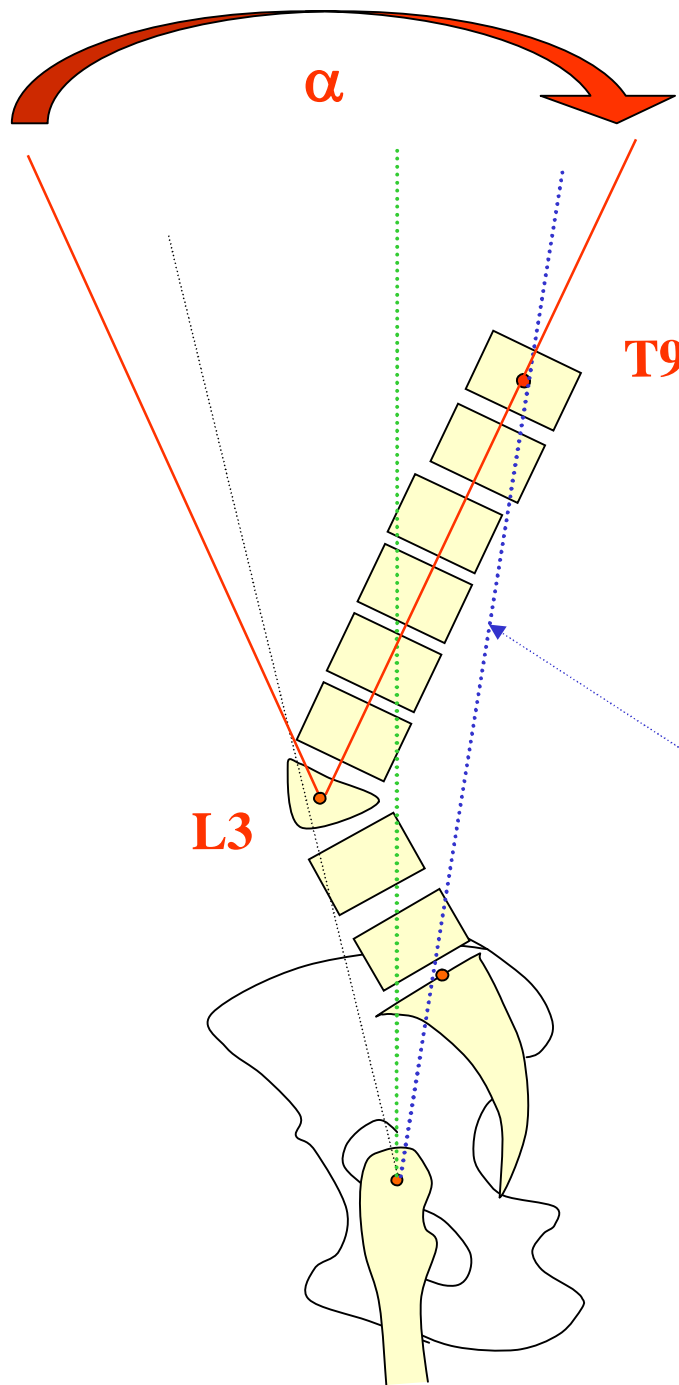
ANGLE





SPINEVIEW





PV=12°

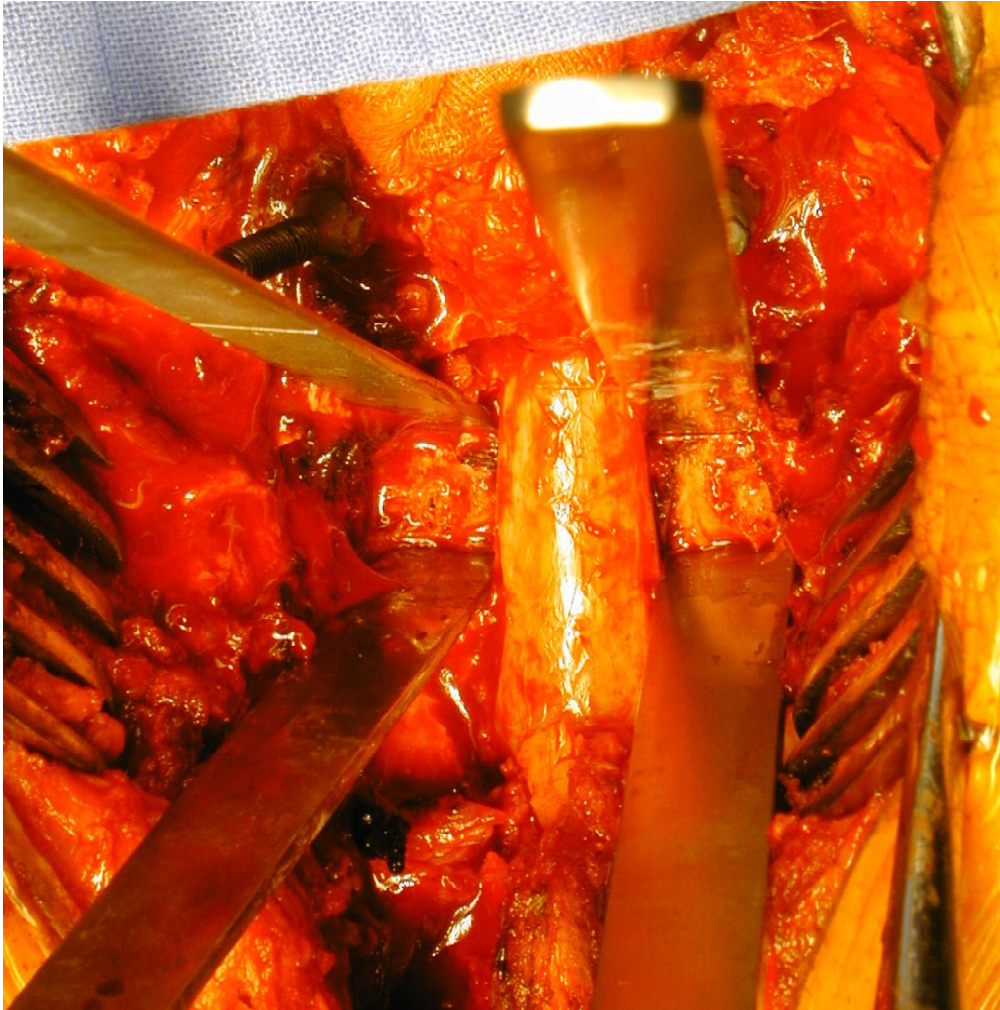
SL=11°

α : osteotomy angle

Theoric sagittal
list to 11°

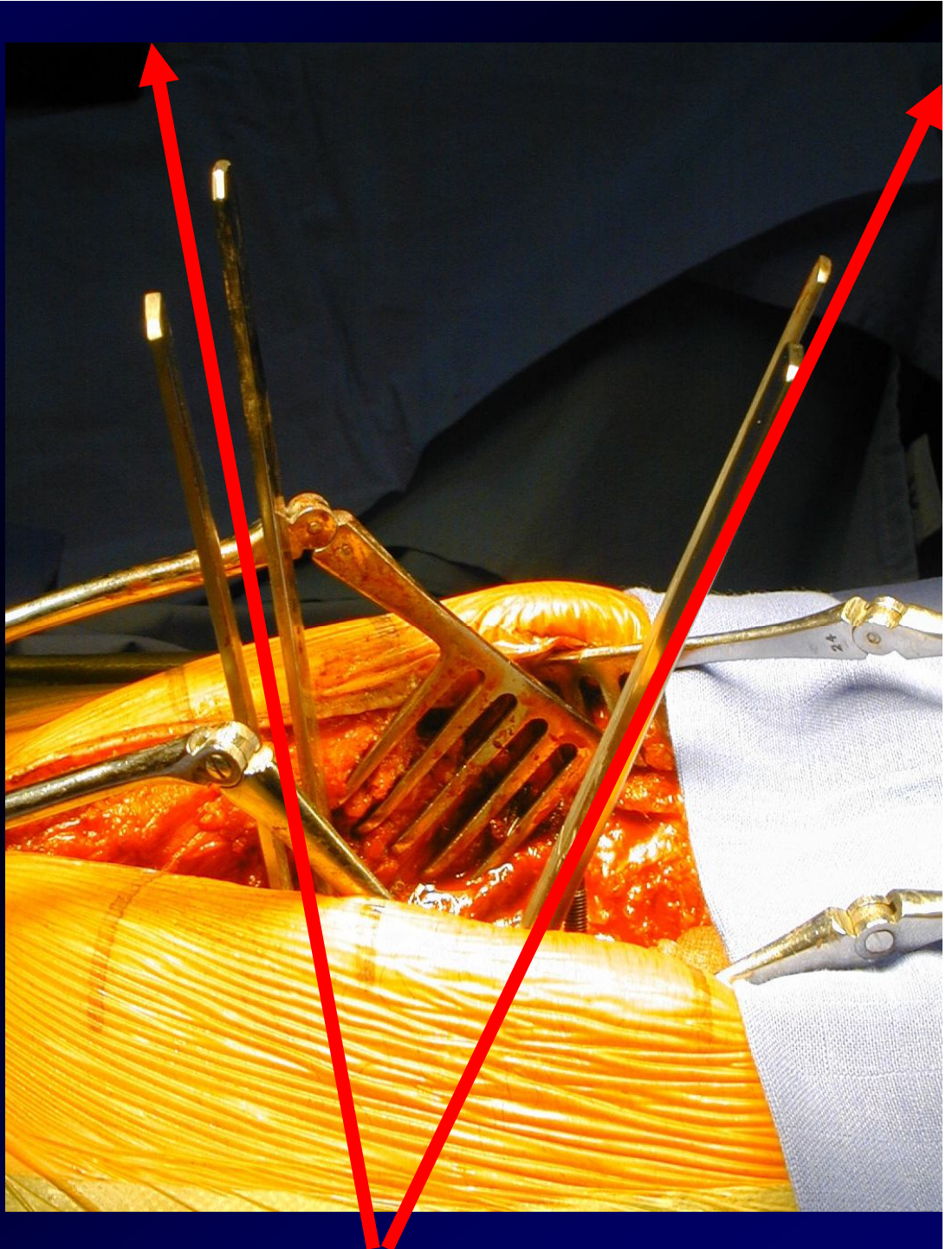
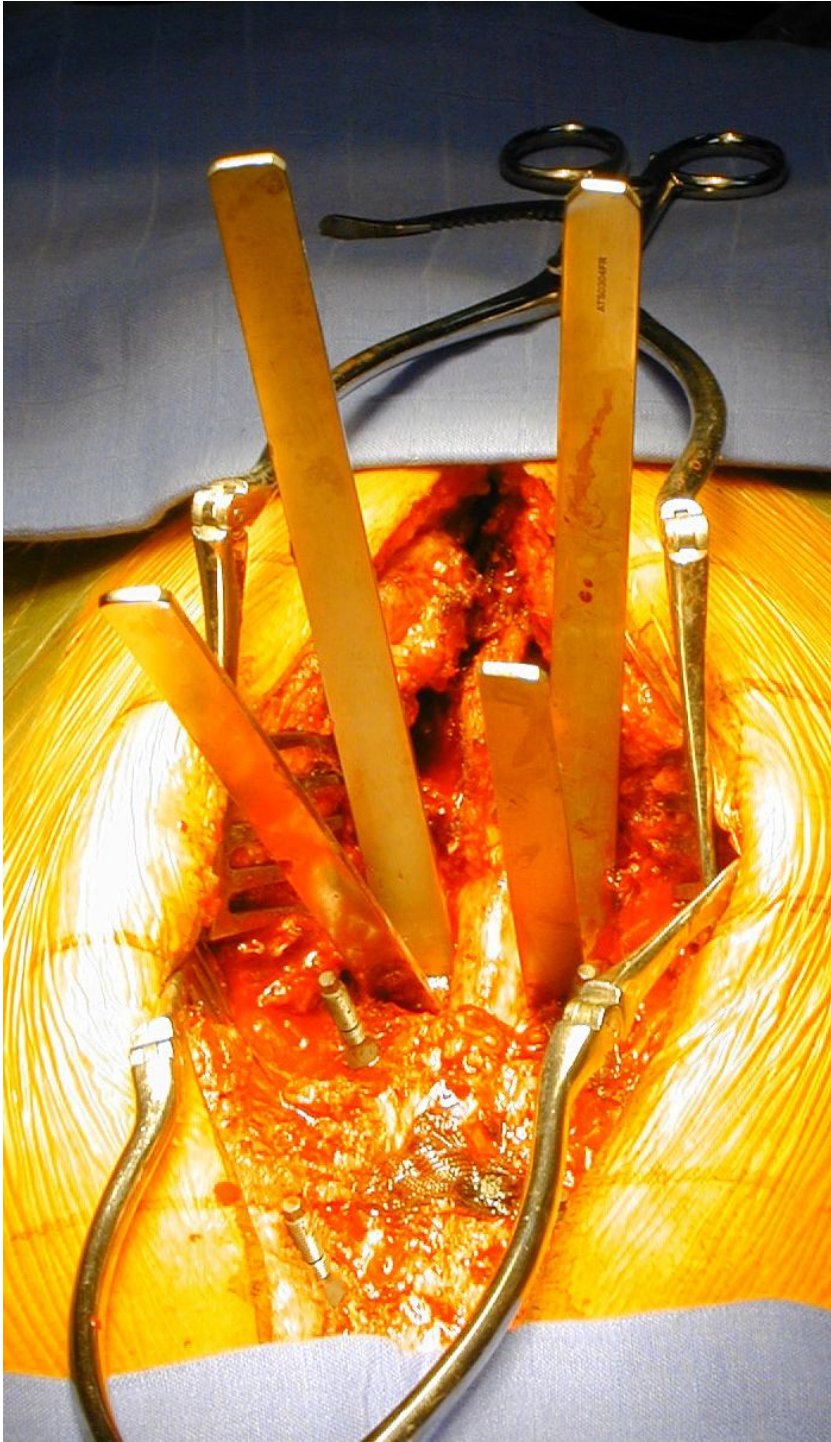
TECHNIQUE

