

MIS options in Adult Spinal Deformity: Magic or Gimmick!

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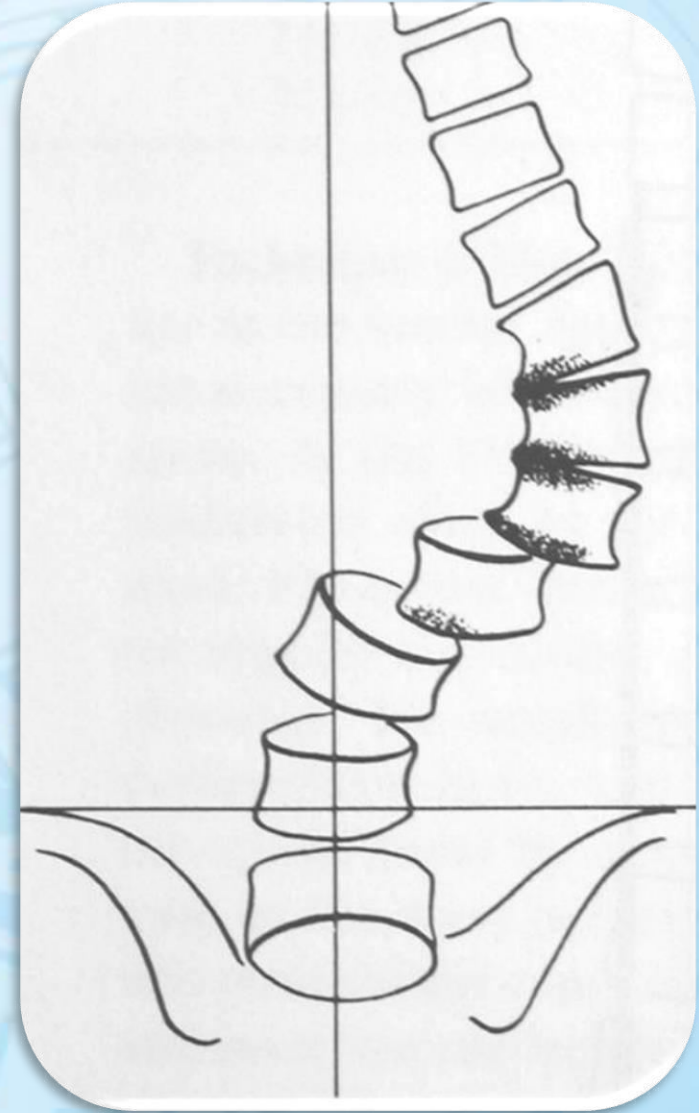
MIS

Minimally invasive surgery

A spinal procedure which produces a significantly reduced approach related collateral damage when compared to the equivalent open surgical procedure.

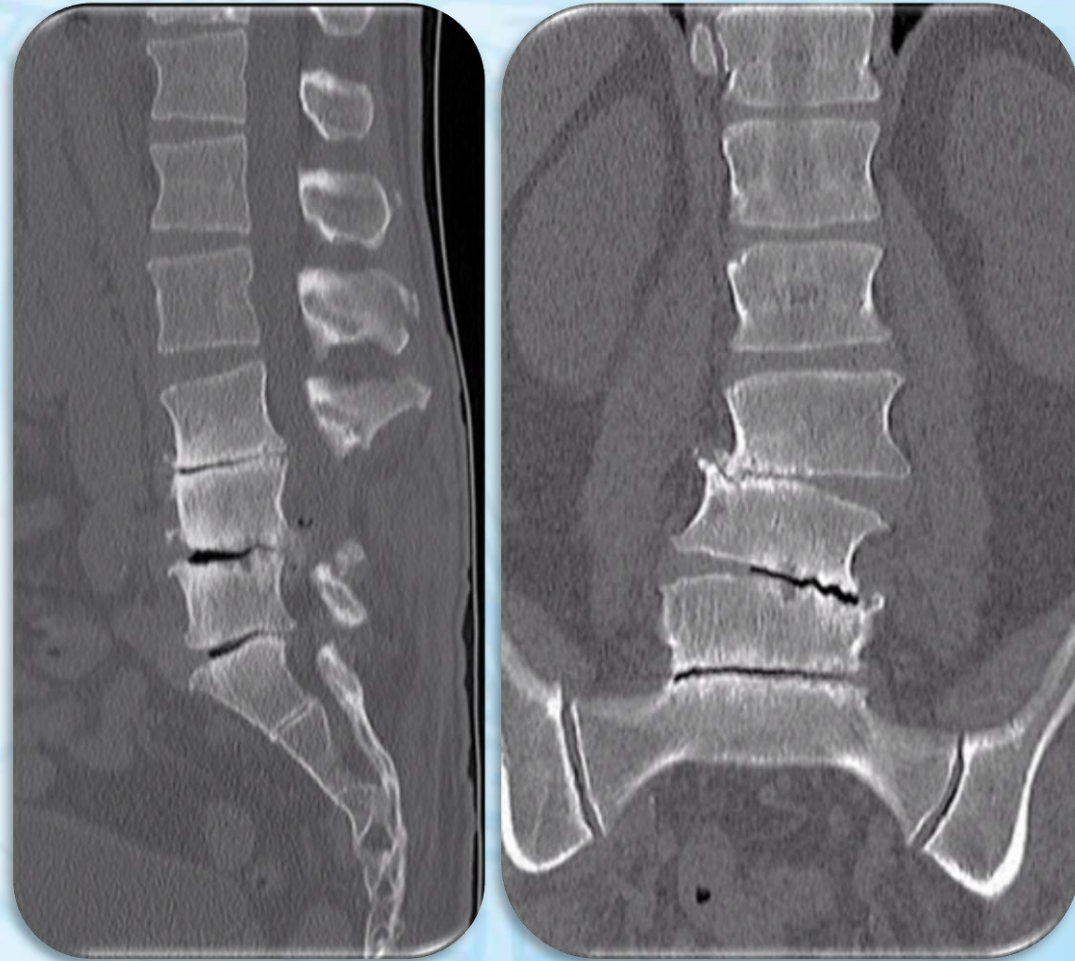
Adult Spinal Deformity:

- De-novo degenerative changes
- Previous congenital, idiopathic curves



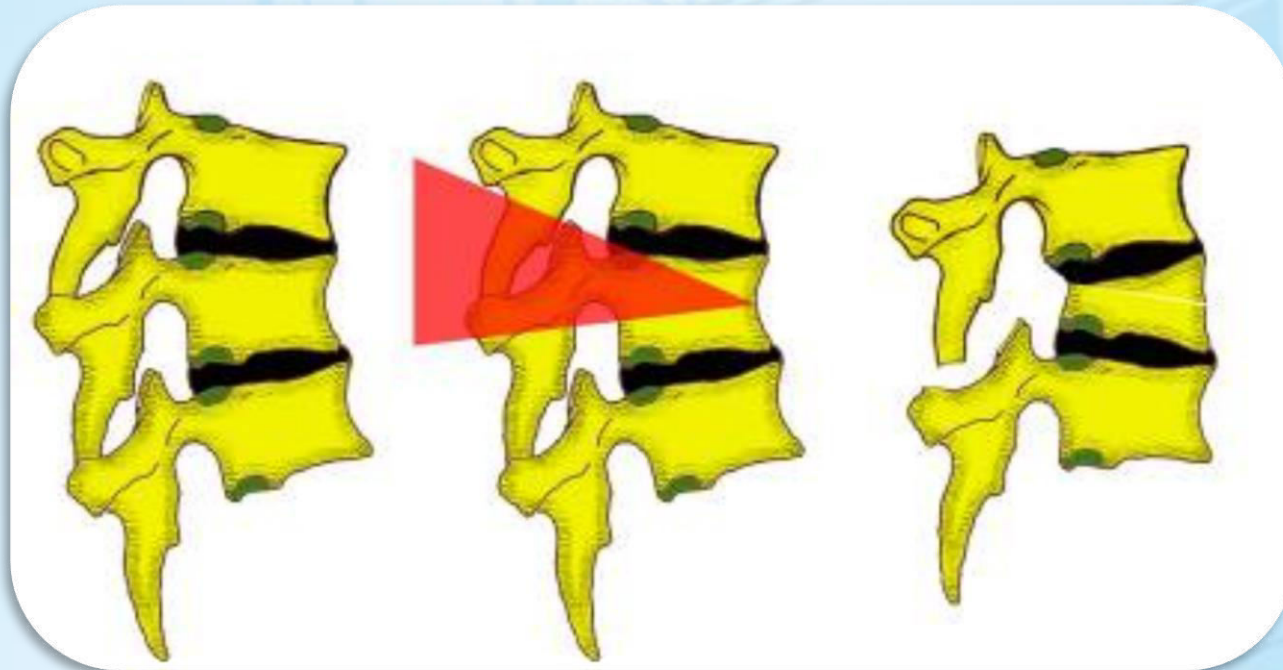
Goals of surgery in ASD

- Decompression
- Instrumentation
- Alignment
- Fusion



Specific issues with ASD

- Older patients
- Pre-operative morbidity
- Procedural complexity
- Complications



Complication profile

- Major / Minor
- PE, MI, Blood loss, New neurologic deficit
- Wound problems, PJK, Re-operation
- Not achieving the surgical goals

Benefits of MIS

- Potential to reduce approach morbidity
- Reduce the collateral damage
- Achieve the desired goals!

MIS experience from non-deformity degenerative problems



- Decompression



- Instrumentation



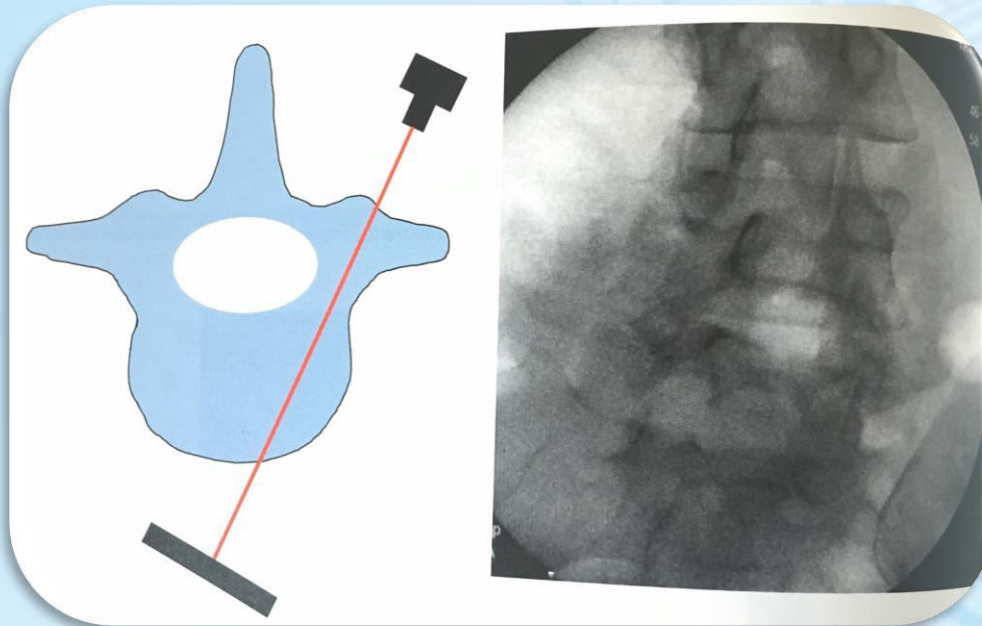
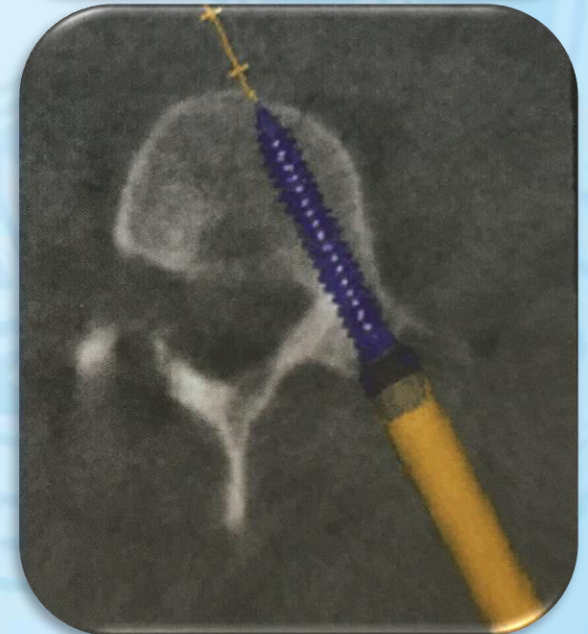
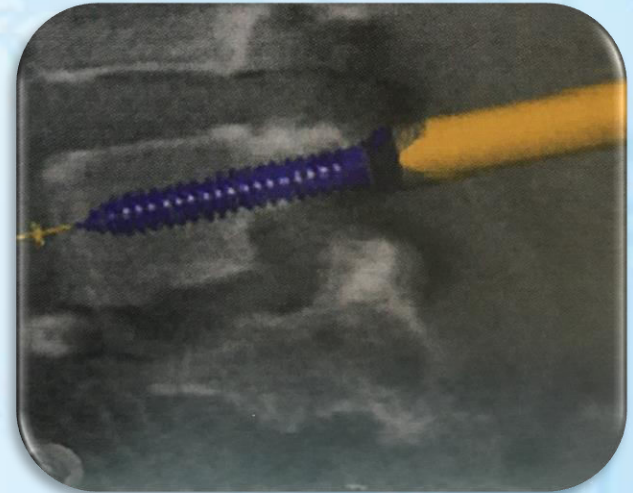
- Fusion