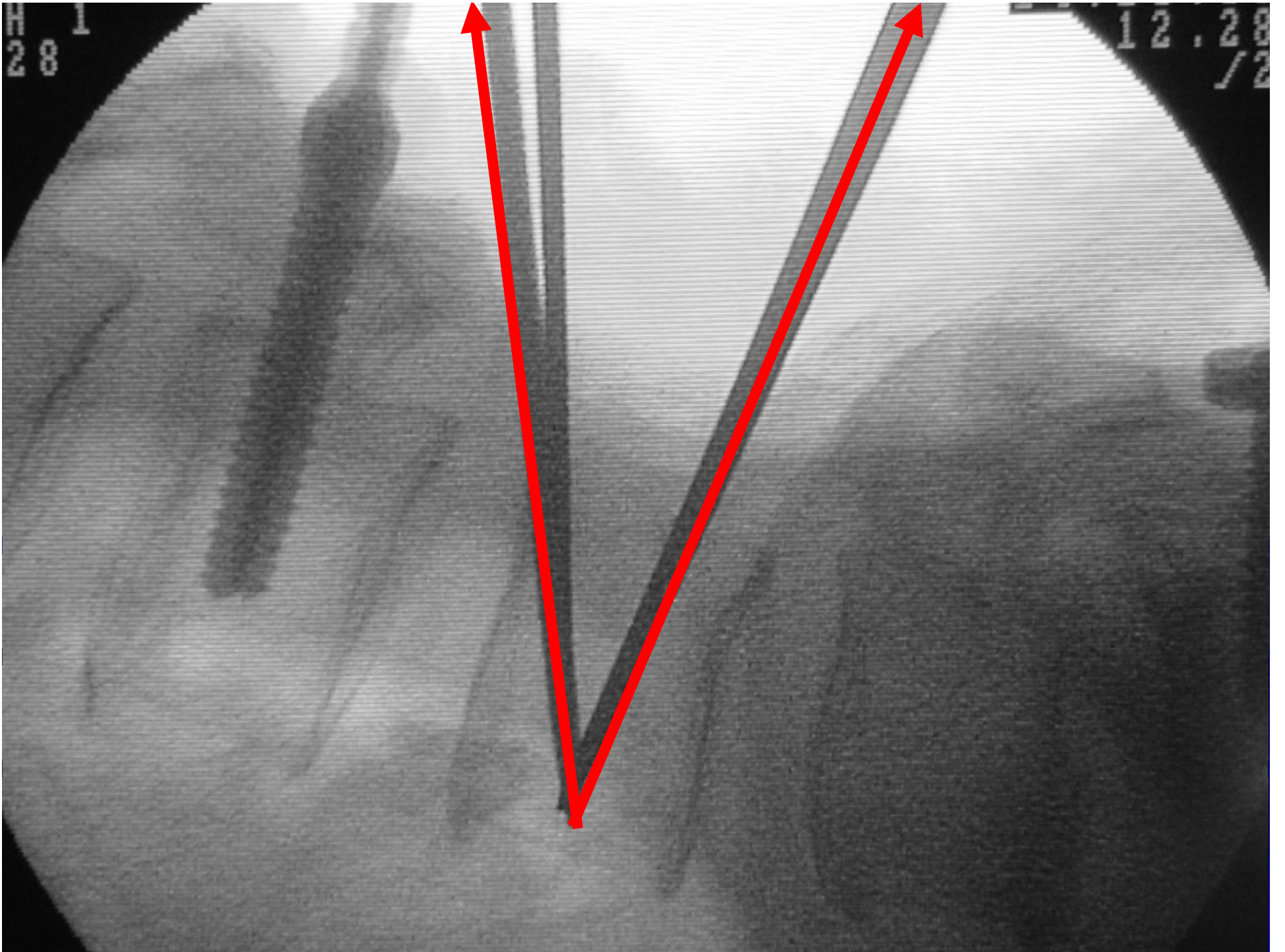
IMPLANTS

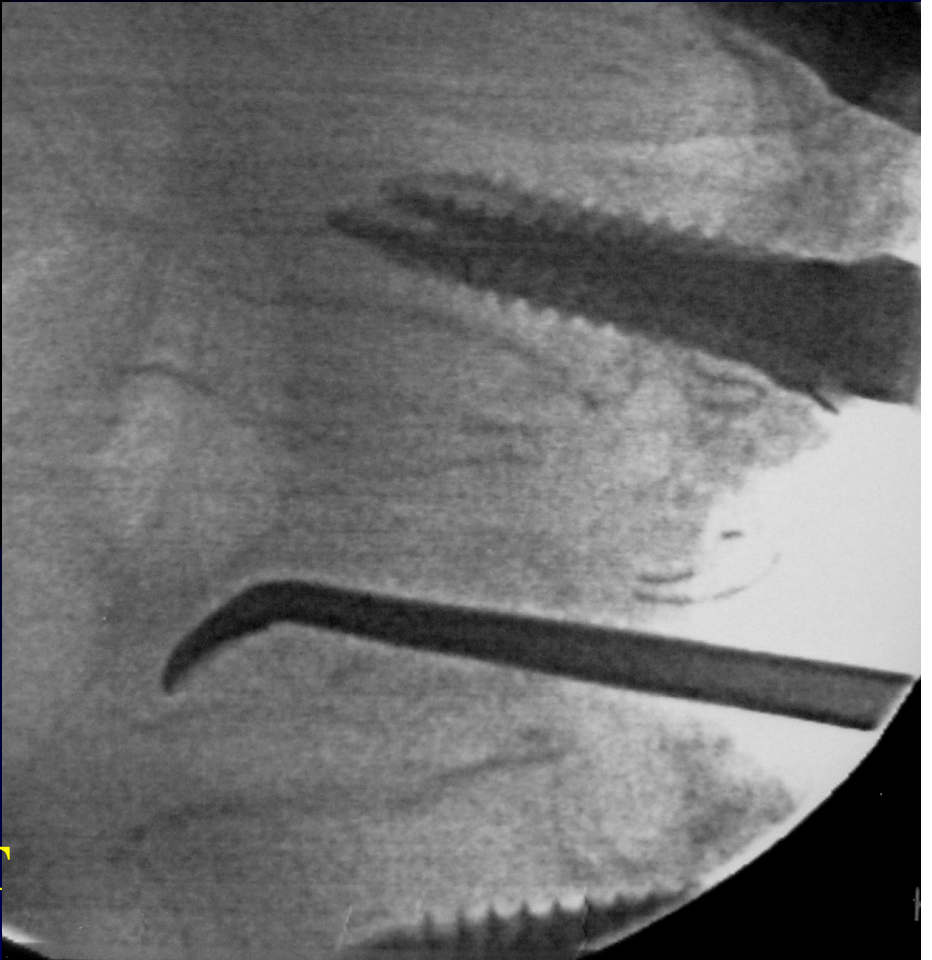
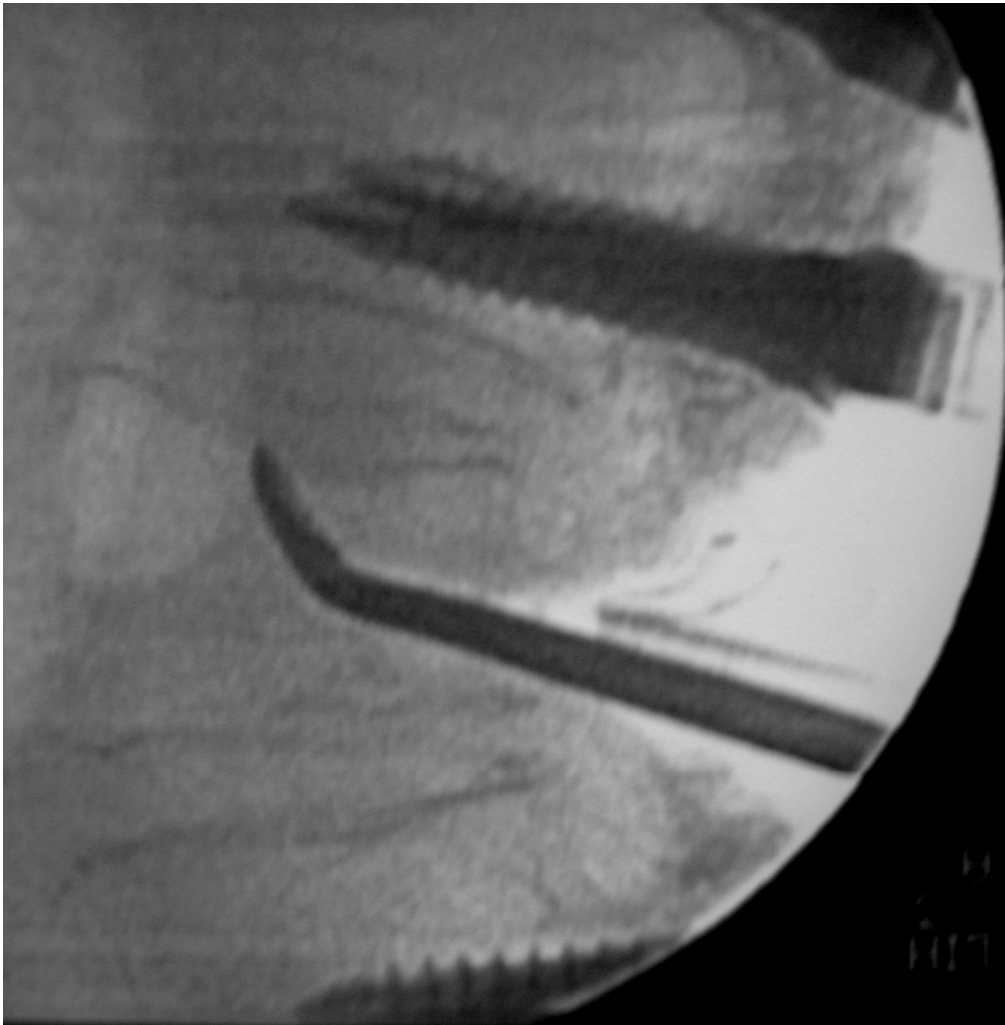


L3





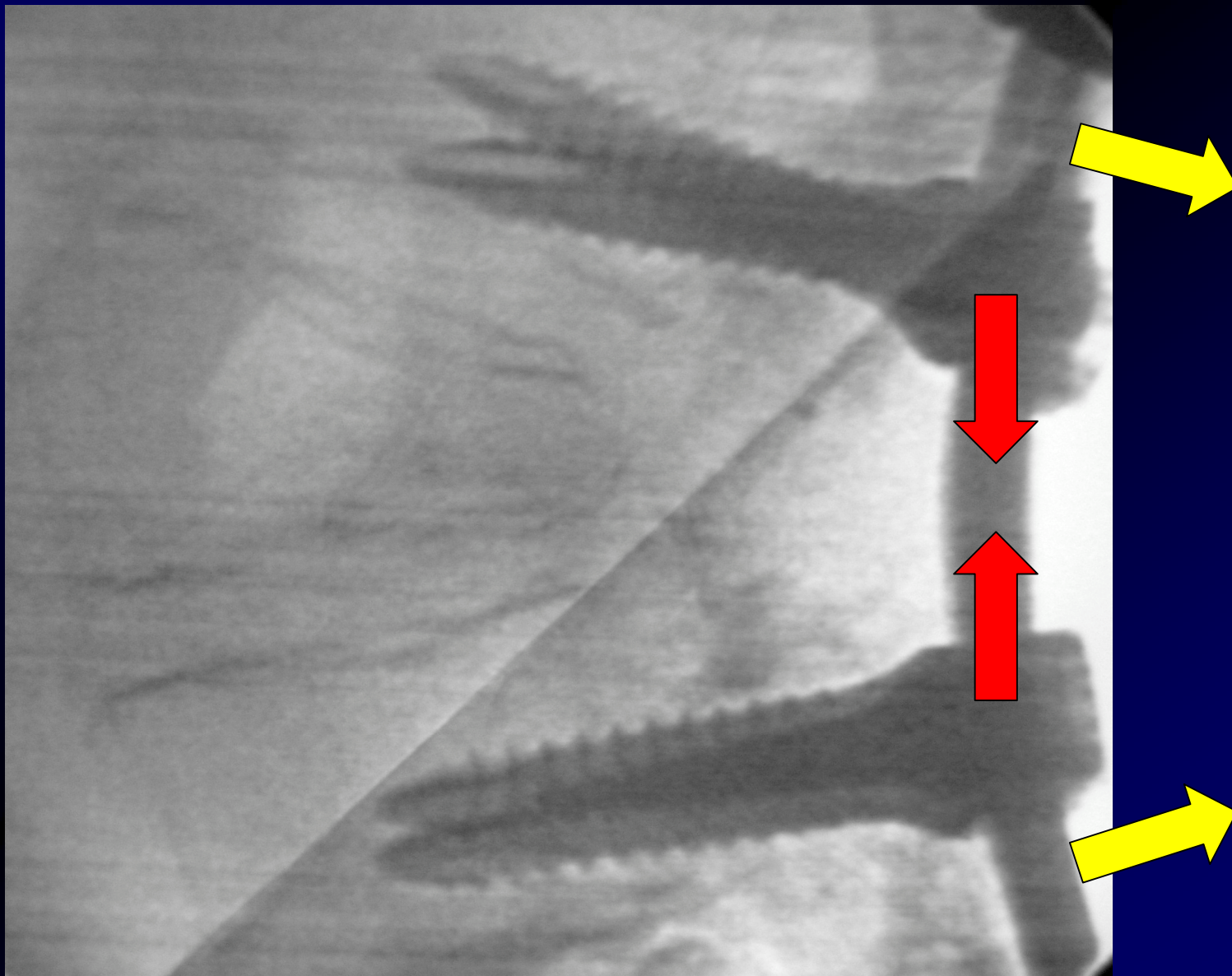




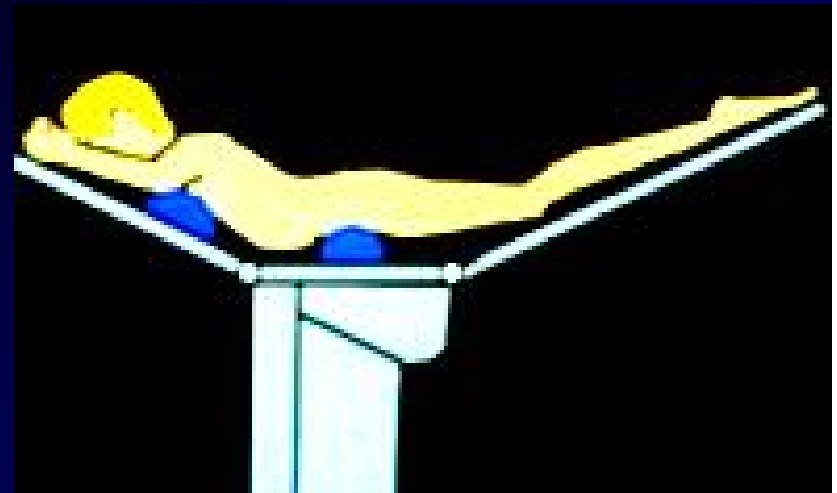
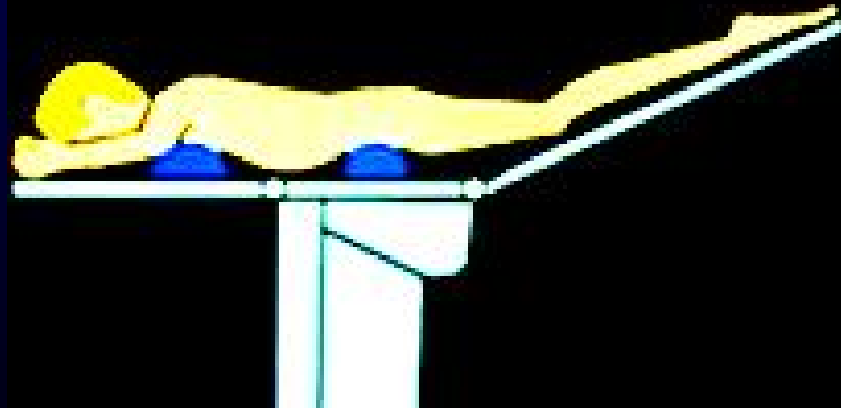
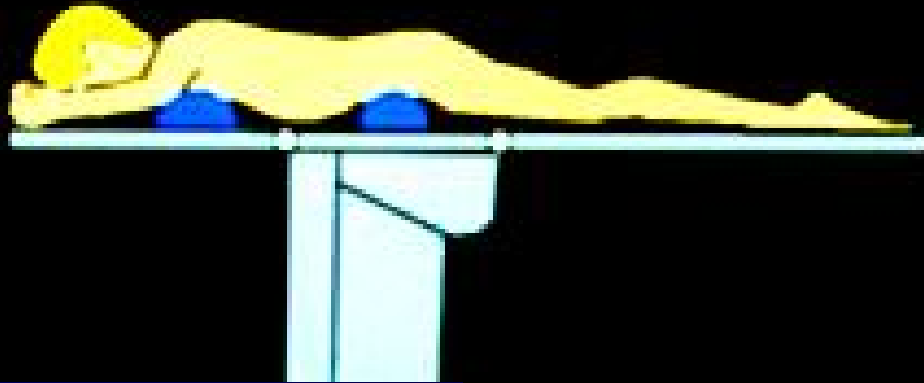
EGG SHELL

TRANSPEDICULAR EVIDEMENT

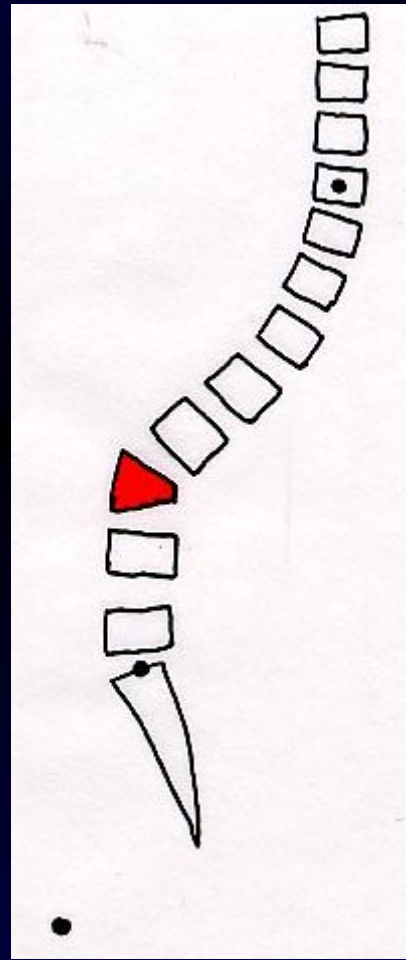
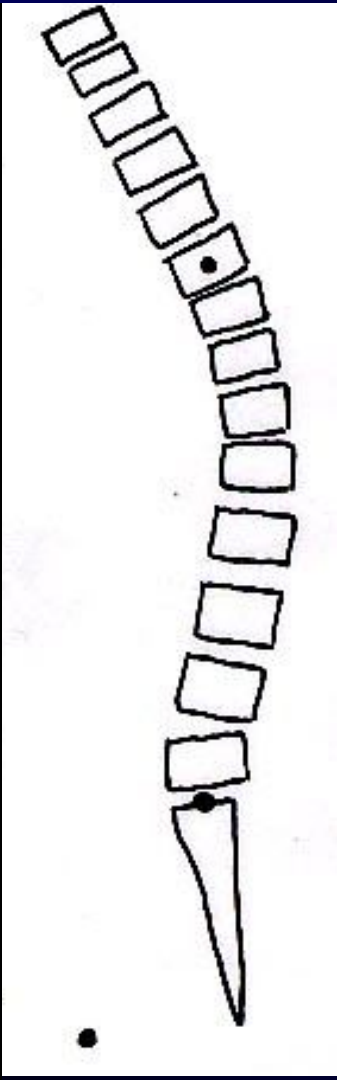
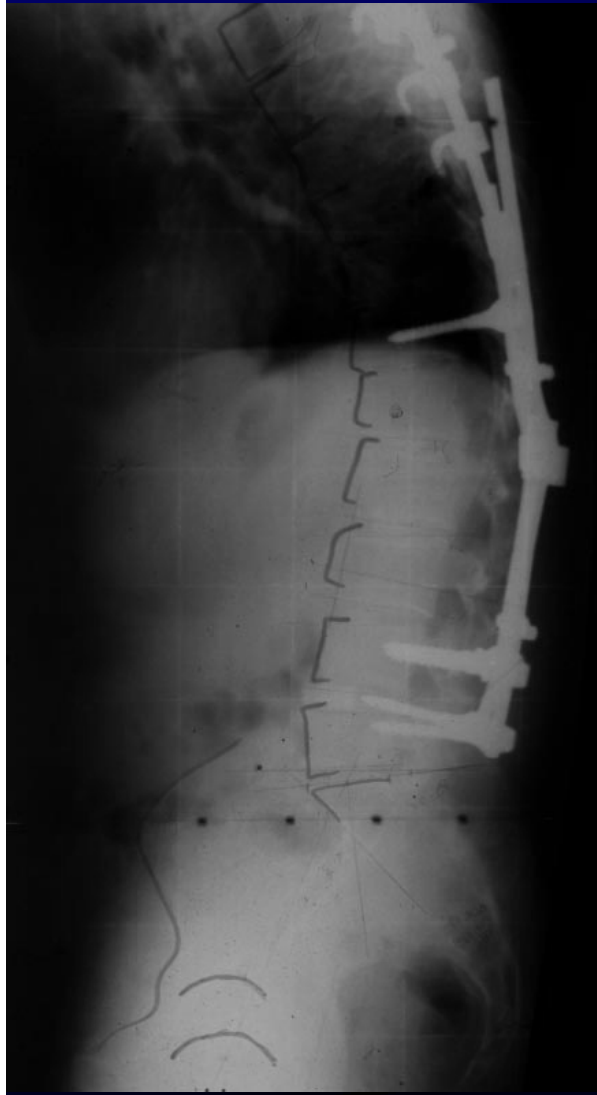
INSTRUMENTAL CLOSURE



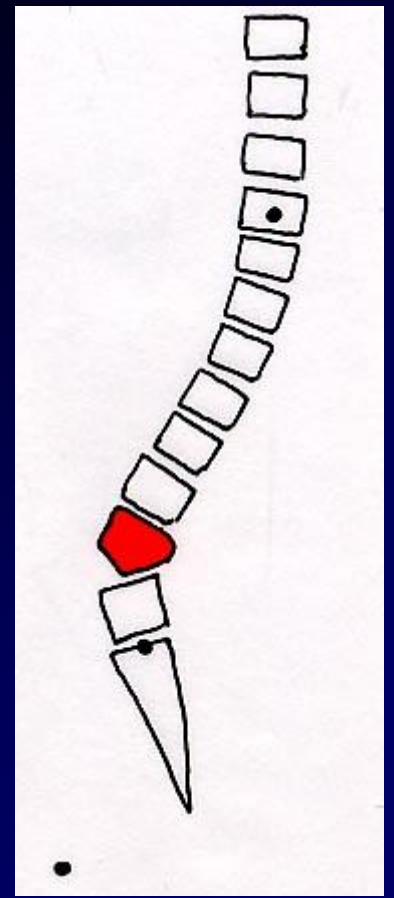
REDUCTION by the



MOVEMENTS of the O. TABLE

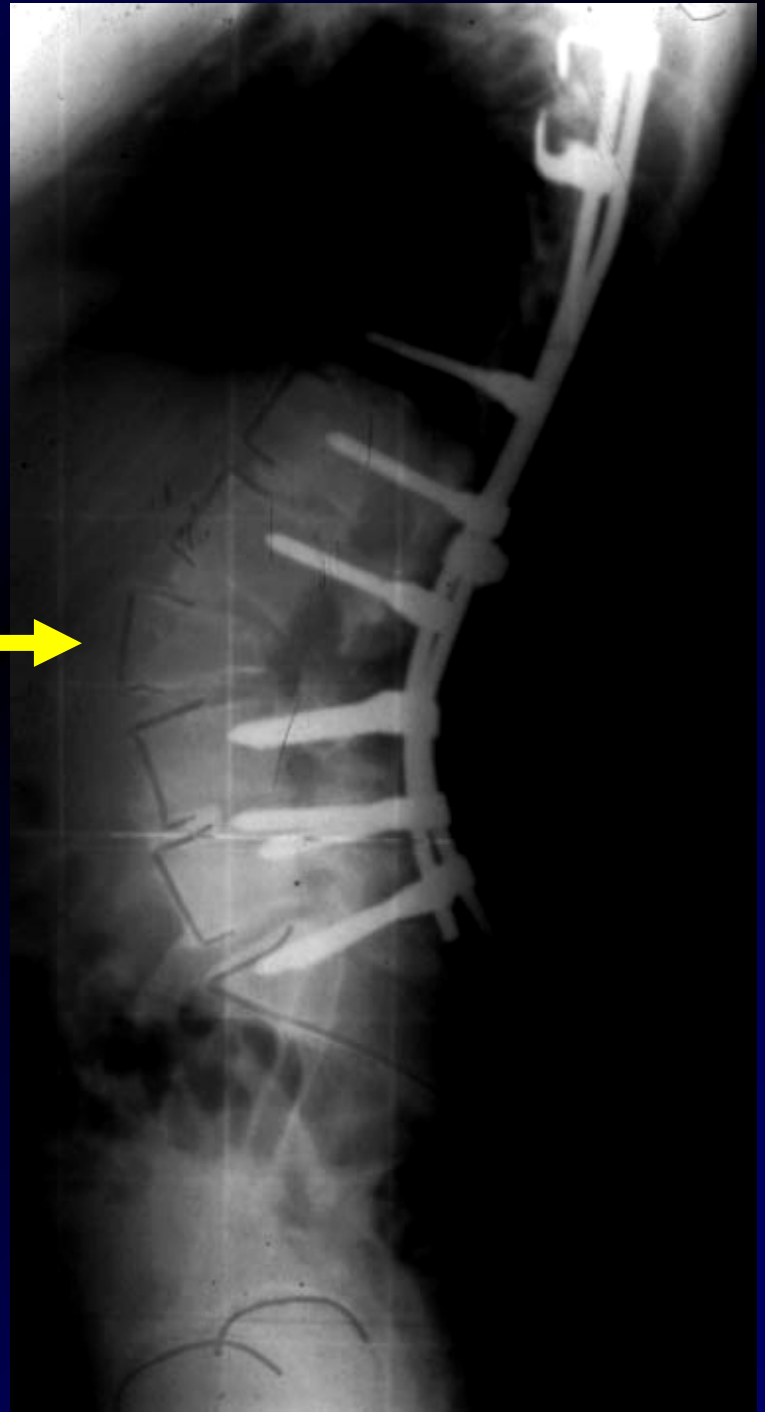
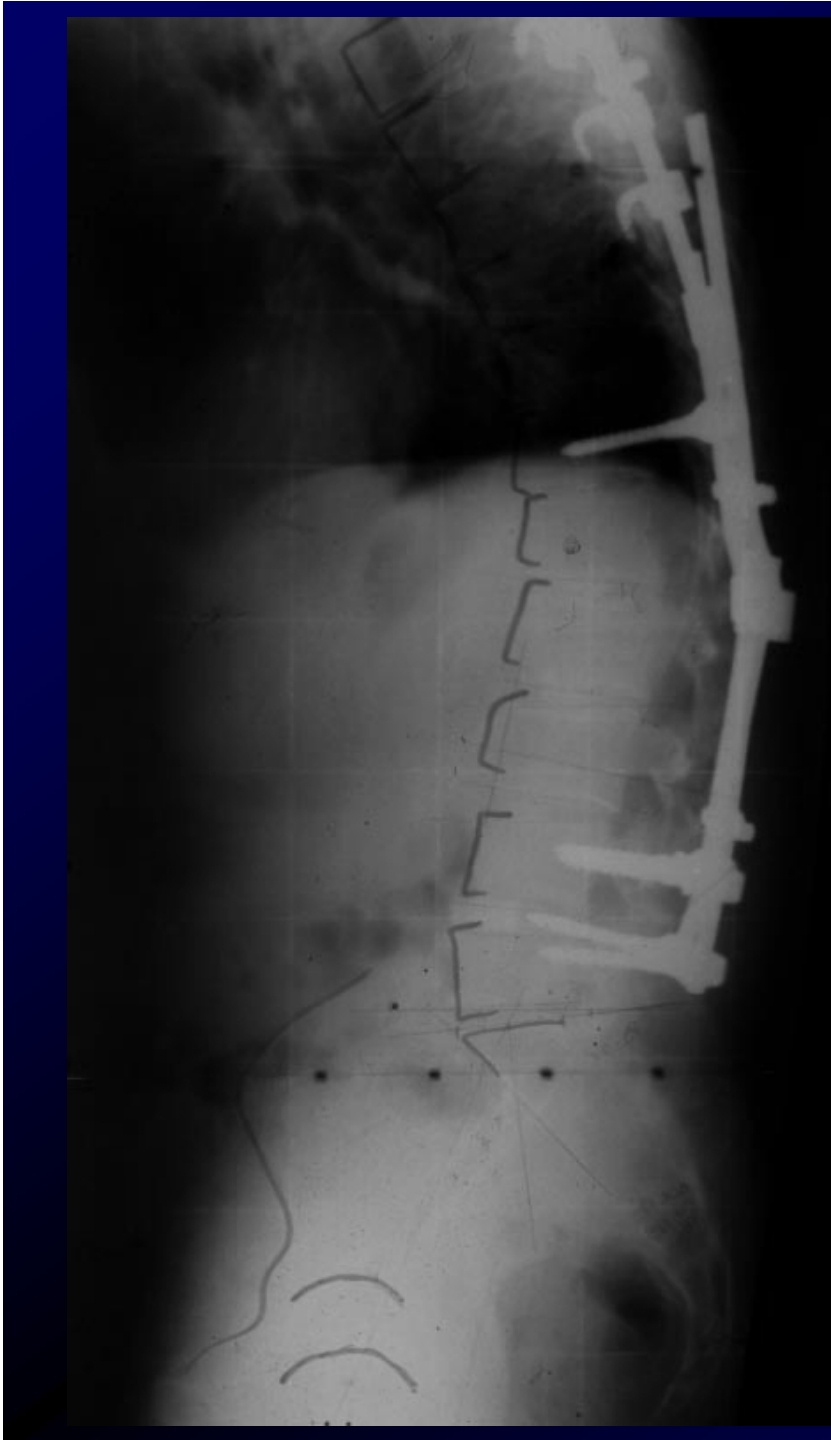


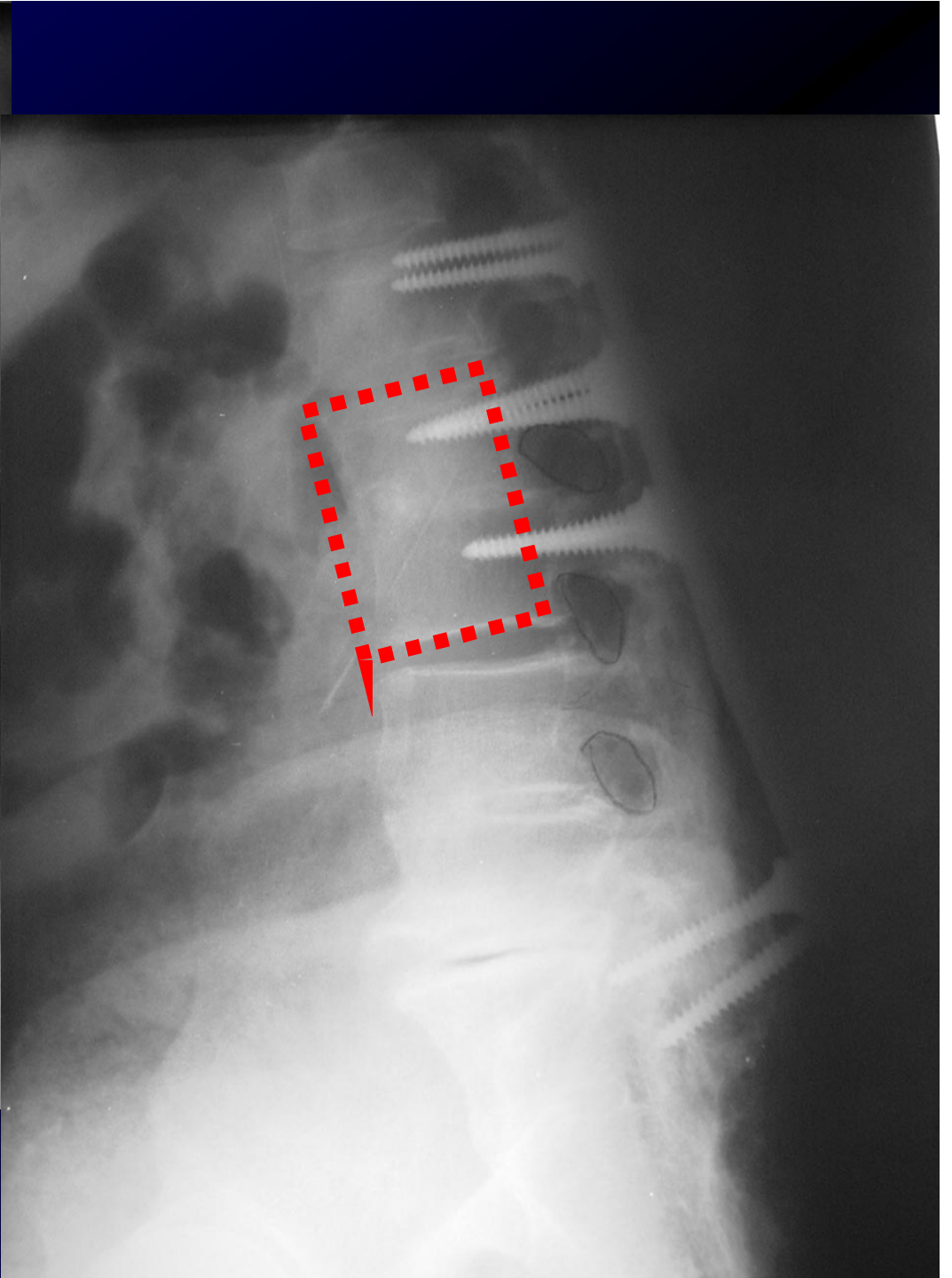
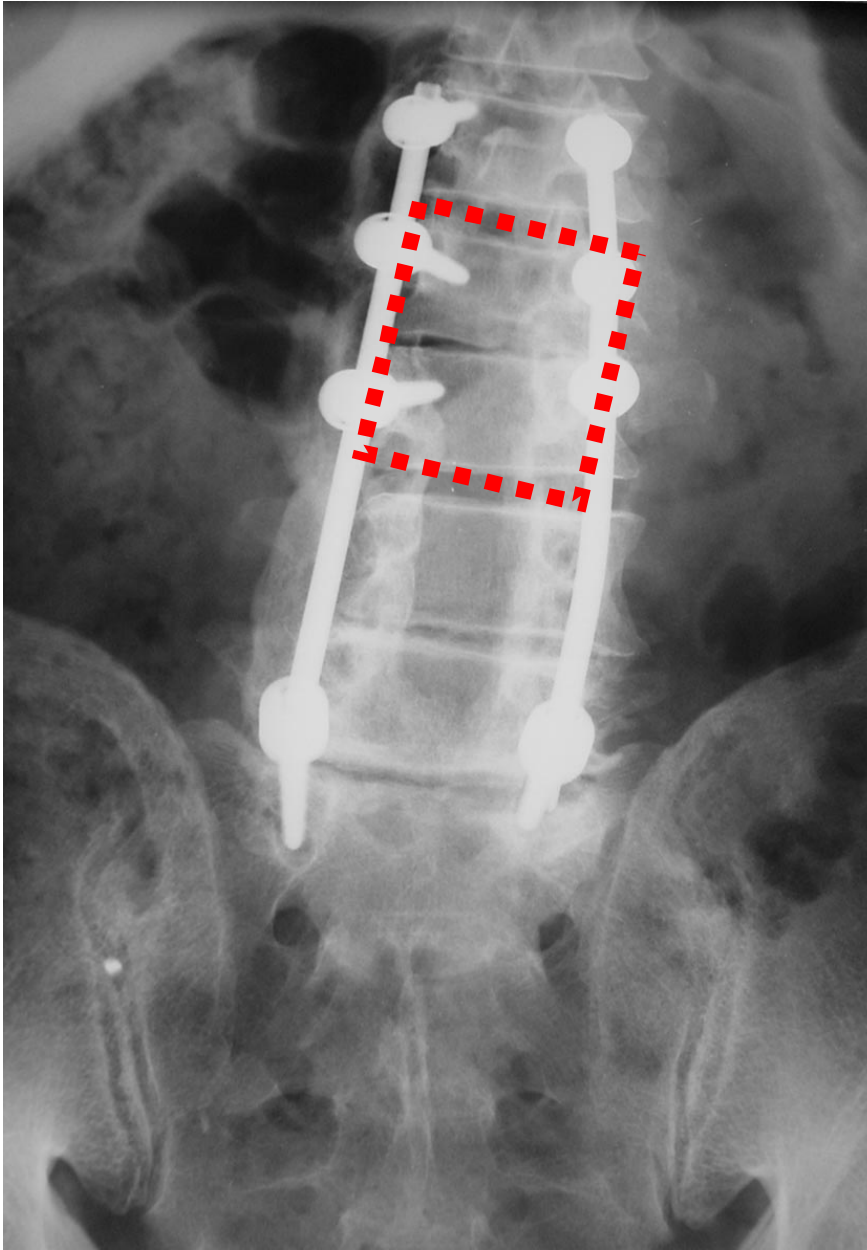
L4:26°



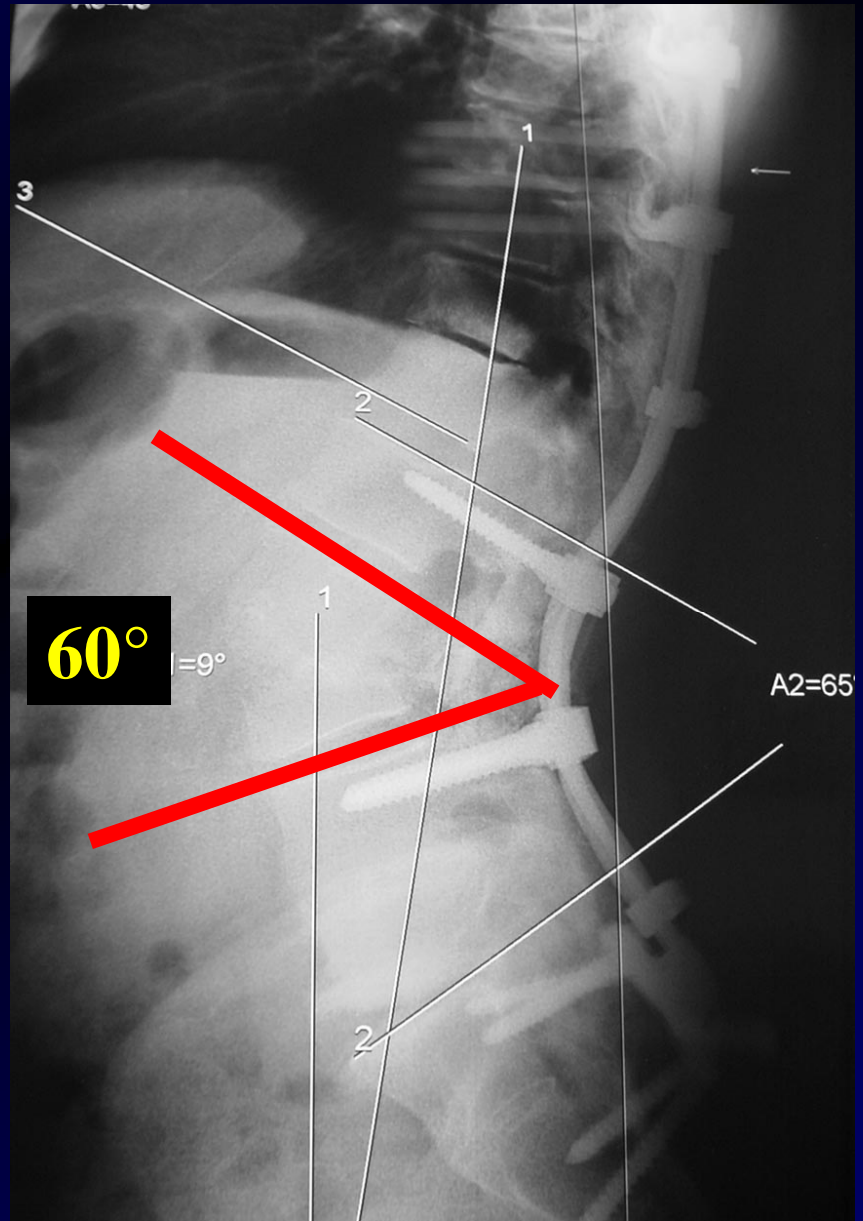
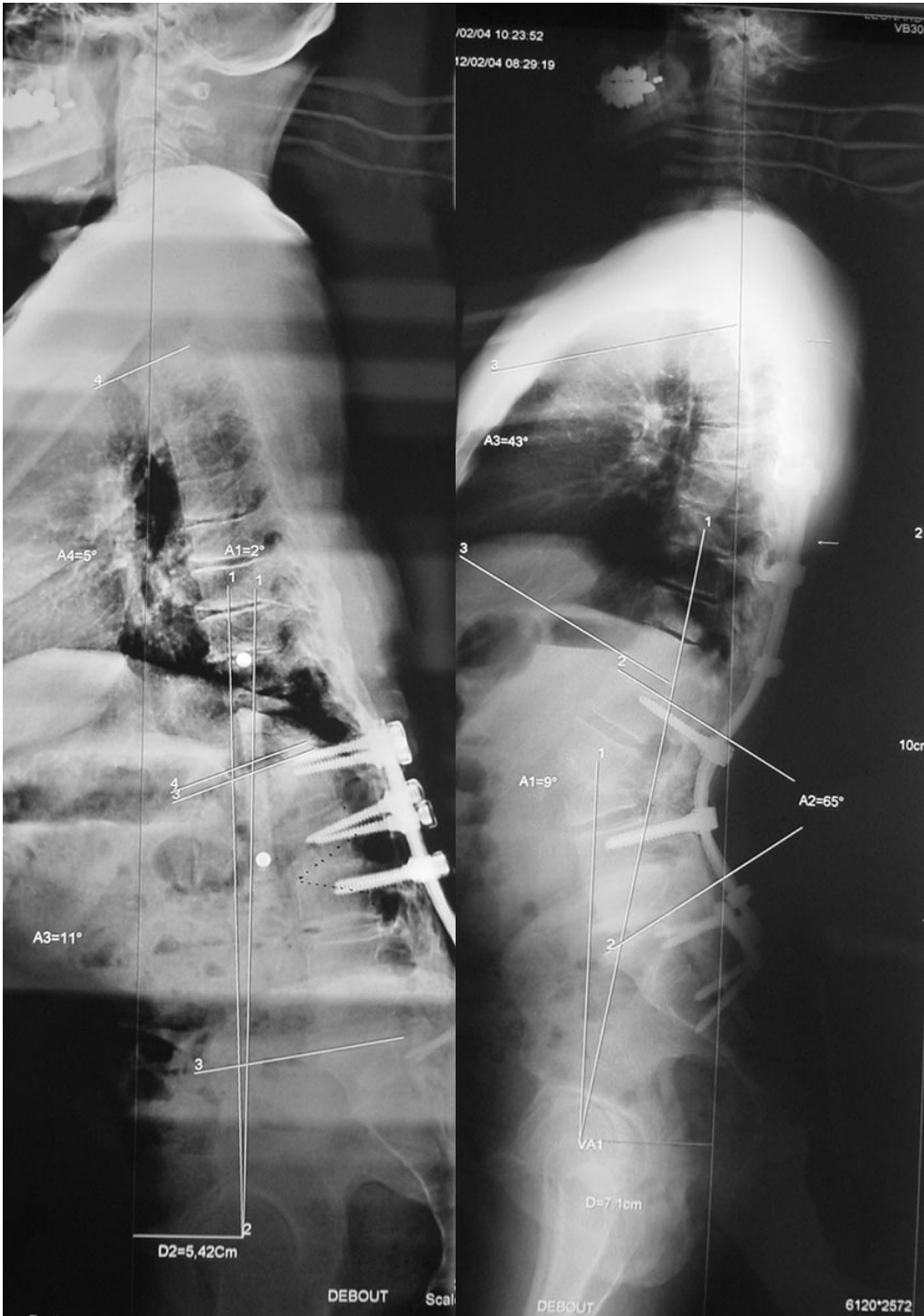
L3:42°