- Alignment

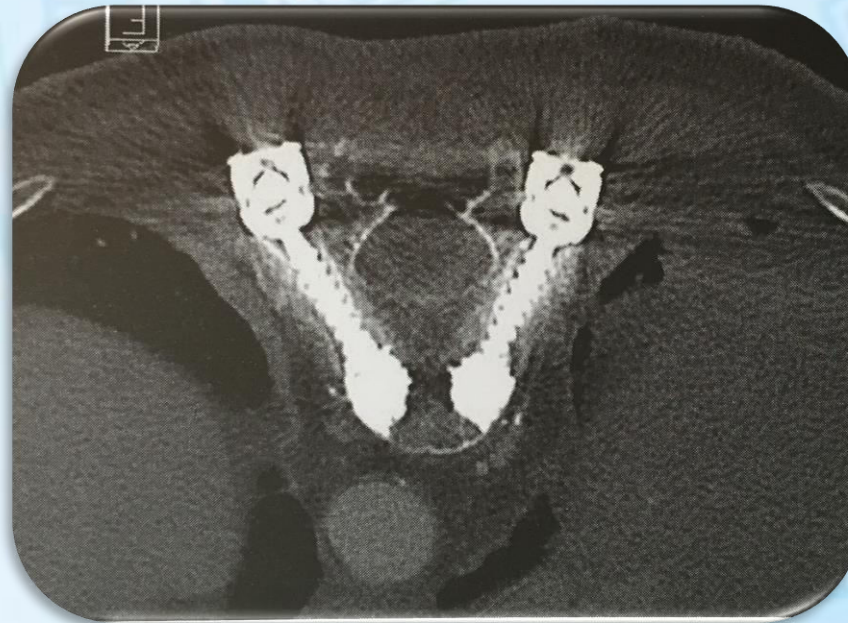
MIS Posterior instrumentation

- Percutaneous screw placements
- Rod contoured and passage



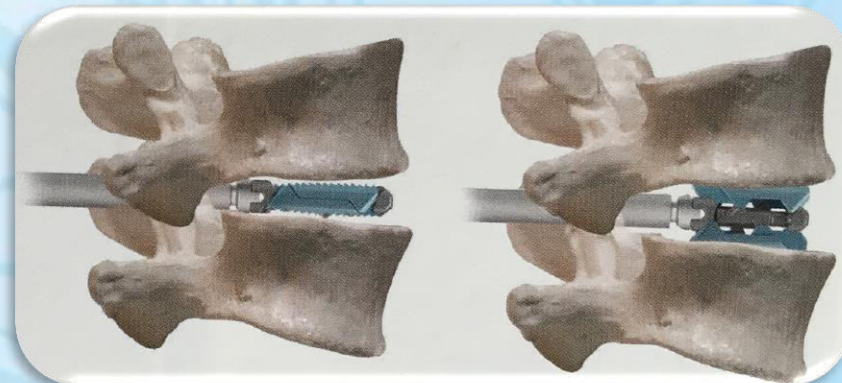
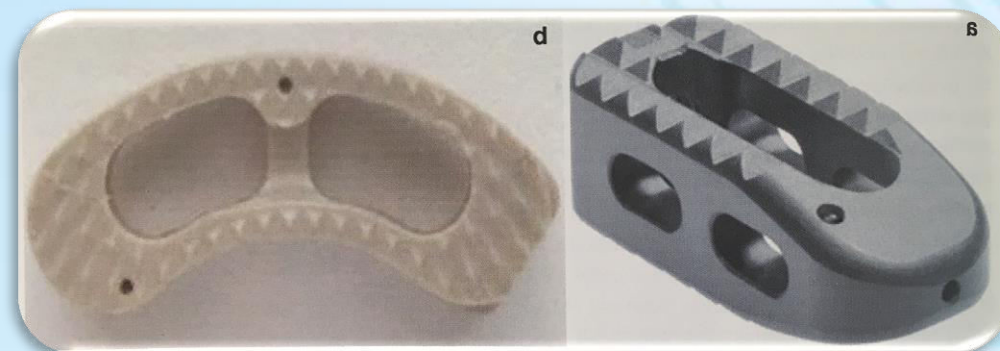
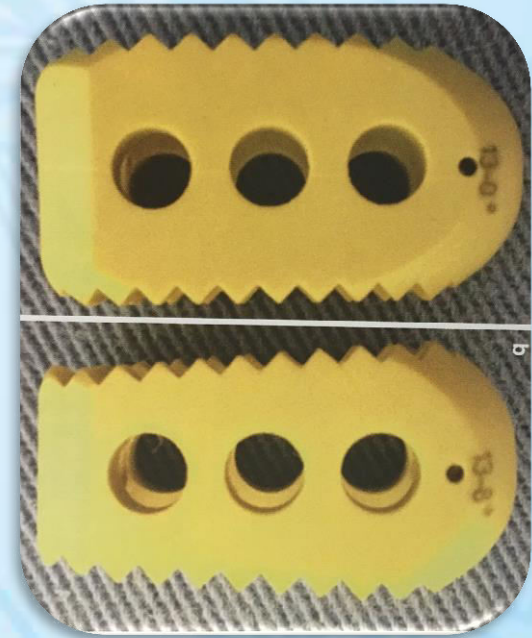
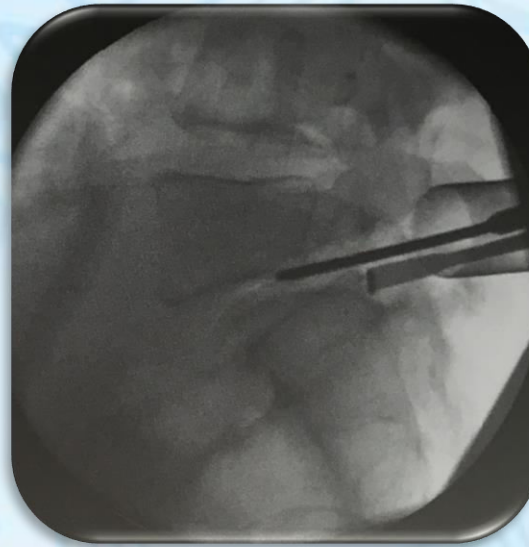
MIS Posterior instrumentation

- S2AI screws for pelvic fixation
- Cement augmentation (screws and vertebra)



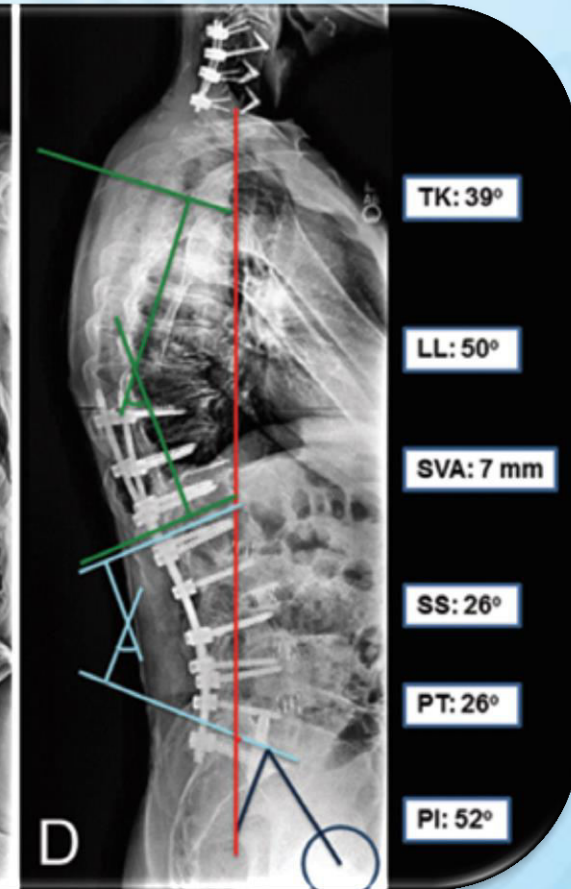
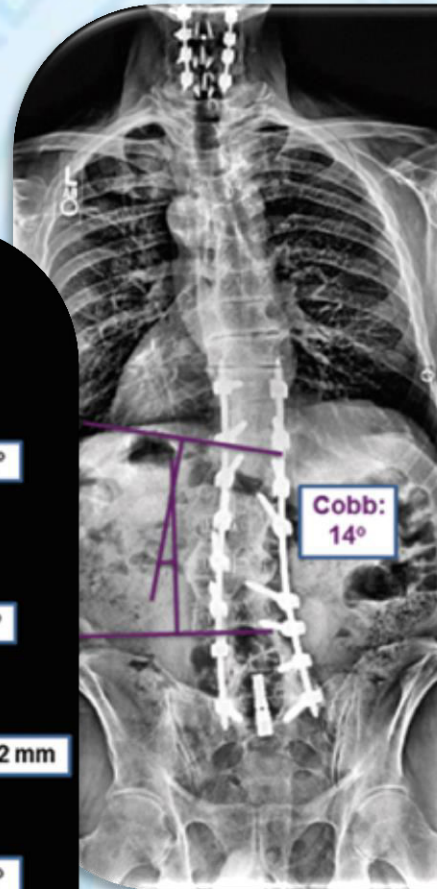
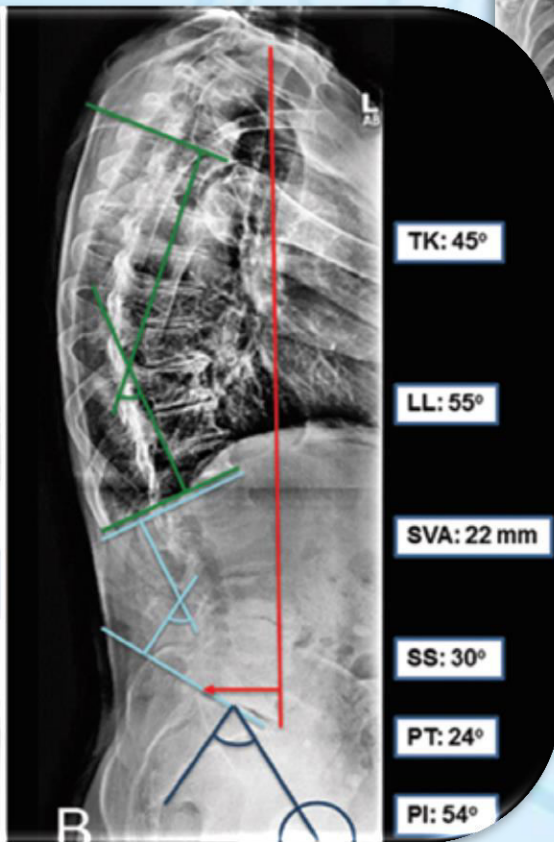
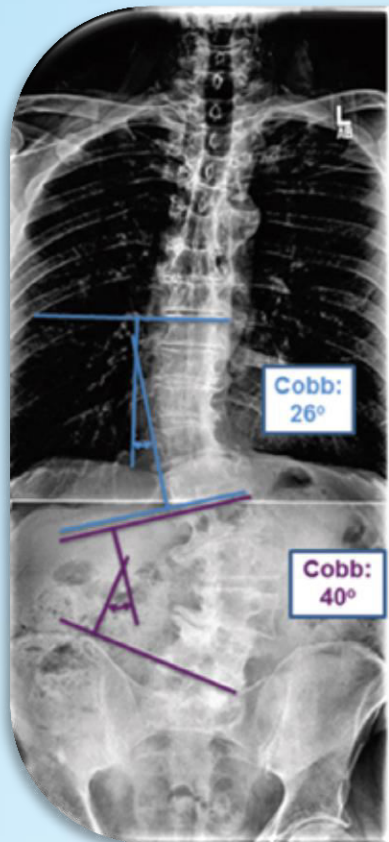
MIS inter-body fusion: posterior