CASE 1





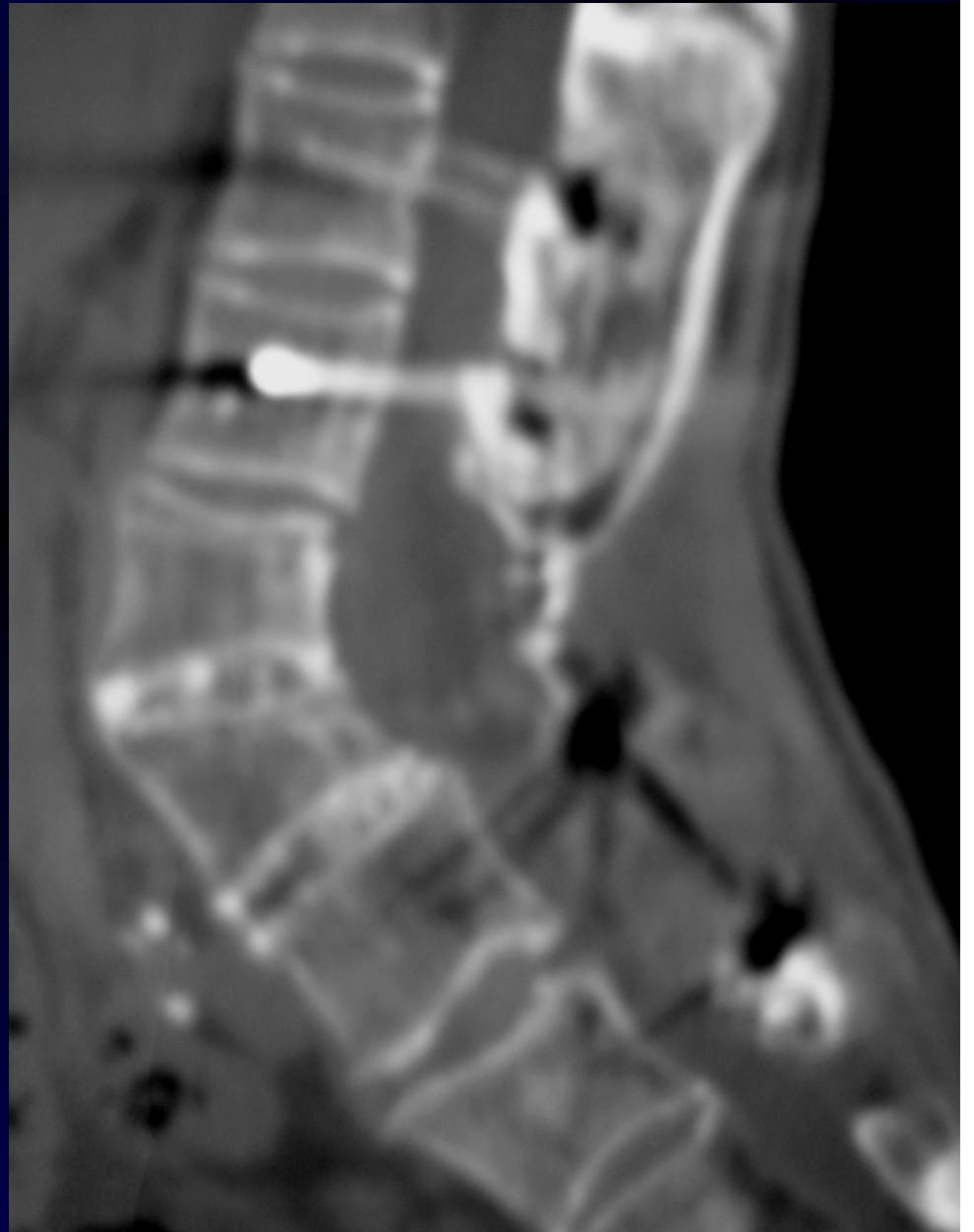
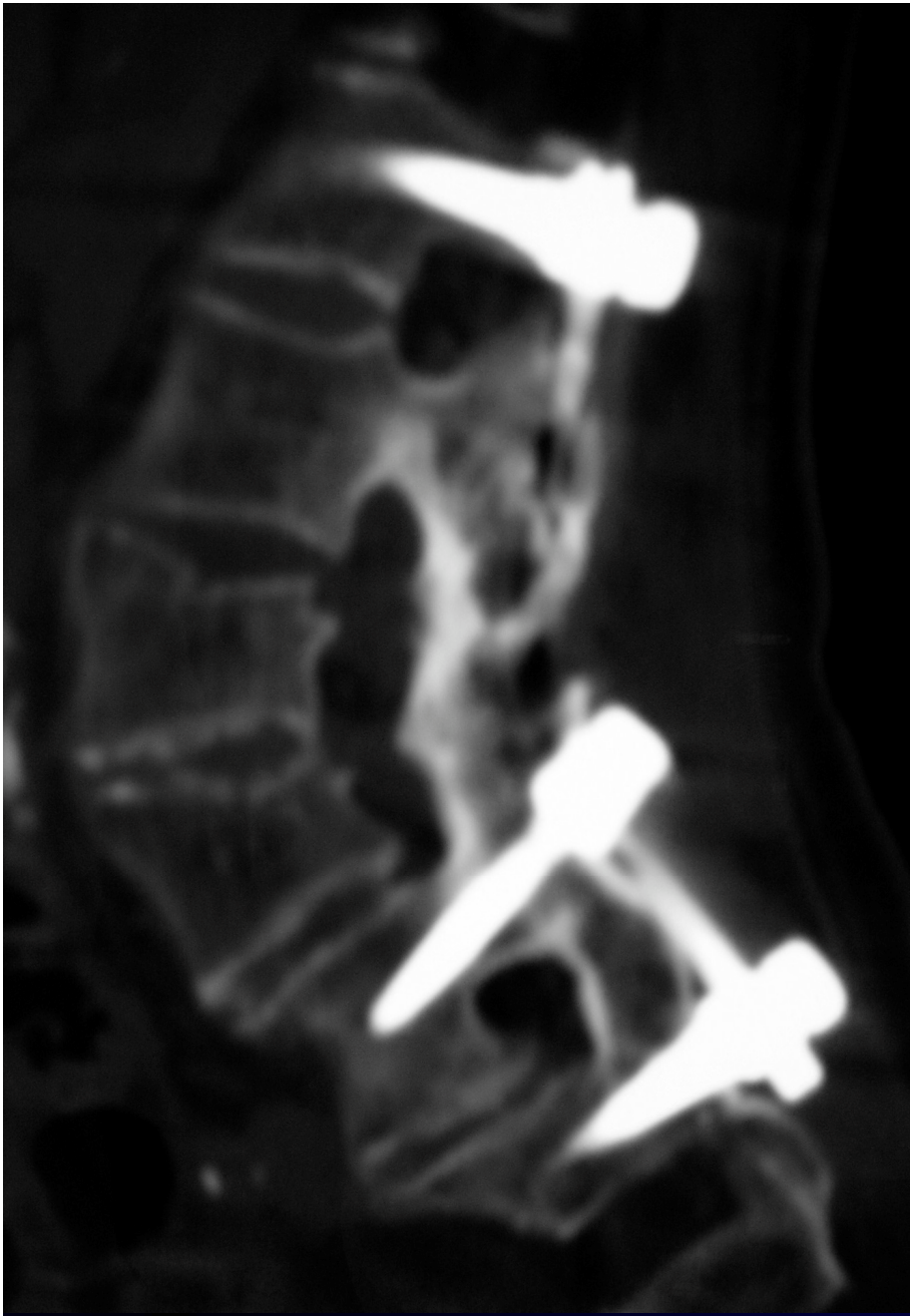
CASE 2

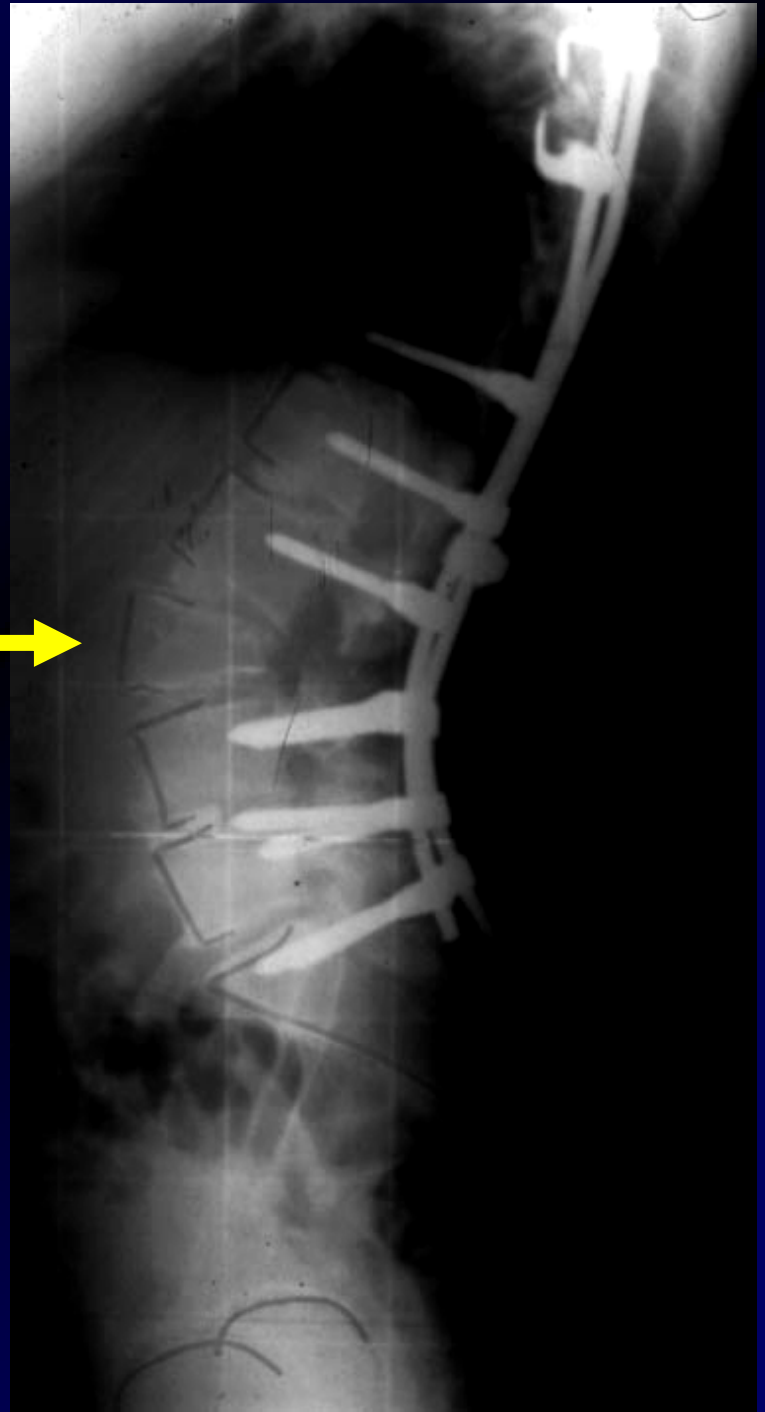
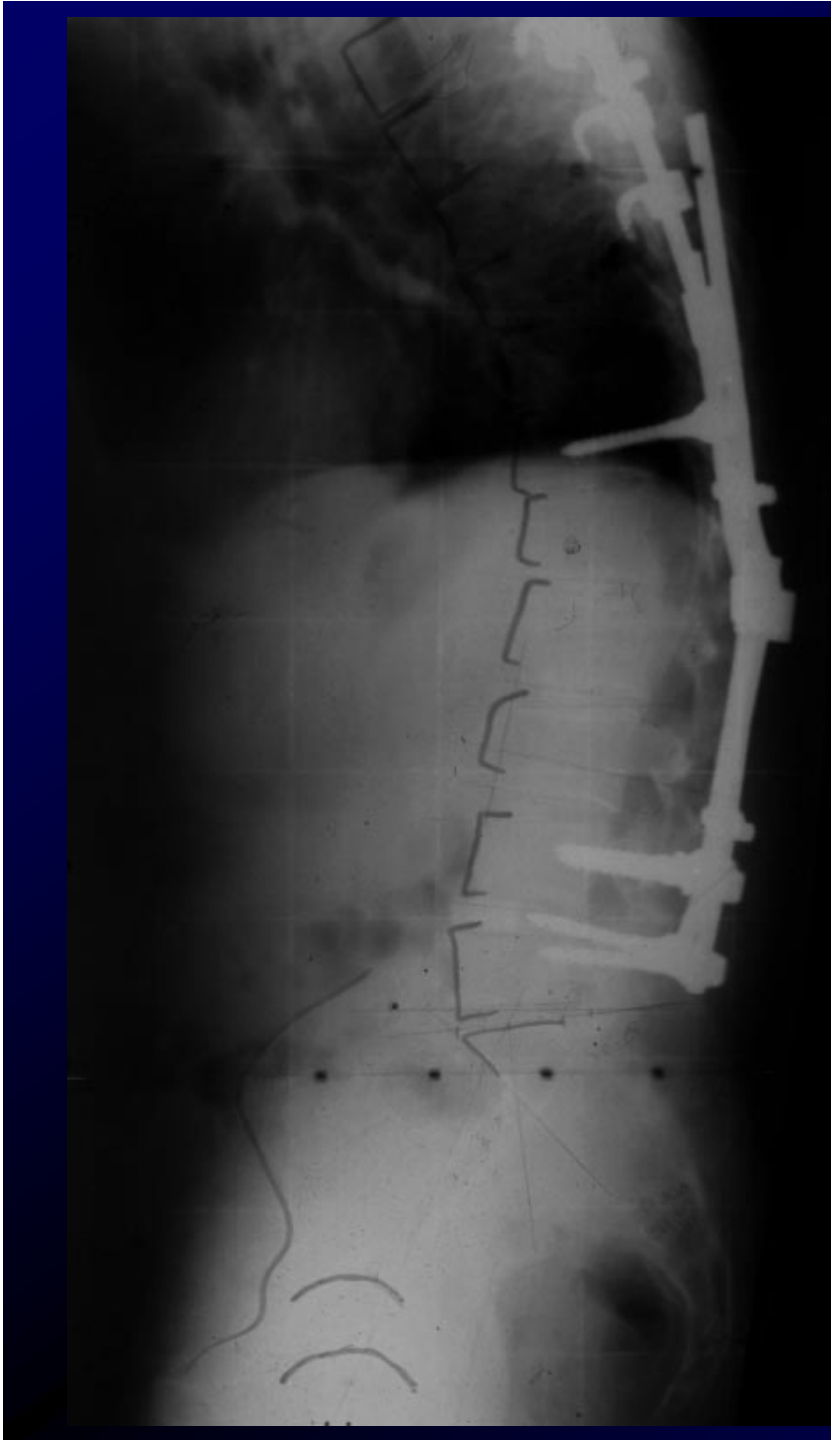


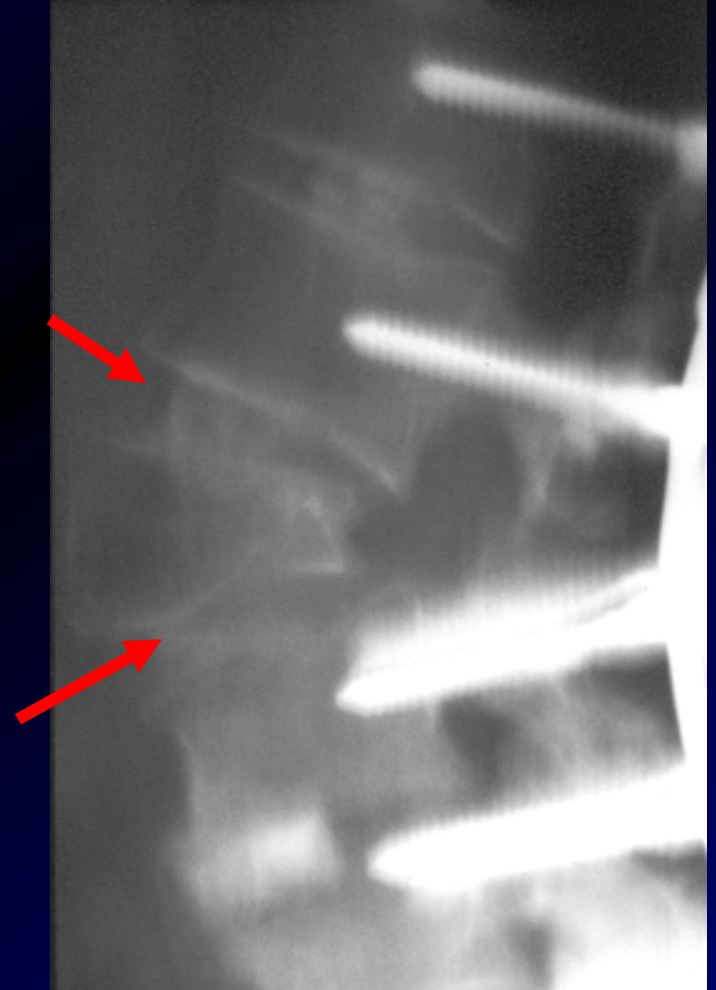
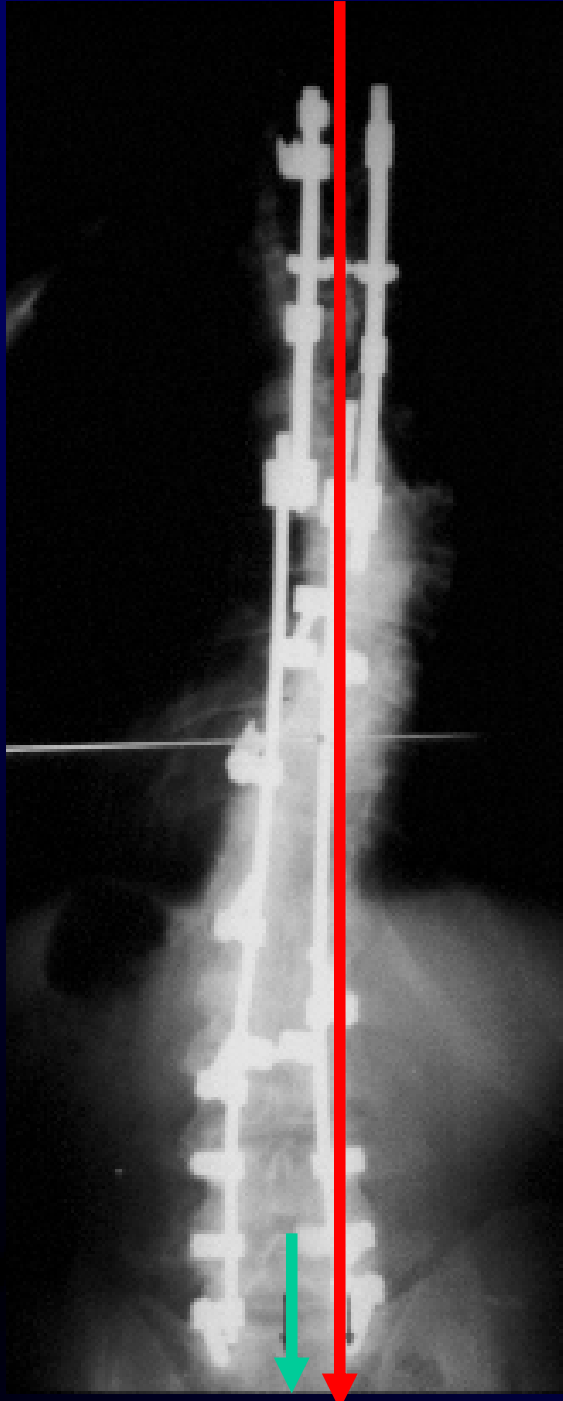