- Multi-level TLIF
- Improved fusion
- Shapes to alter alignment



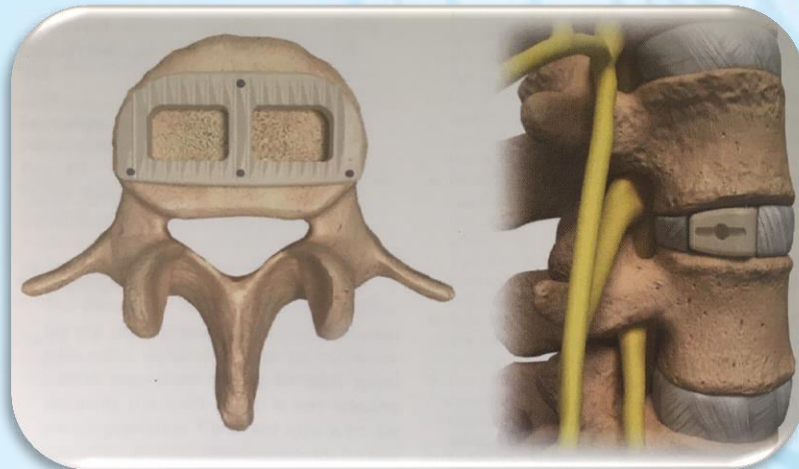
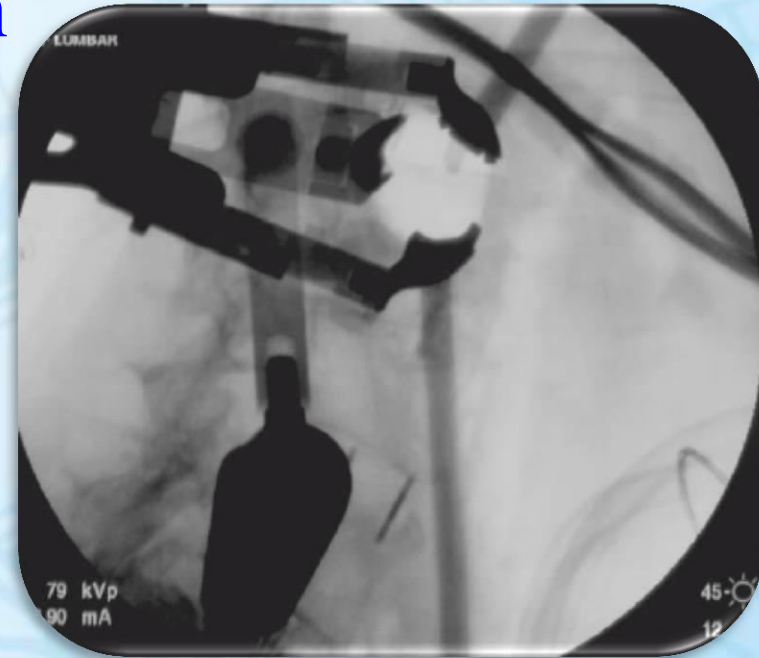
cMIS