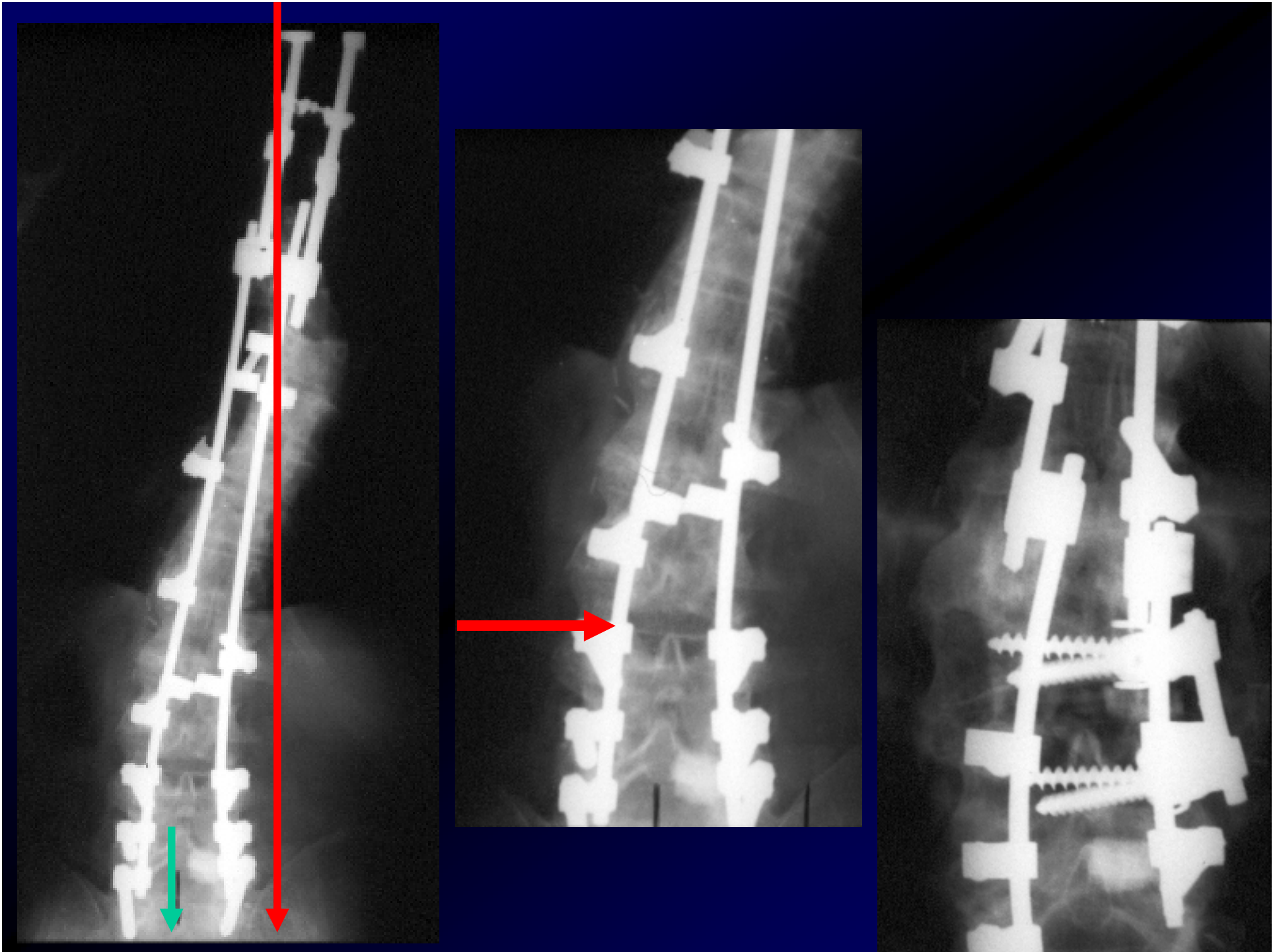
TRANSPEDICULAR OSTEOTOMY RISKS

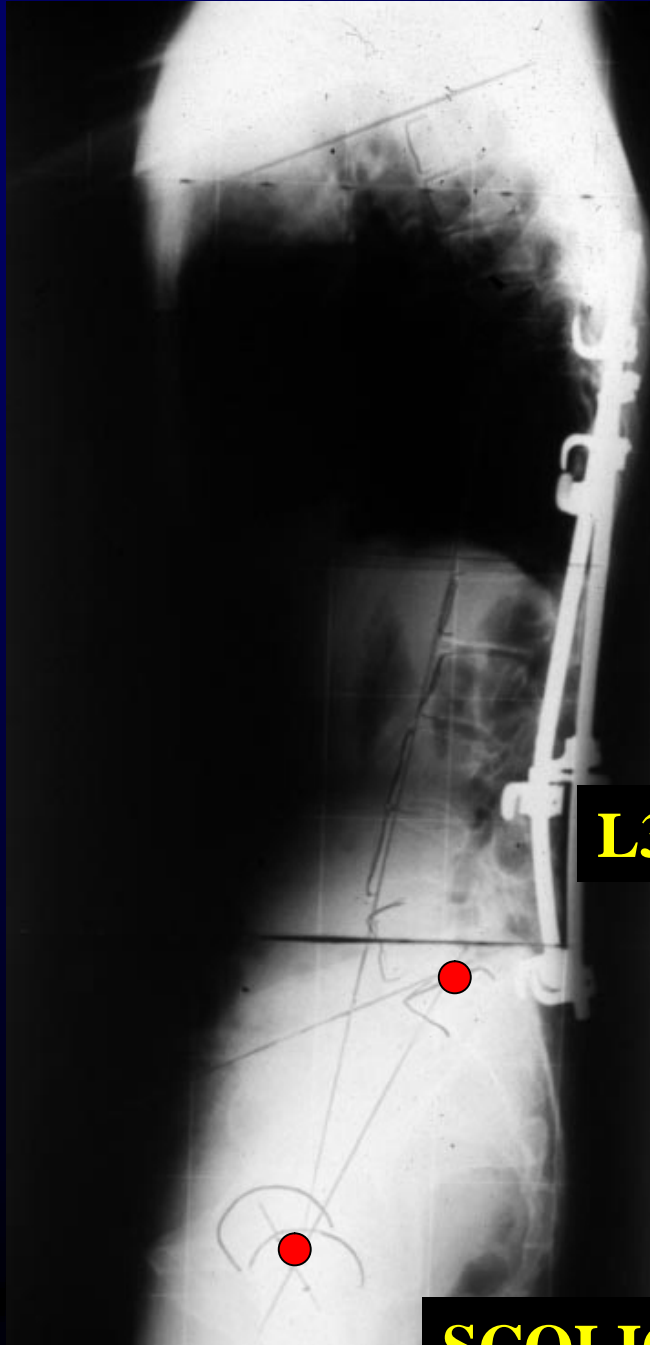
- **NEUROLOGIC DEFICIT (radicular , transitory)**
- **BLEEDING**
- **CSF LEAKAGE**
- **PSEUDARTHROSIS**
- **SEPSIS**







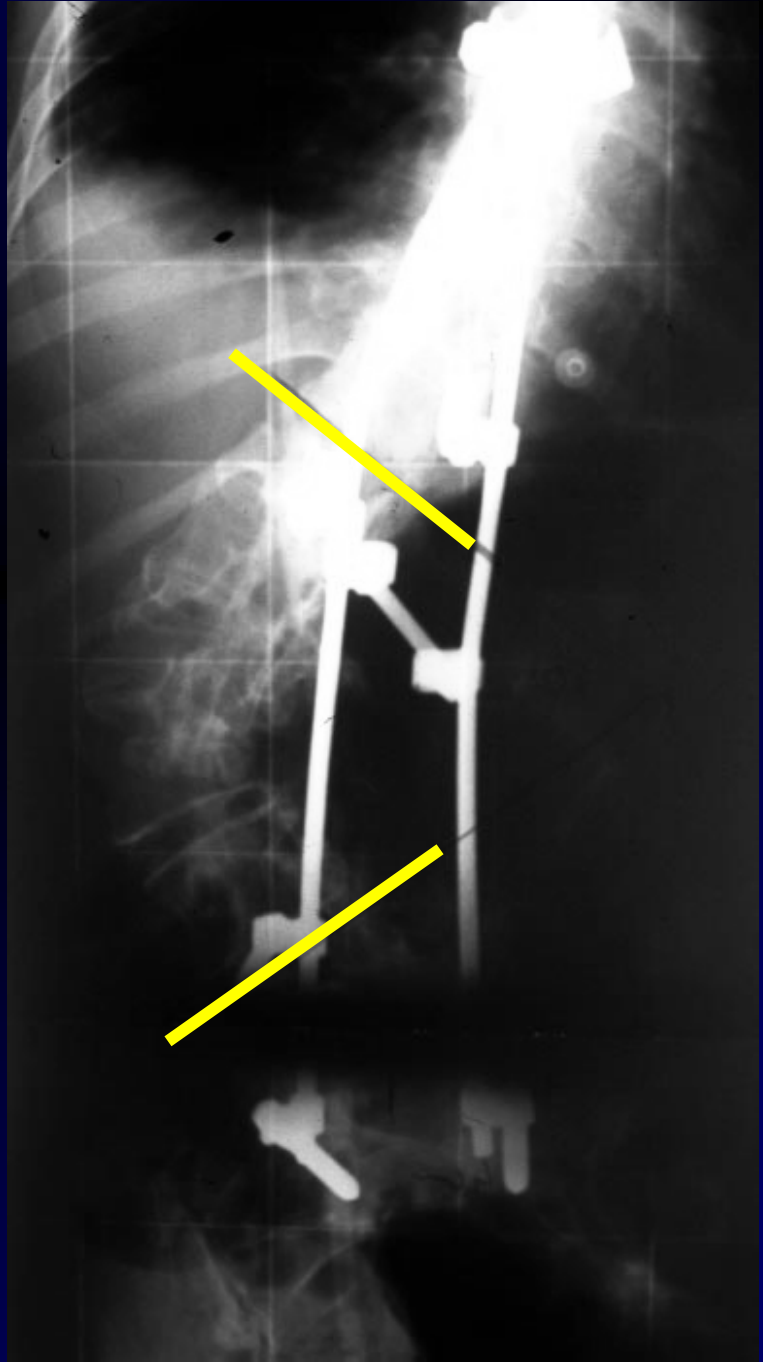


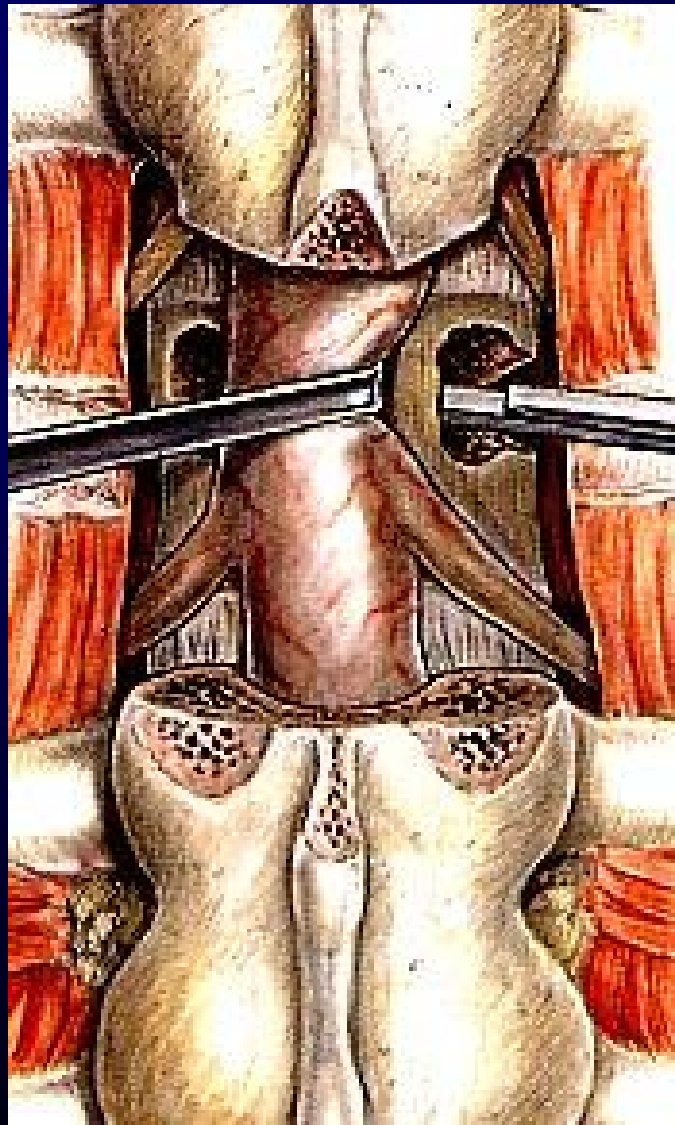


L3 OSTEOTOMY



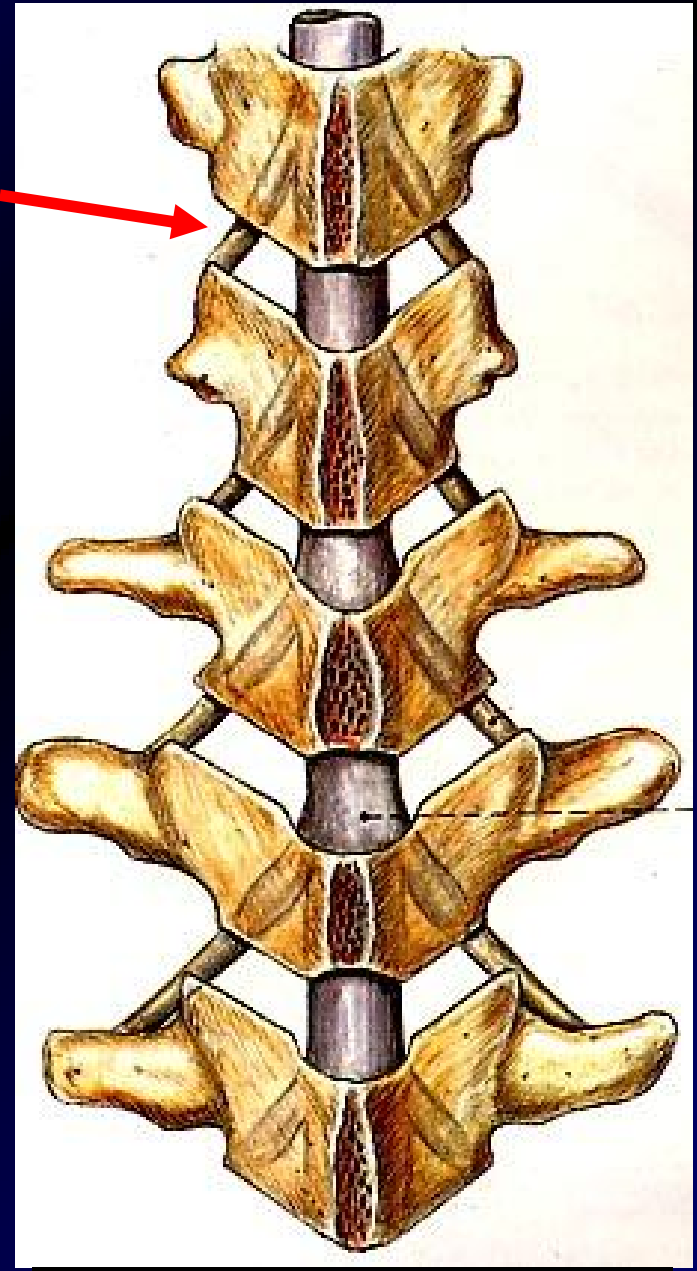
SCOLIOSIS WORSENING





TRANSPEDICULAR OSTEO.

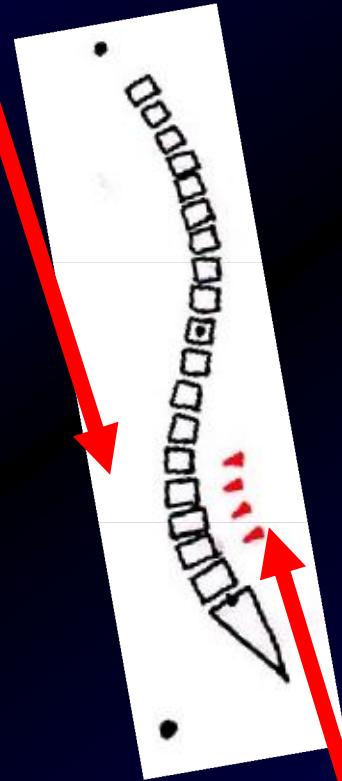
8° à 10°



MULTILEVEL O.



ANTERIOR RELEASE



4 LEVELS POST. OST.

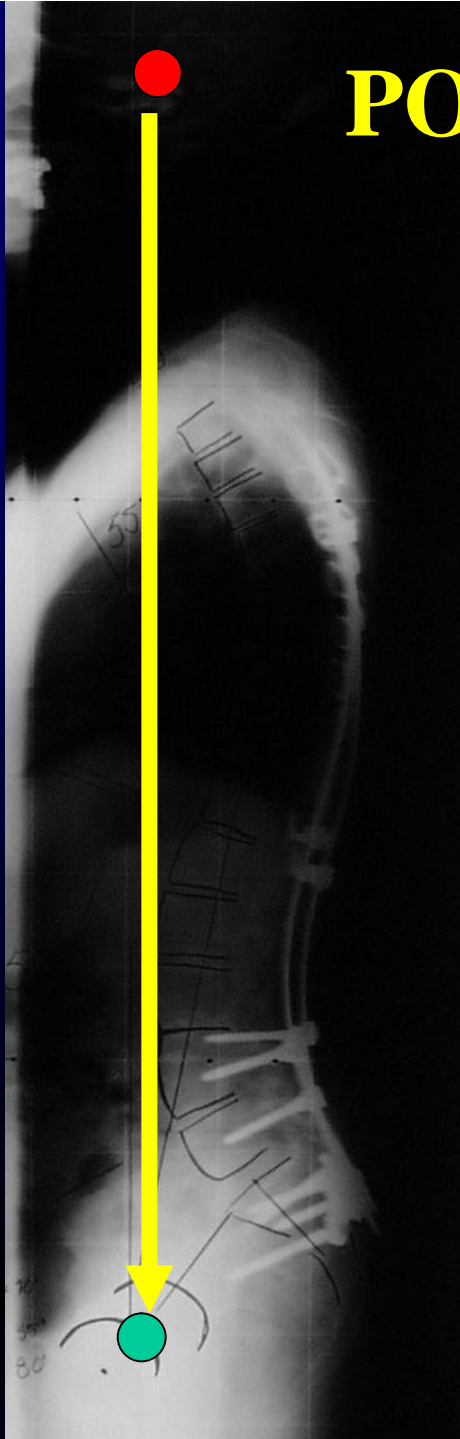


PRE OPERATIVE WALKING



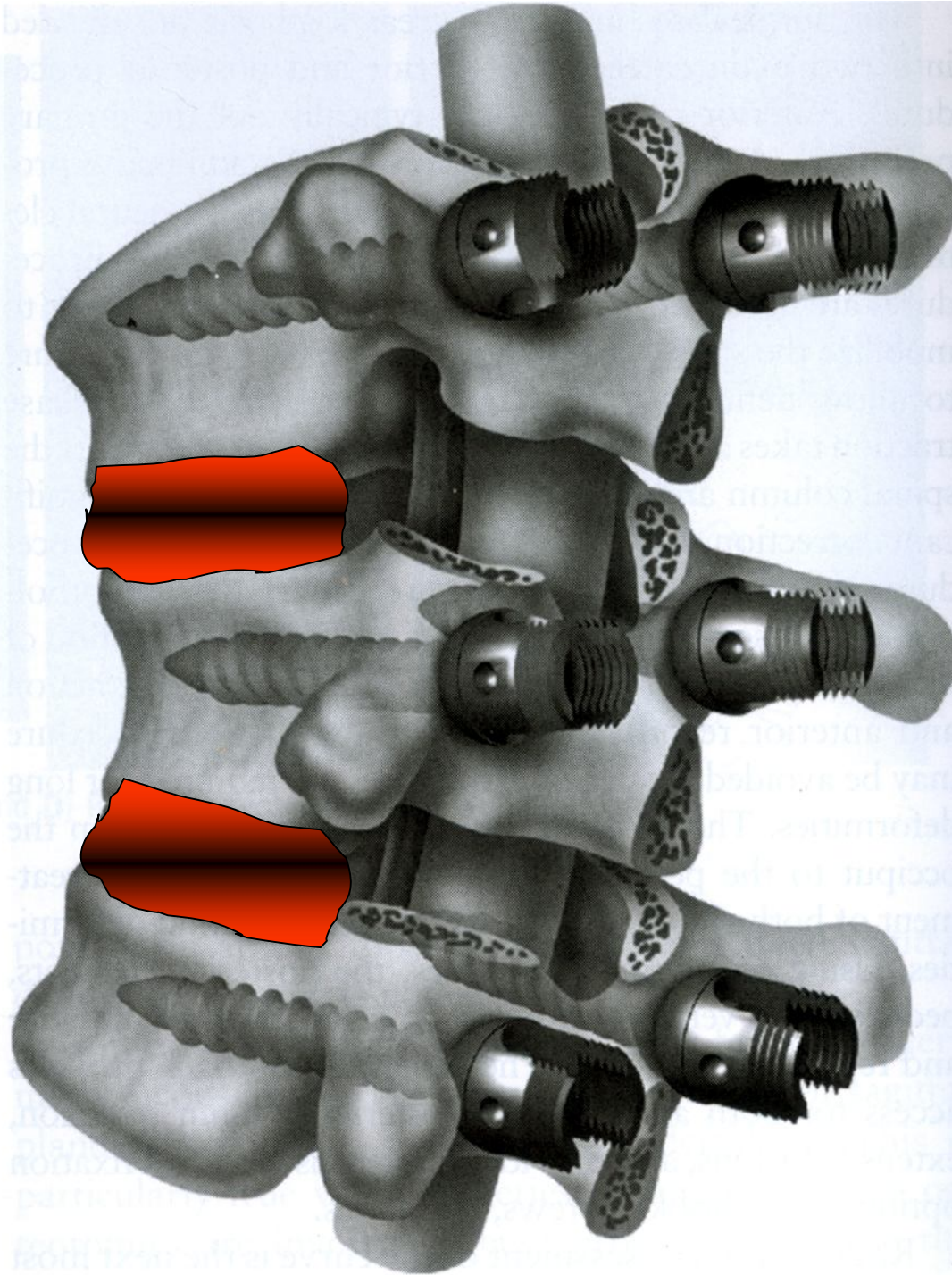
QuickTime™ et un
décodeur Cinepak Codec par Radius[32]
sont requis pour visionner cette image.

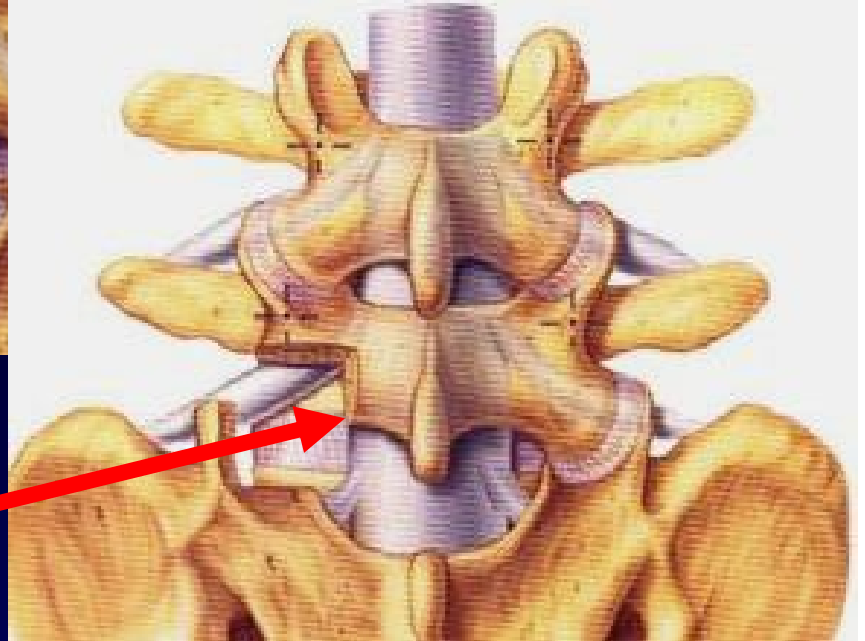
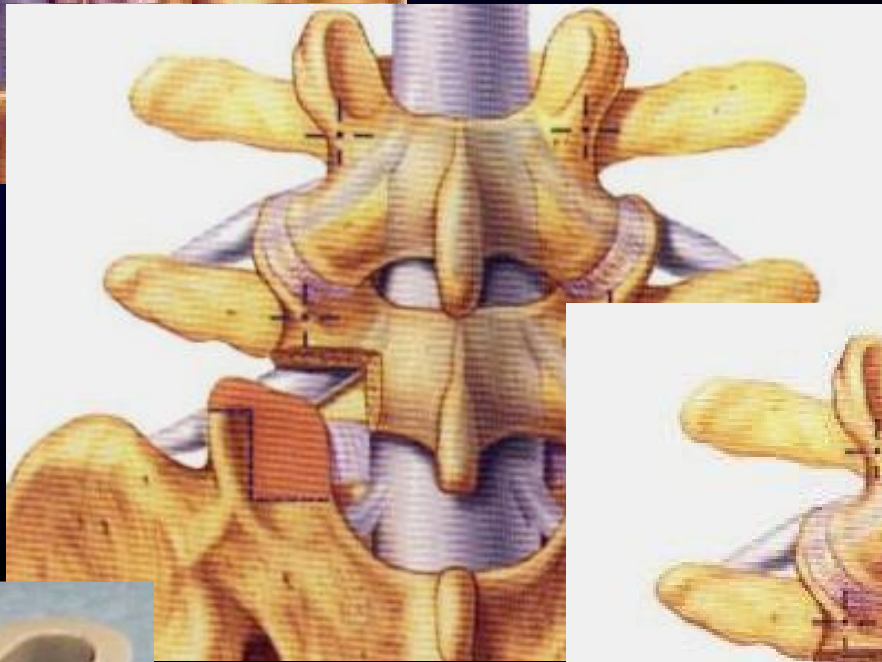
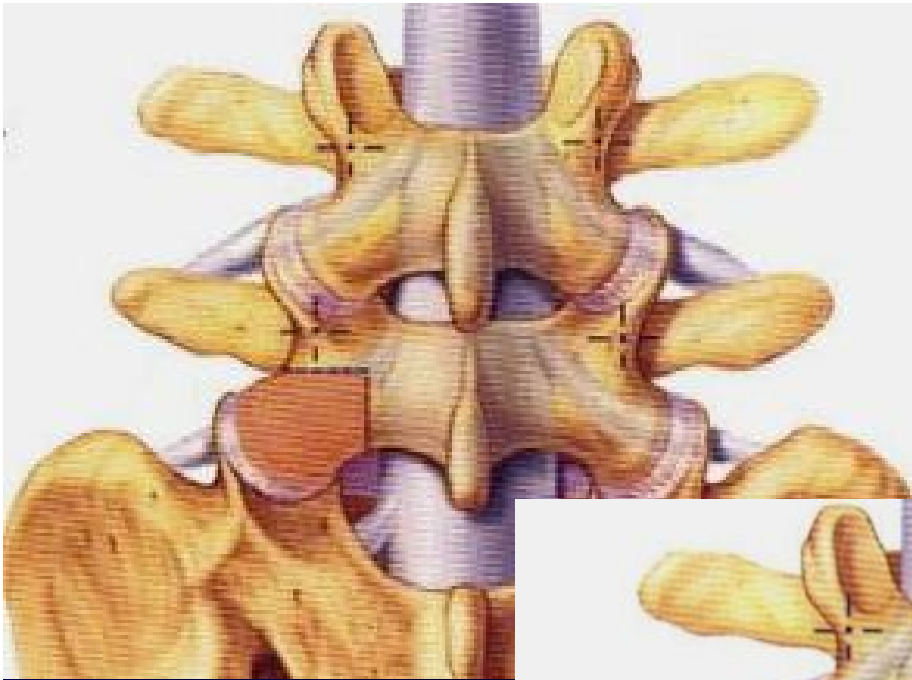
POSTOPERATIVE WALKING

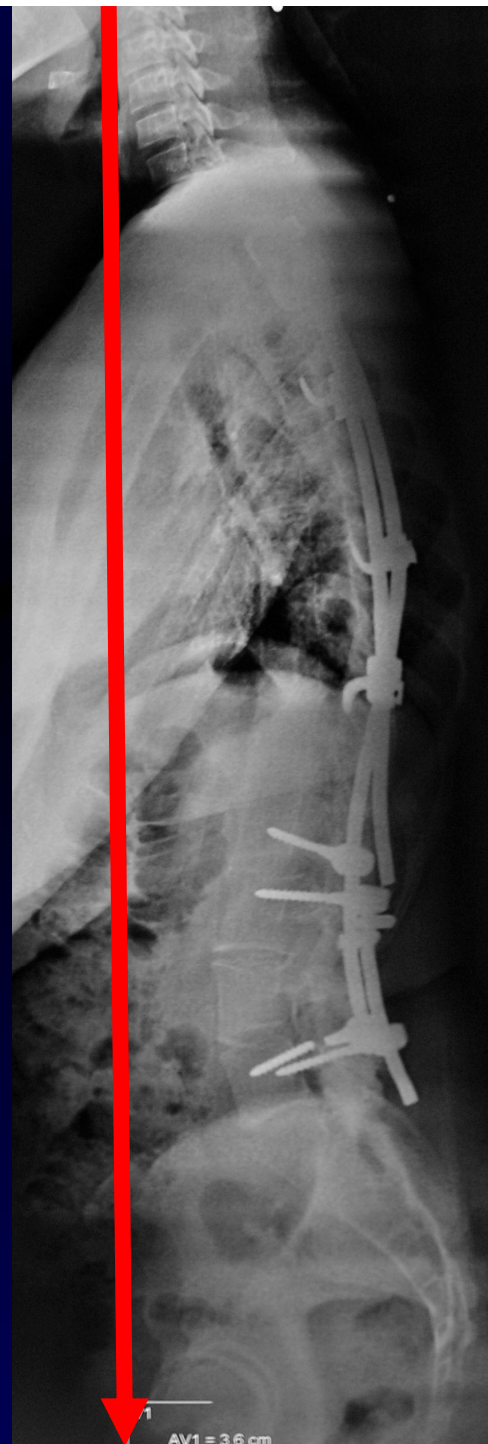
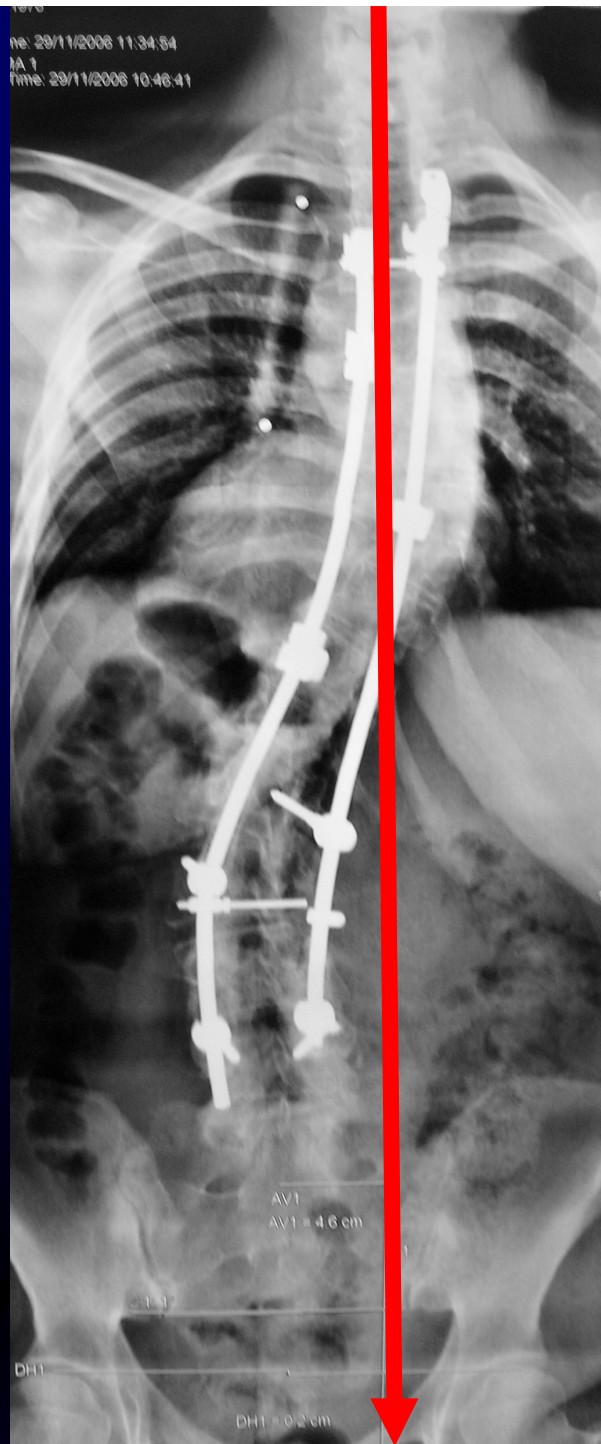


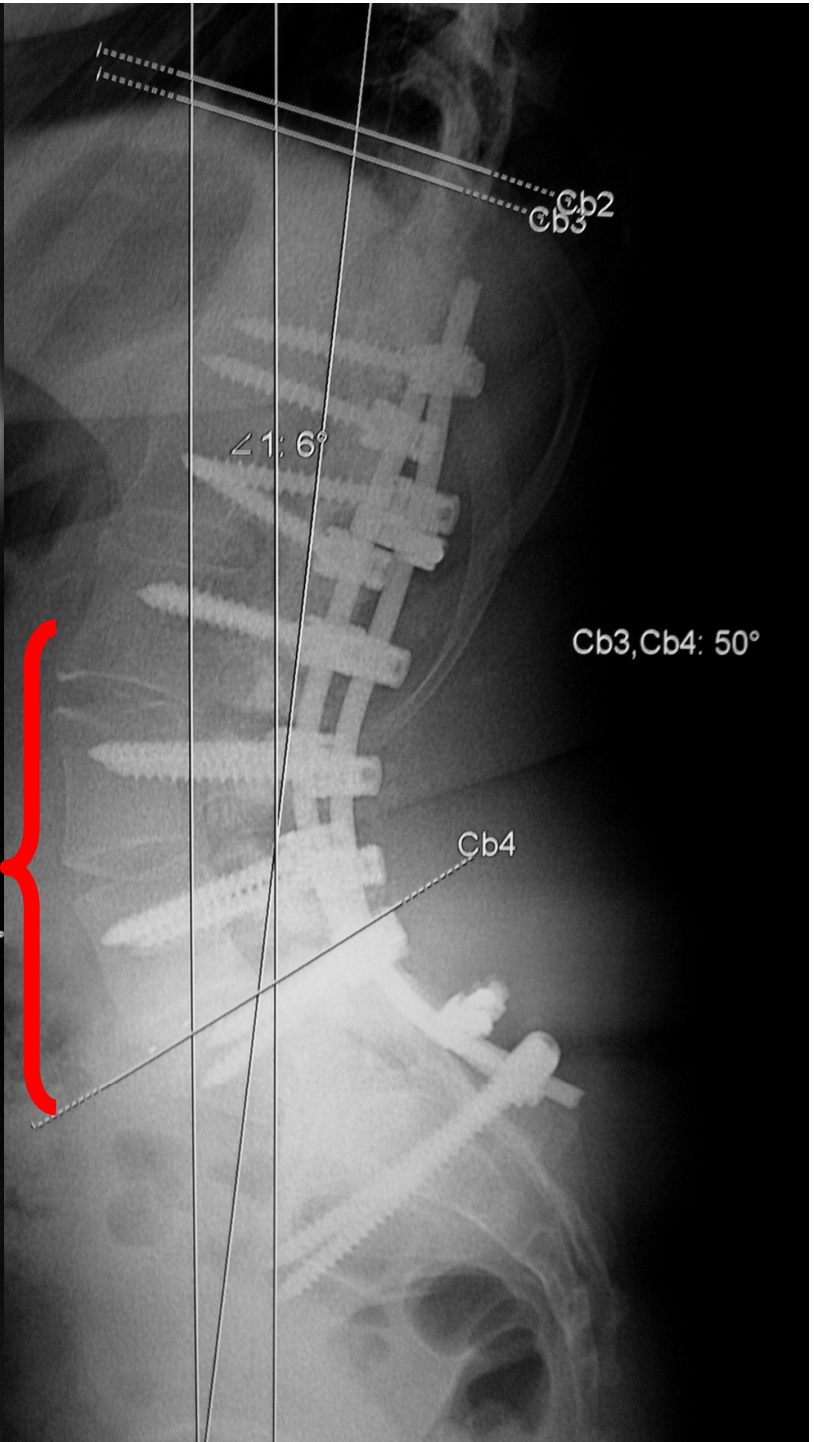
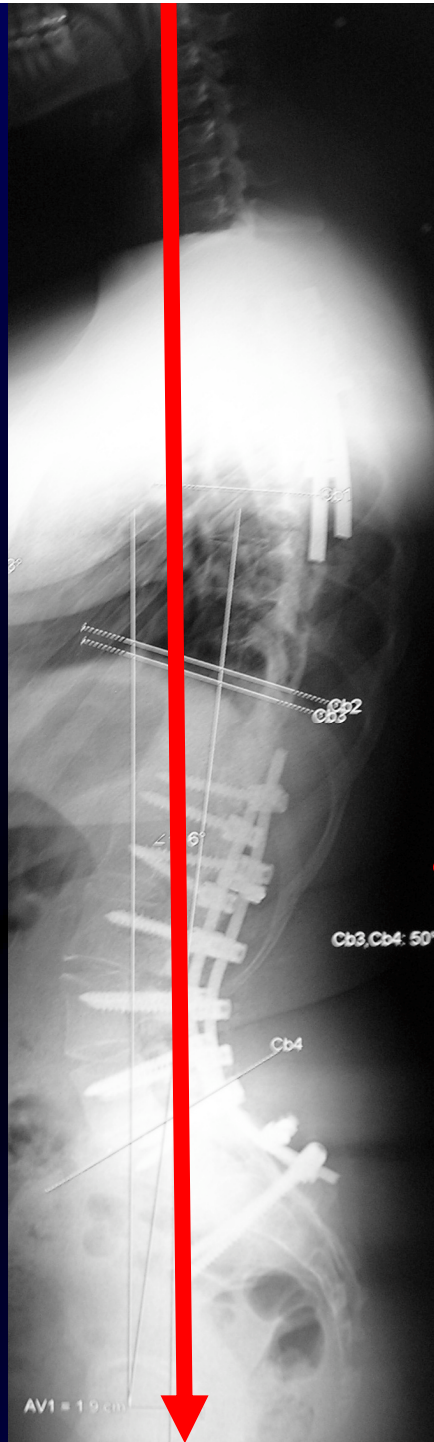
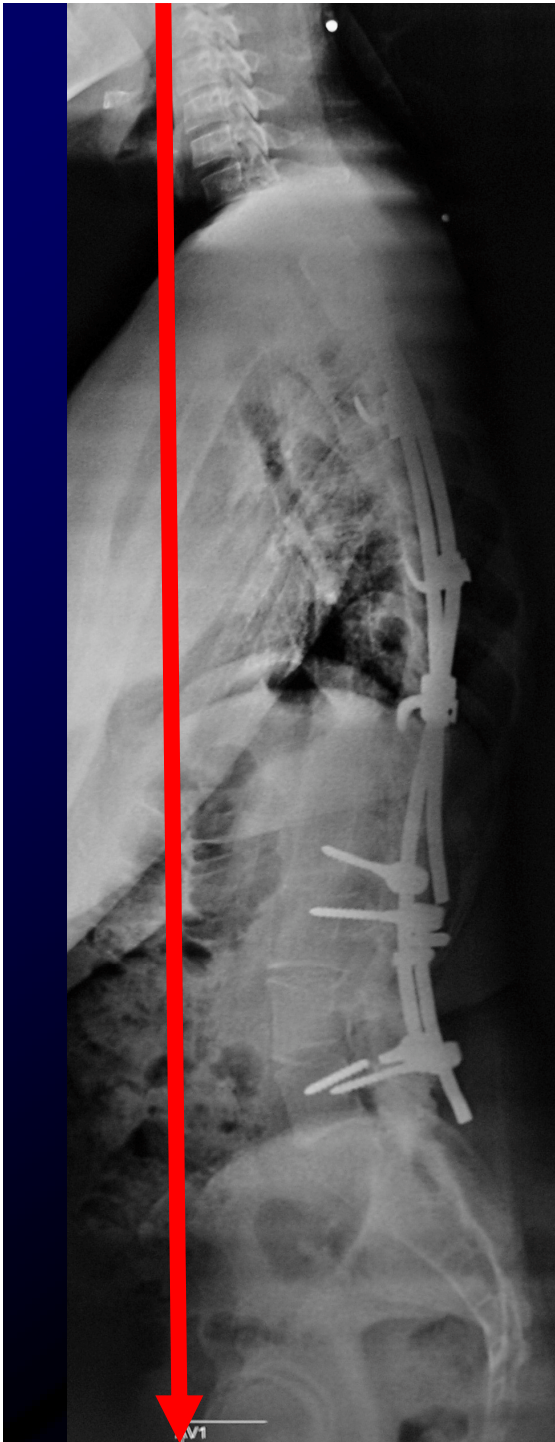
QuickTime™ et un
décompresseur H.263
sont requis pour visionner cette image.