Anterior and Posterior MIS



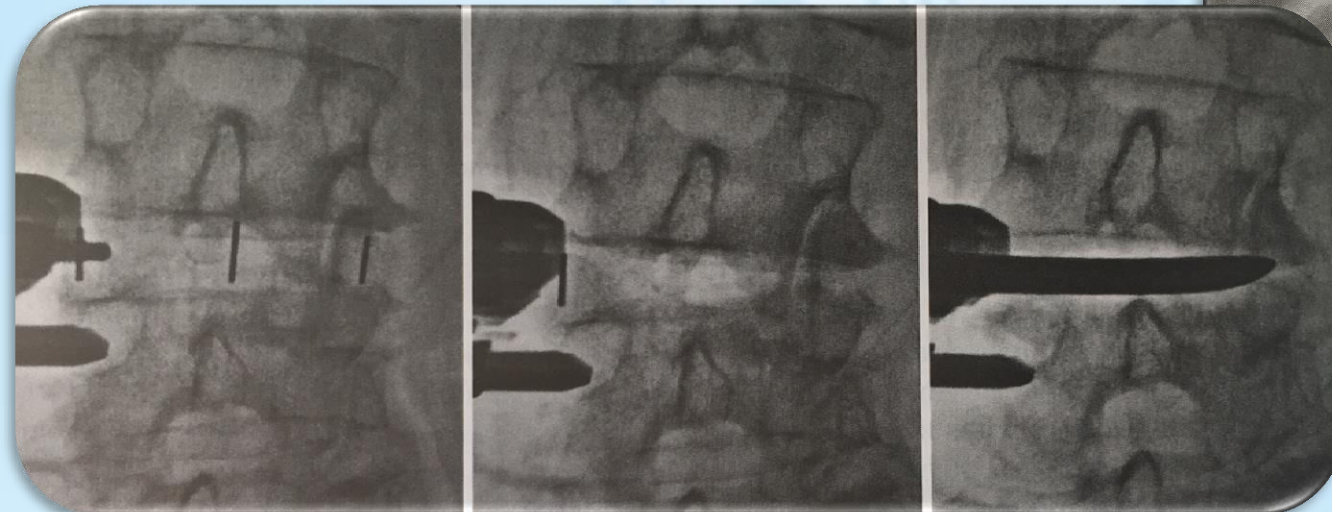
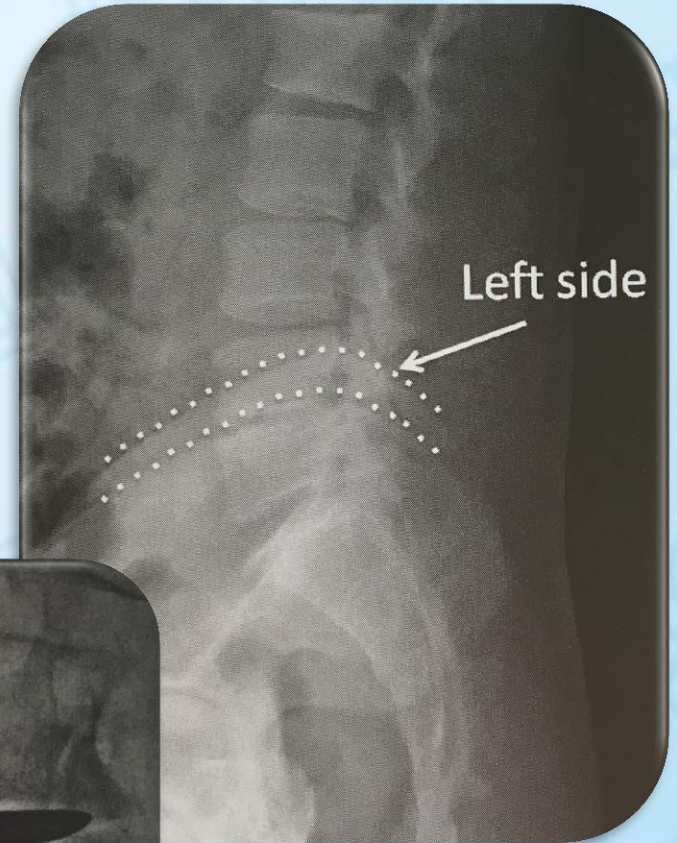
MIS inter-body fusion: lateral

- Lateral trans-psoas approach
- Neuro-monitoring
- Indirect decompression



MIS inter-body fusion: lateral

- Correcting the coronal deformity
- Convex or concave
- Dealing with the Iliac crest



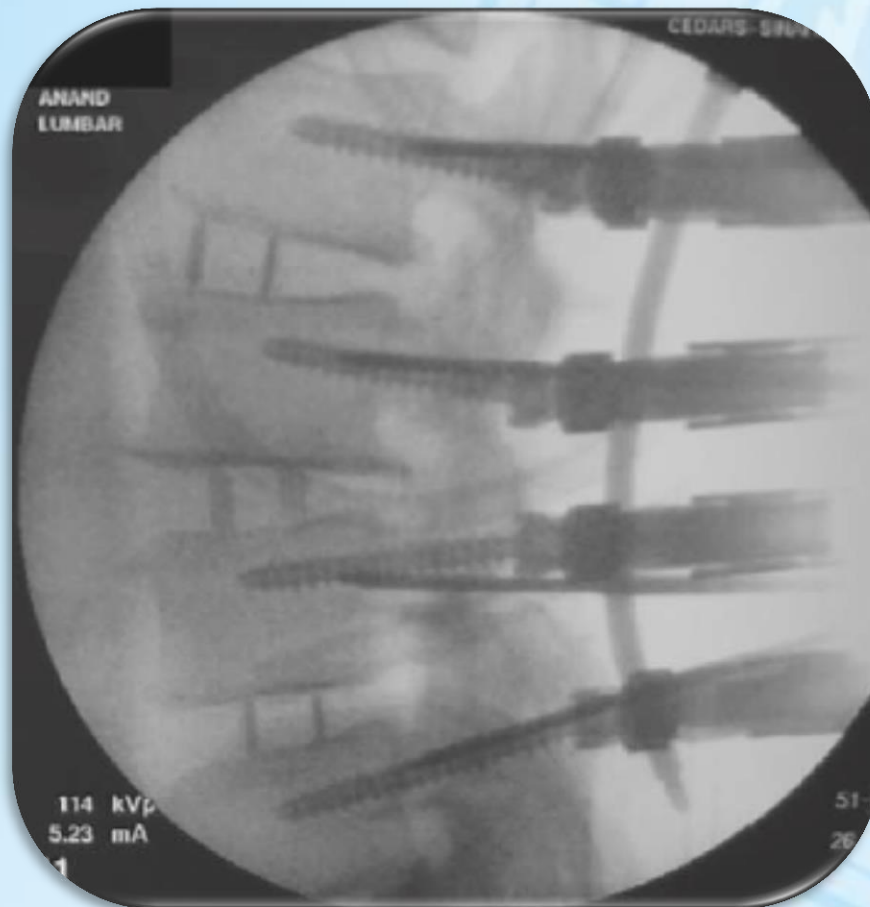
Complications of LIF

- Thigh dysesthesia
 - Ilio-inguinal, Ilio-hypogastric, Genito-femoral
- Hip flexor weakness
 - Motor deficit, Plexus neuropraxia, Psoas trauma
- Vascular, Bowel injury
- Cage subsidence

Minimally Invasive Multilevel Percutaneous Correction and Fusion for Adult Lumbar Degenerative Scoliosis

A Technique and Feasibility Study

*Neel Anand, MD, Eli M. Baron, MD, Gowriharan Thaiyananthan, MD, Kunwar Khalsa, BS,
and Theodore B. Goldstein, MD*