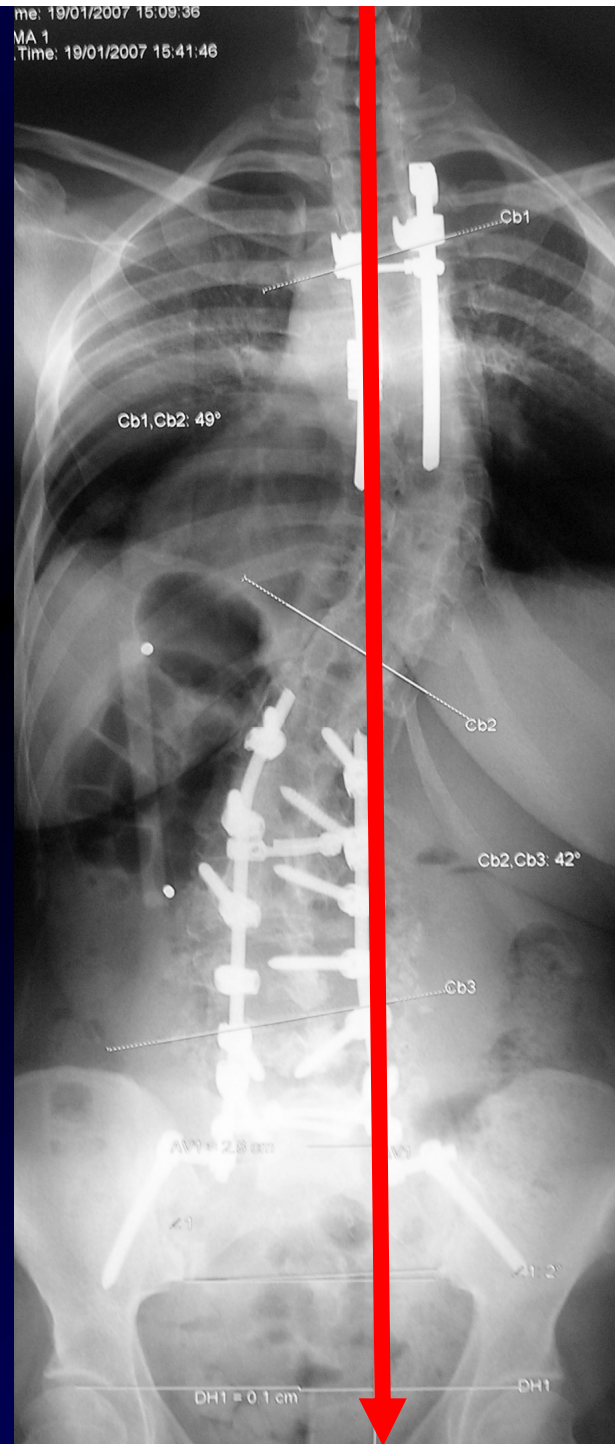
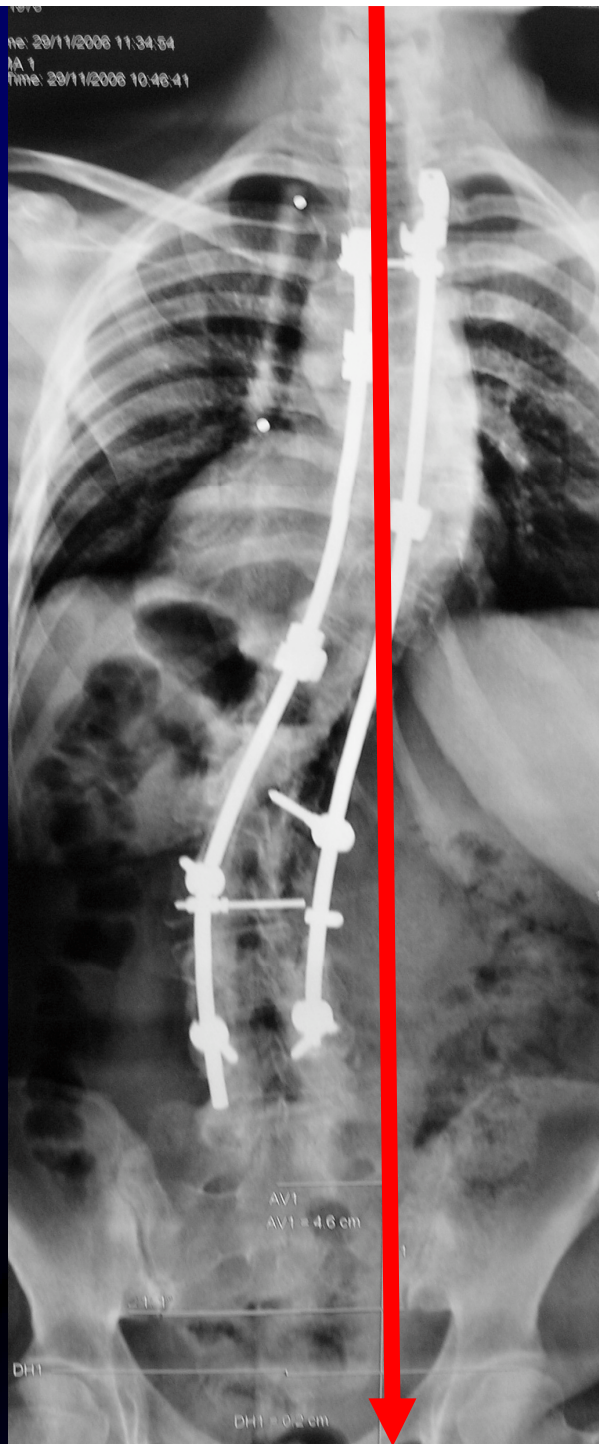
T.L.I.F.

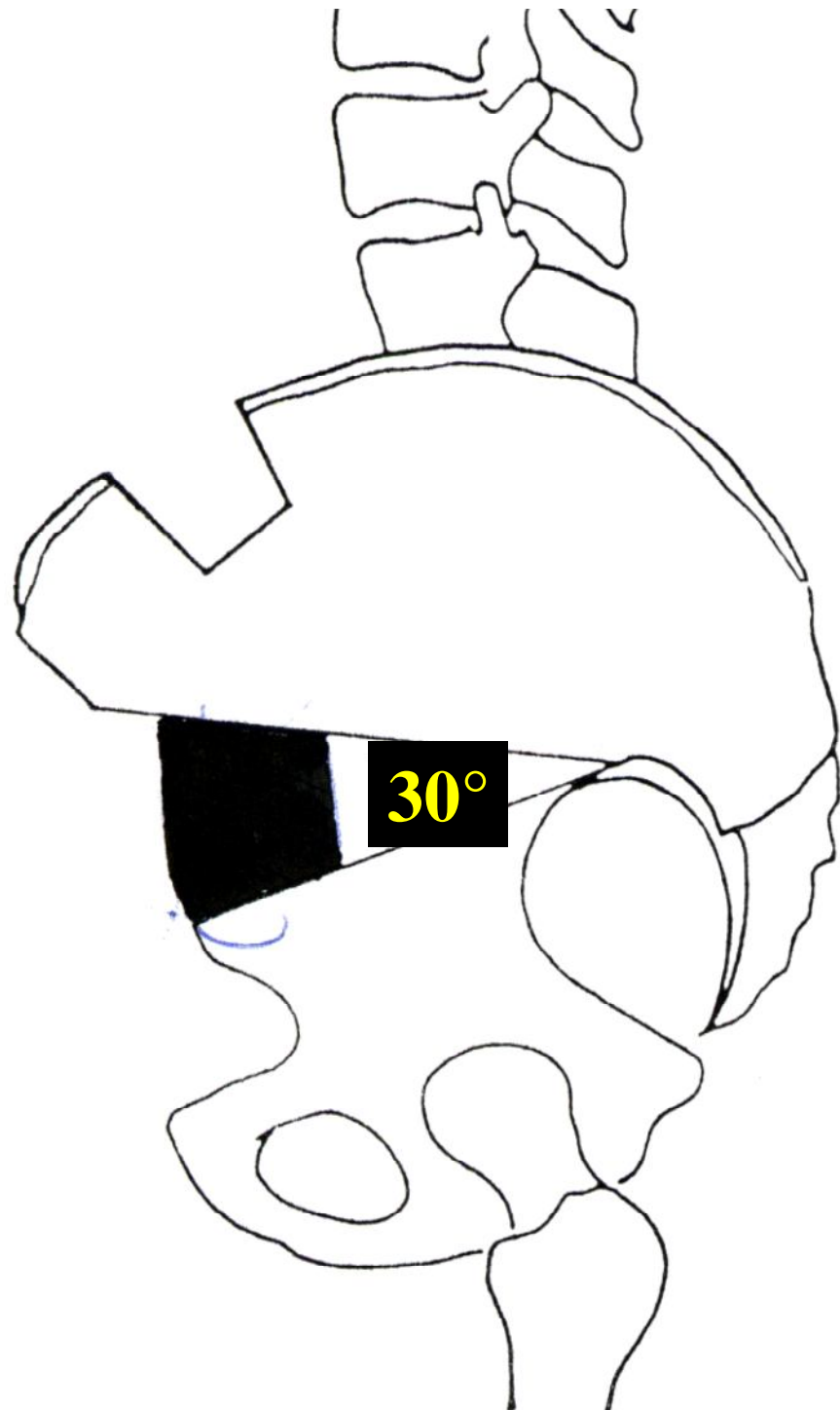










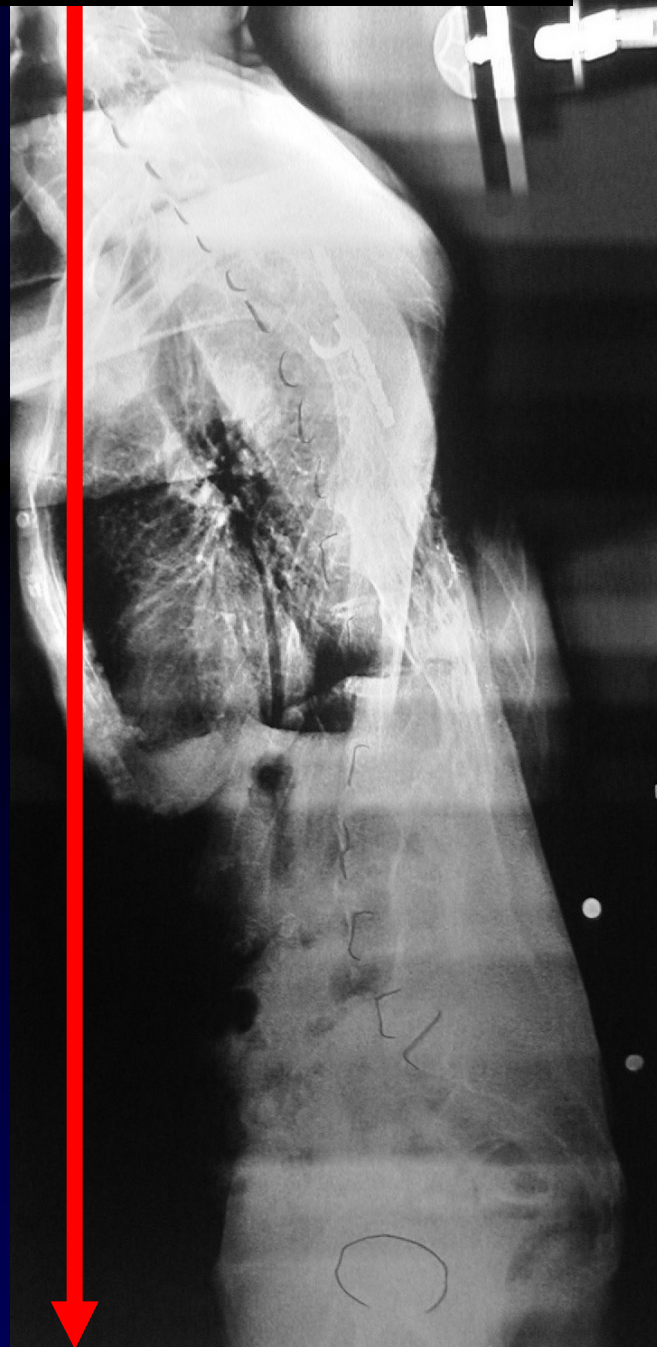
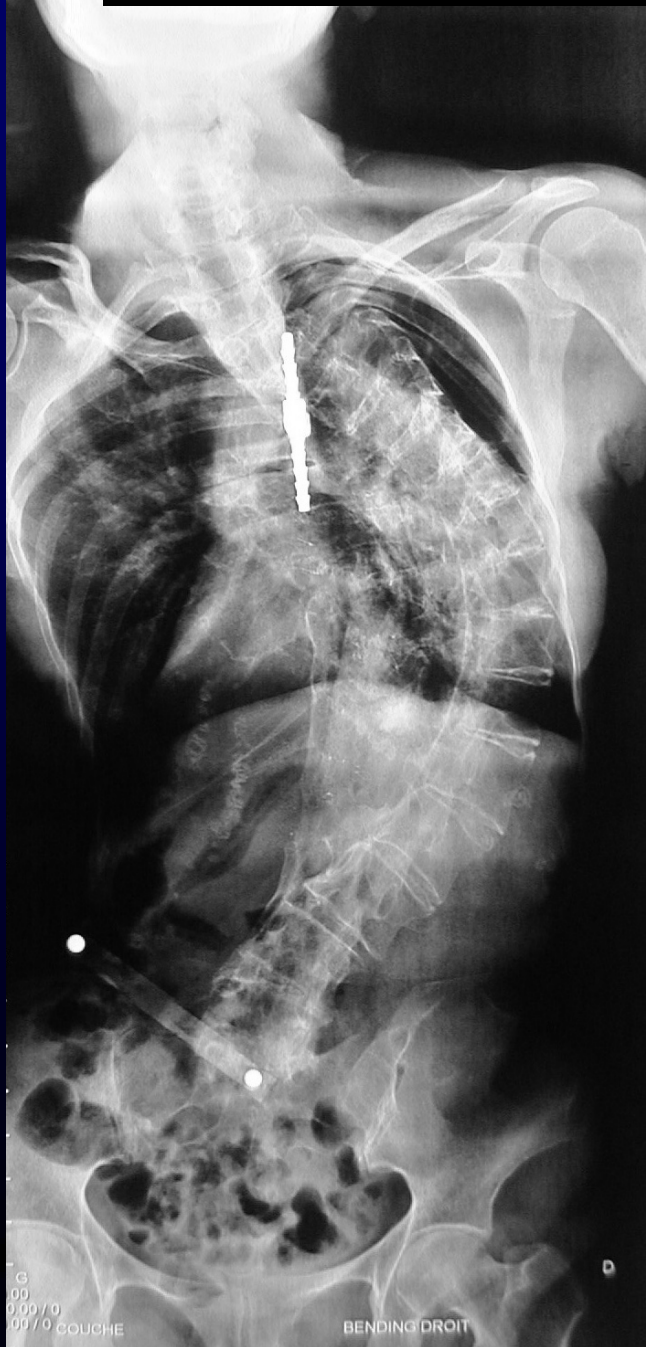


PELVIC OSTEOTOMY

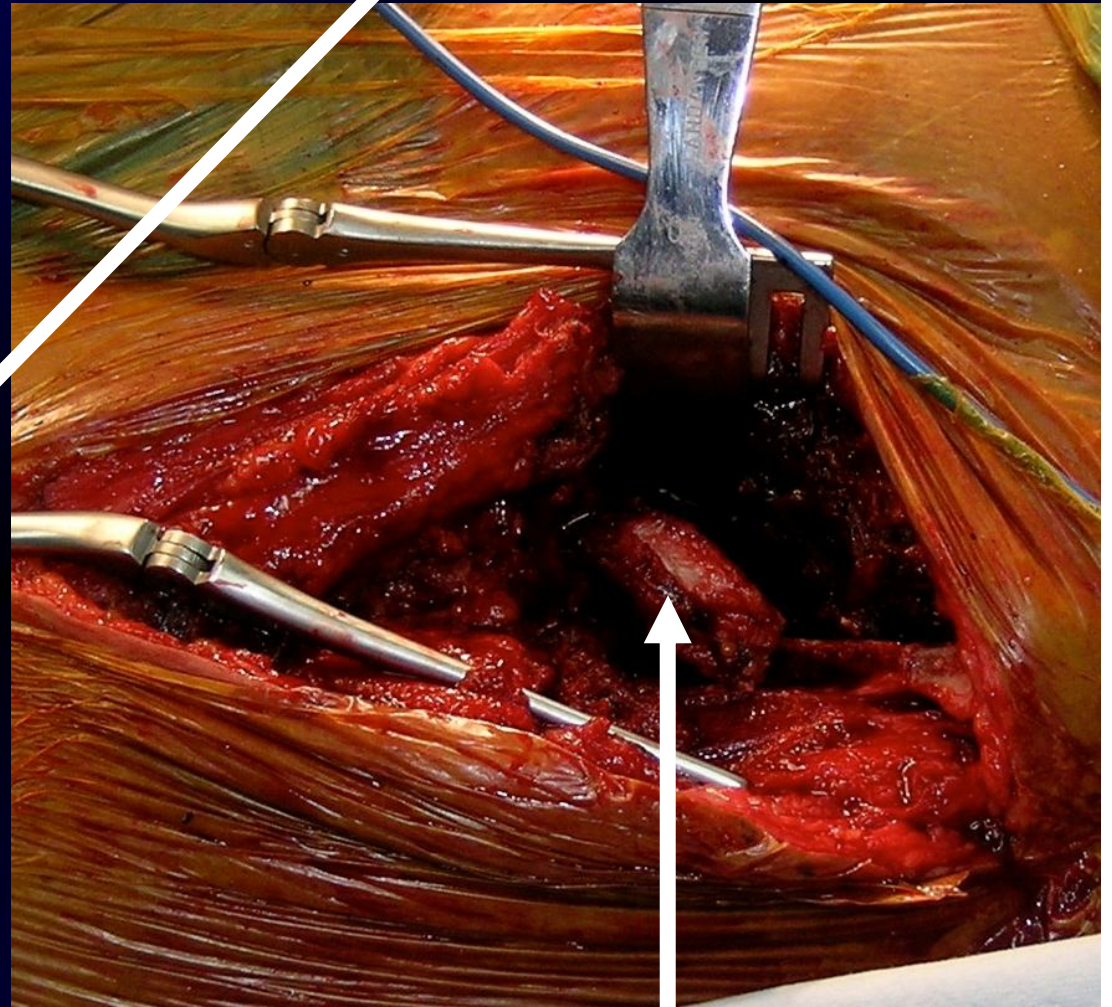
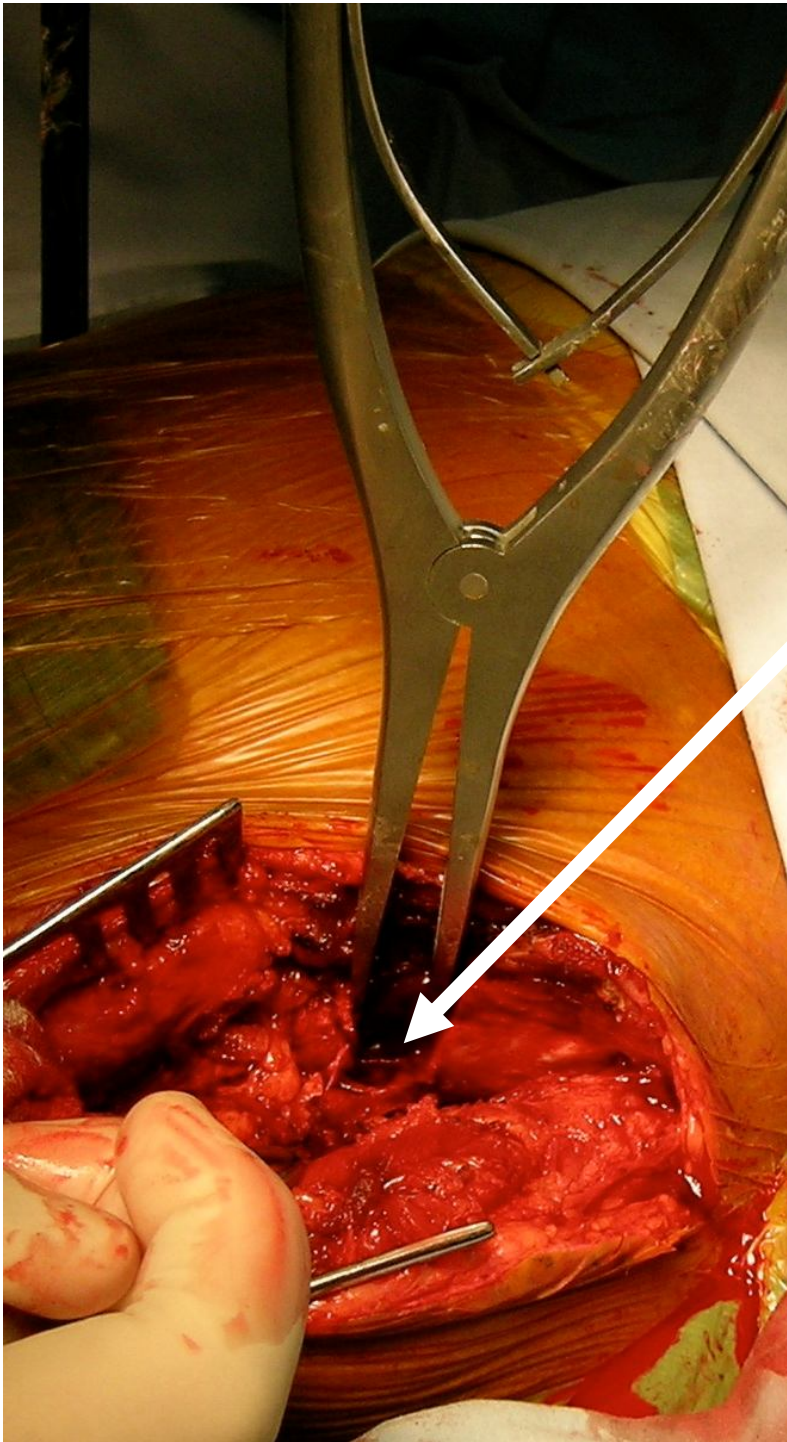
WILSON 1969