Anand et al J Spinal Disord 2008

Anand et al Neurosurg Focus 2010

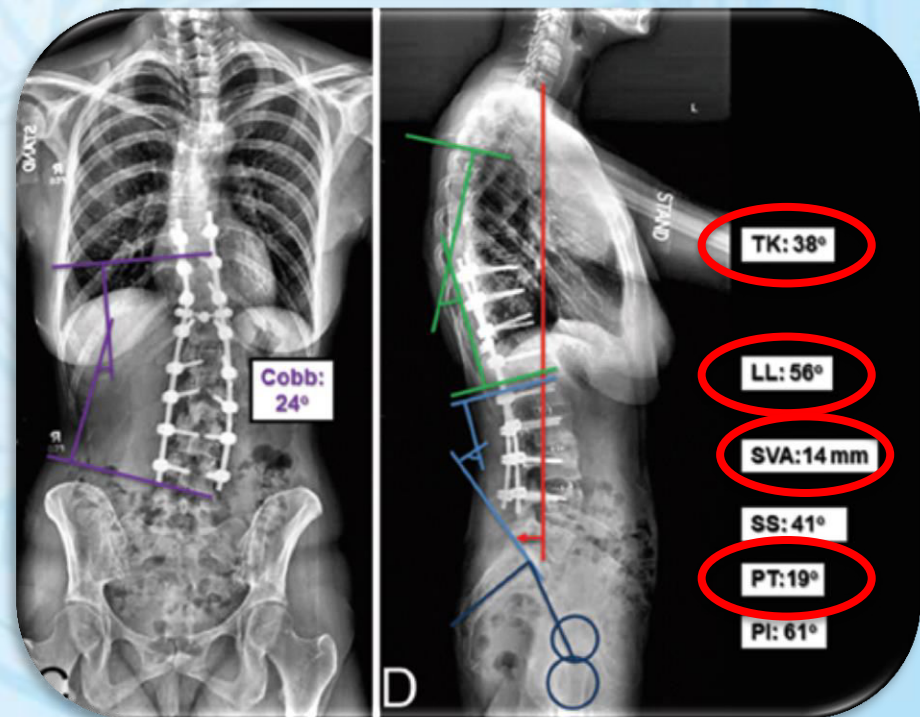
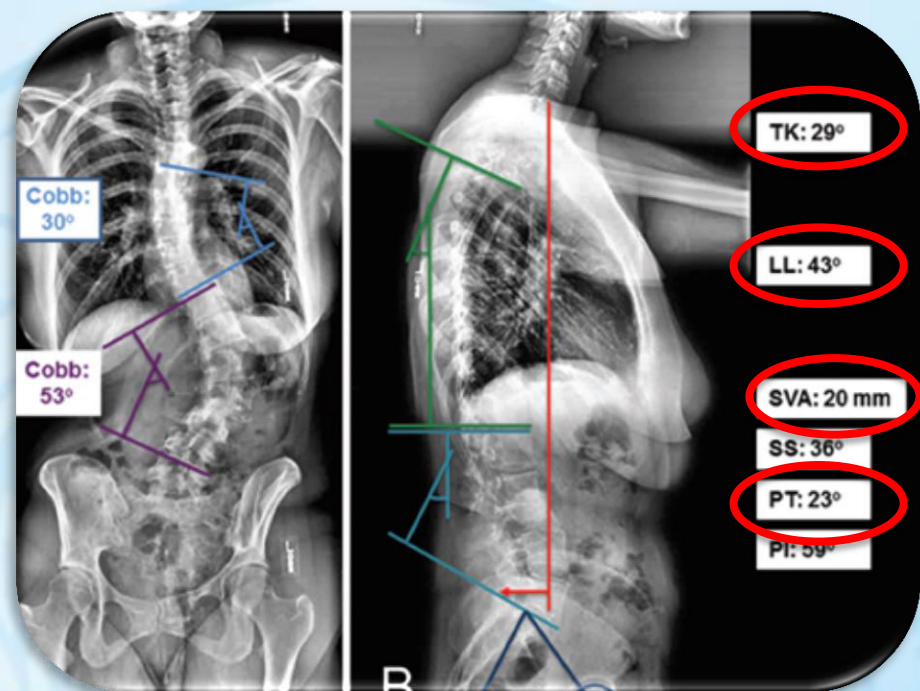
Anand et al ESJ 2012

Hybrid

Hybrid

MIS inter-body and
Posterior open (\pm
osteotomies)

Park (ISSG)
JNS 2015



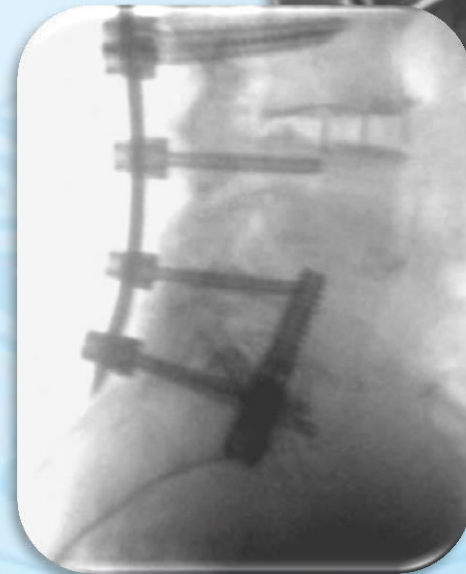
Current limitations: ceiling effect of correction