SEGAL 1971

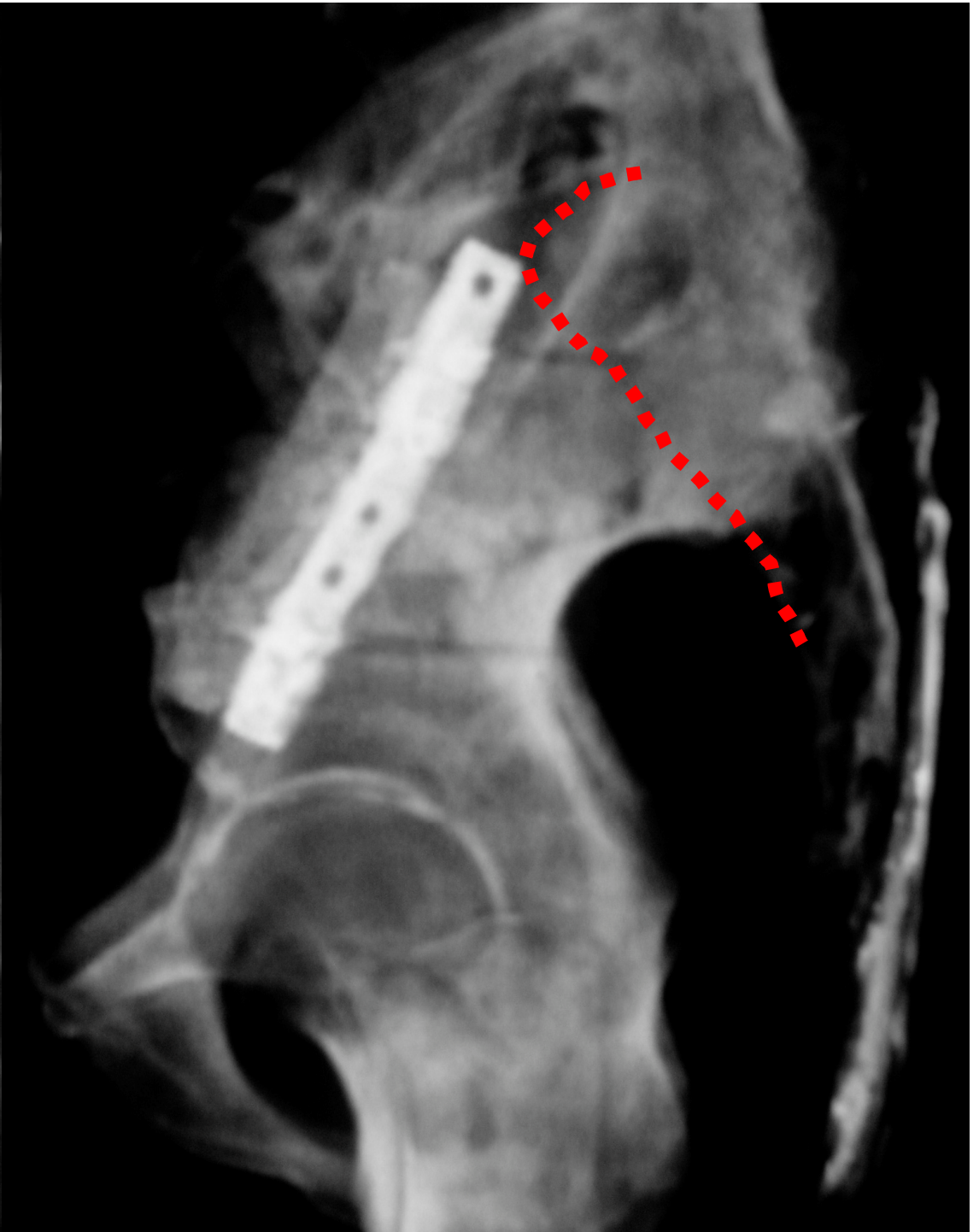
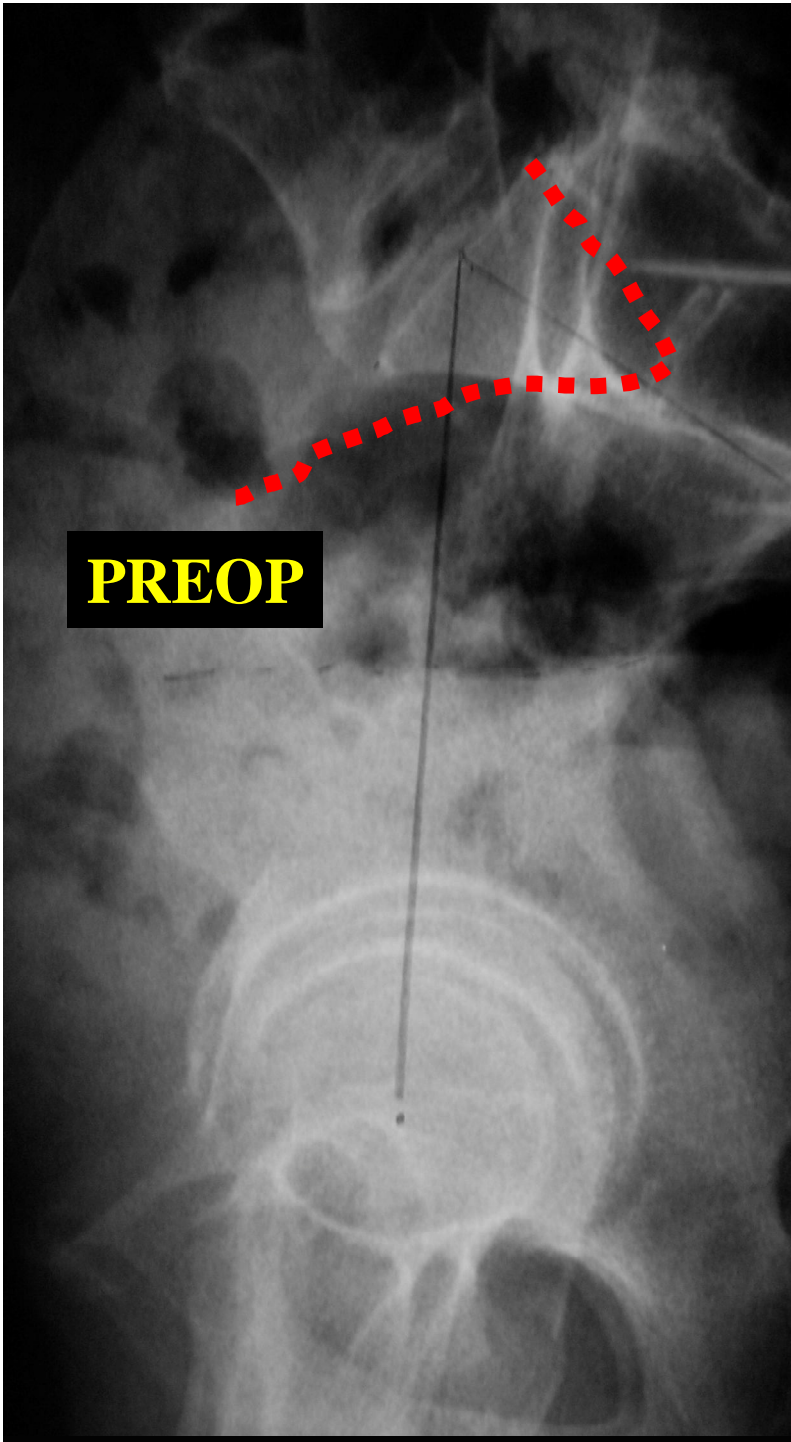
ANTERIOR & POSTERIOR MULTIOPERATED P.

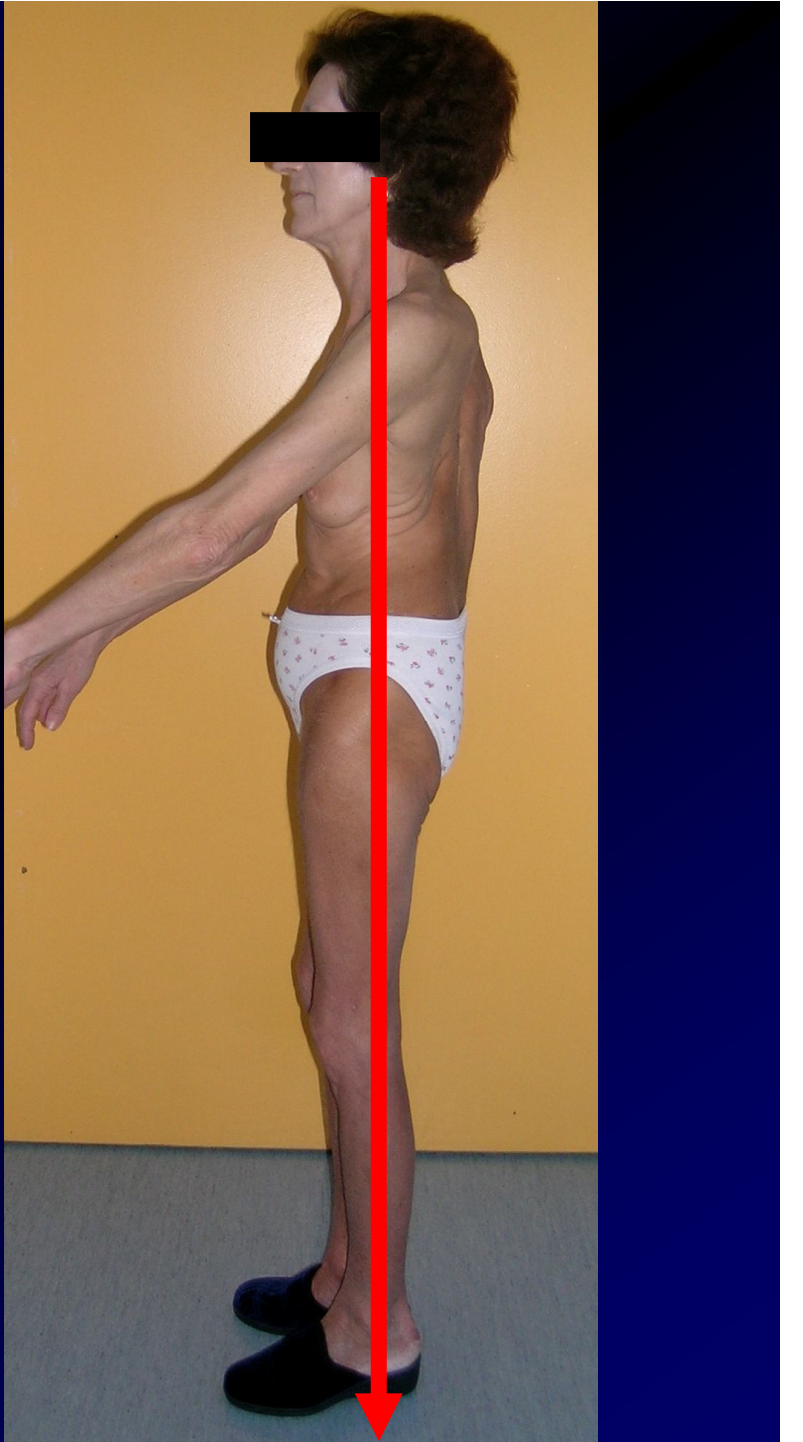
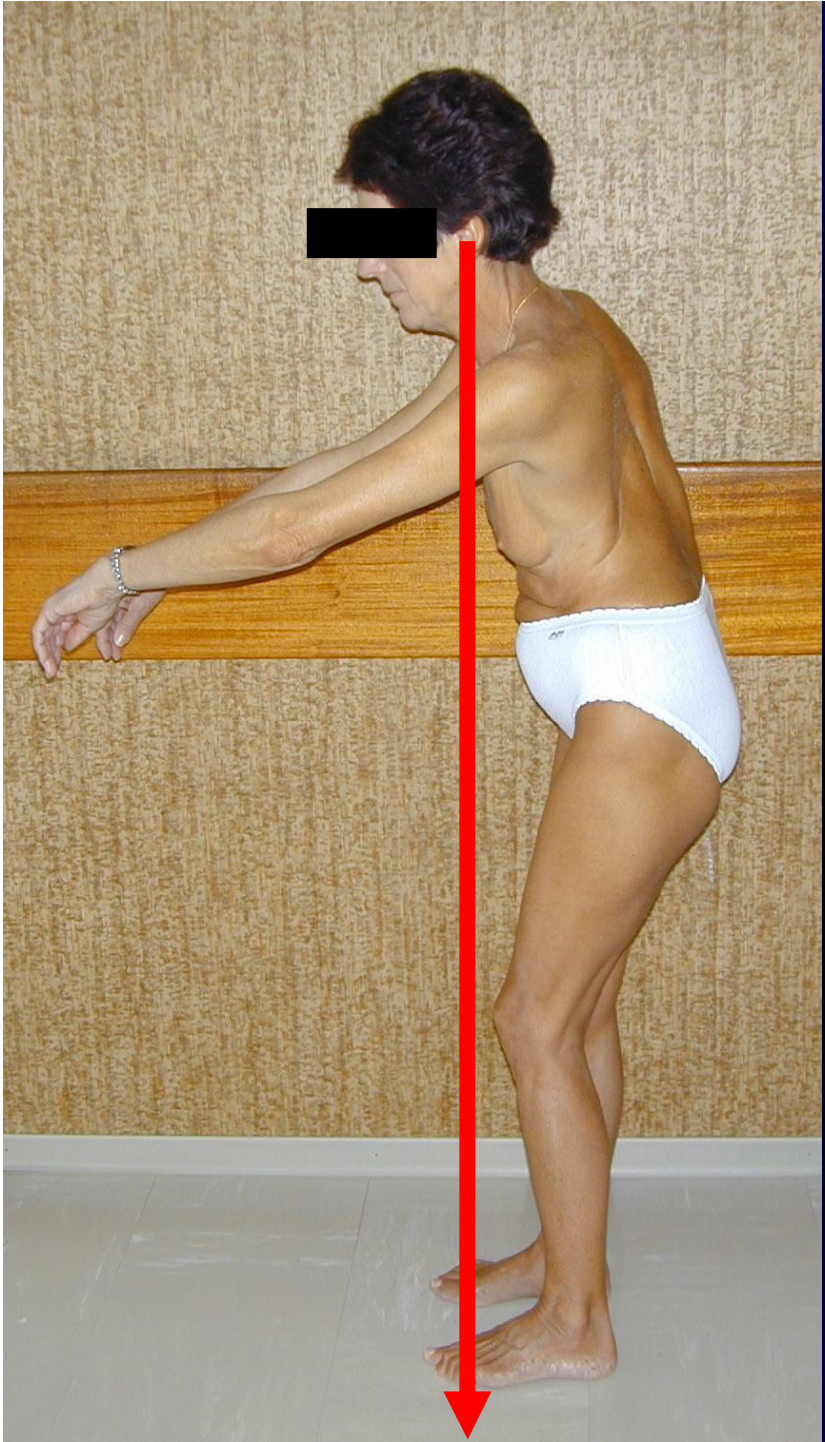


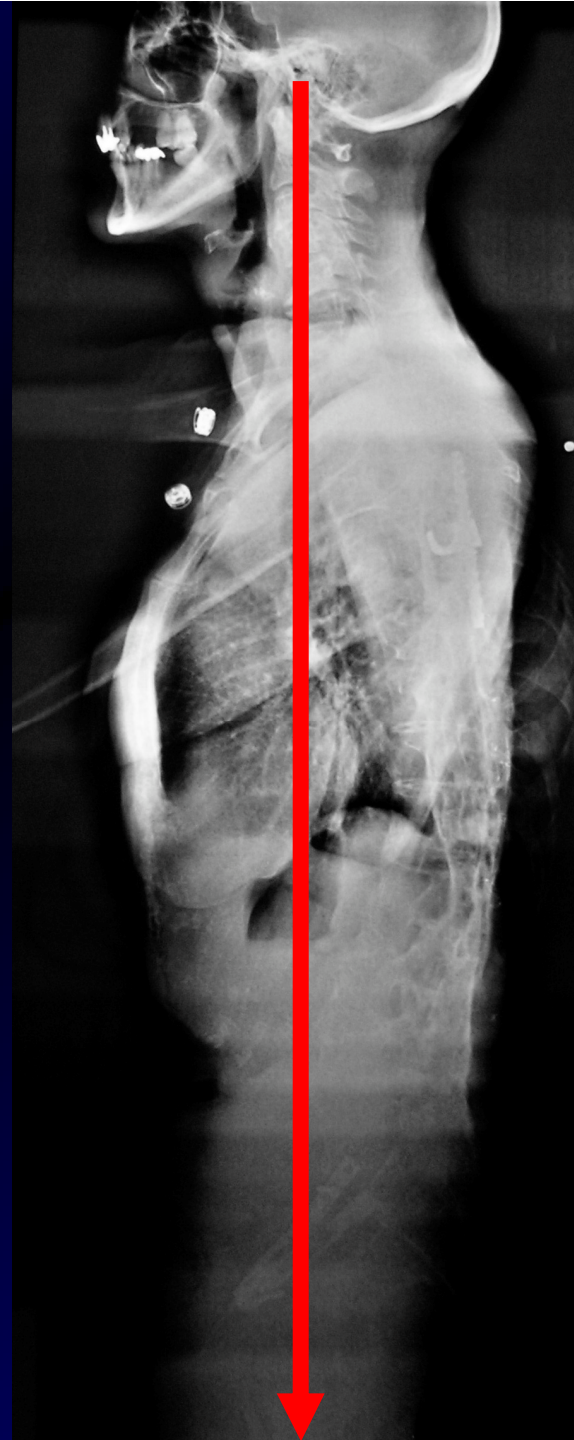
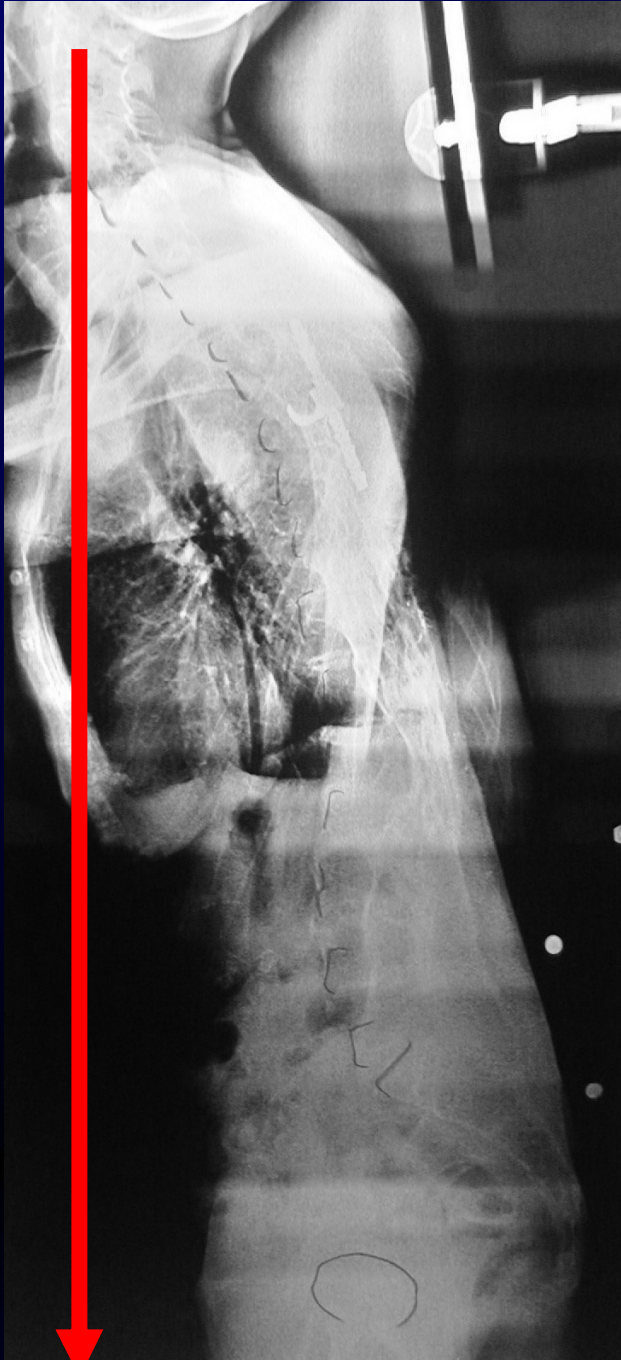
LEFT OSTEOTOMY



GRAFT







CONCLUSIONS (1)

to **EVALUATE SAGITTAL BALANCE**
you must consider

{ **SHAPE & POSITION of PELVIS**
POSITION of HIPS and KNEES +++



CONCLUSIONS (2)

ARTHROGENIC KYPHOSIS

there is ASSOCIATION with

**OSTEOARTICULAR
MUSCULAR LESIONS**



CONCLUSIONS (3)

SPONDYLOLISTHESIS

**ISTHMIC LYSIS is correlated with HIGH
INCIDENCE**

**LUMBOSACRAL KYPHOSIS (L.S.K.) is more
PEJORATIVE than SLIPPAGE**

**SURGICAL CORRECTION of the L.S.K. can
correct the GLOBAL IMBALANCE**



CONCLUSIONS (4)

OSTEOTOMIES

TRANSPEDICULAR O. is a good procedure to correct fixed imbalance cases

PREOPERATIVE CALCULATION is mandatory

PELVIC OSTEOTOMY is the last possibility