	Stand-alone	c MIS	Hybrid
Cobb	23	34	55
Lordosis	5	5.7	16.6
SVA	--	--	**

ISSG study

Fractional curve

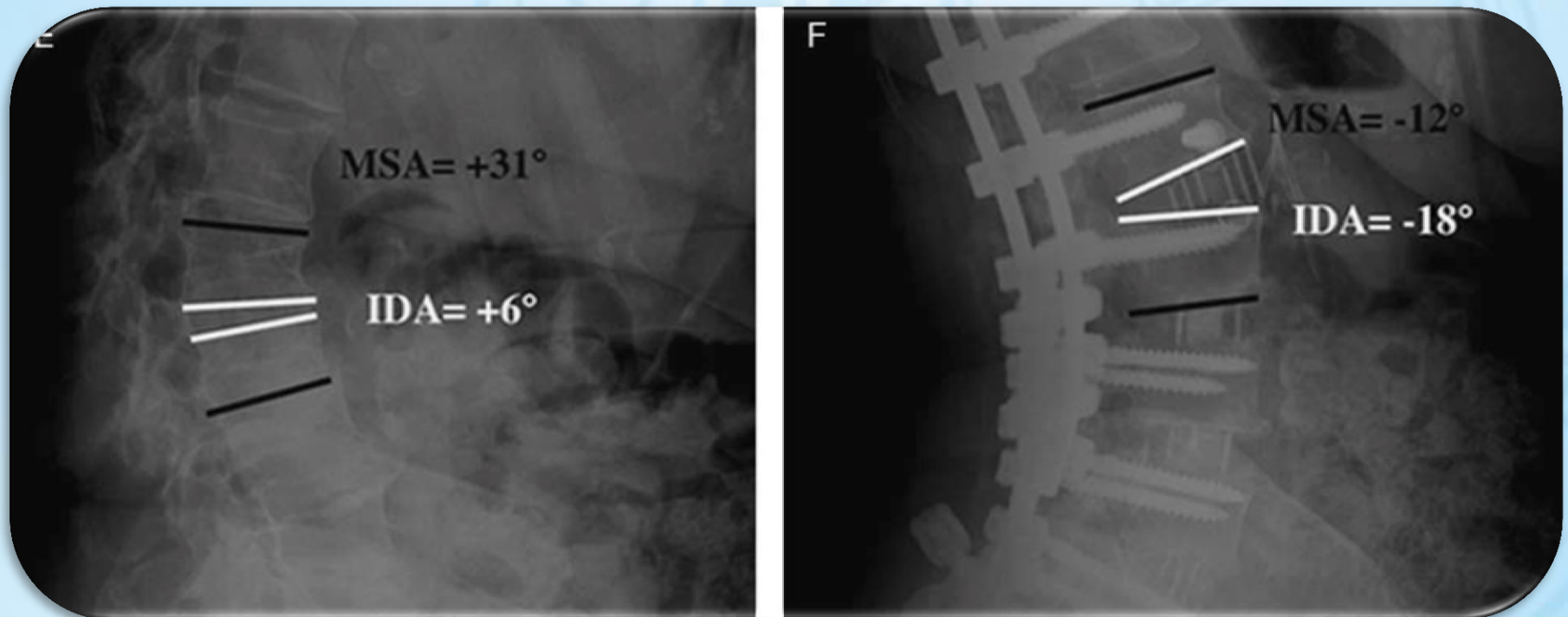
- Fuse L5S1 to avoid DJK
- ALIF:
 - large foot-print,
 - 15° lordosis,
 - load share,
 - indirect decompression
- Axial LIF
- Pelvic bolts / S2AI screws



Anterior Column Realignment (ACR) for Focal Kyphotic Spinal Deformity Using a Lateral Transpsoas Approach and ALL Release

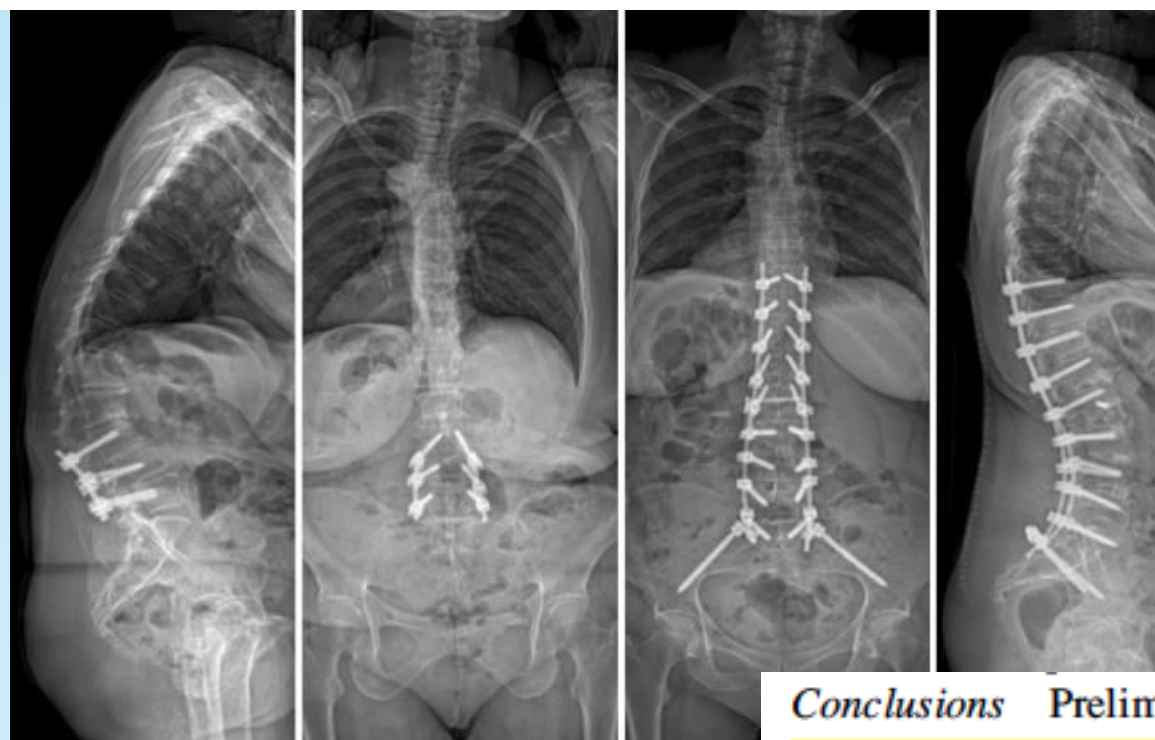
Behrooz A. Akbarnia, MD,† Gregory M. Mundis, Jr, MD,* Payam Moazzaz, MD,*
Nima Kabirian, MD,* Ramin Bagheri, MD,* Robert K. Eastlack, MD,‡ and Jeff B. Pawelek, BS**

J Spinal Disord Tech • Volume 27, Number 1, February 2014



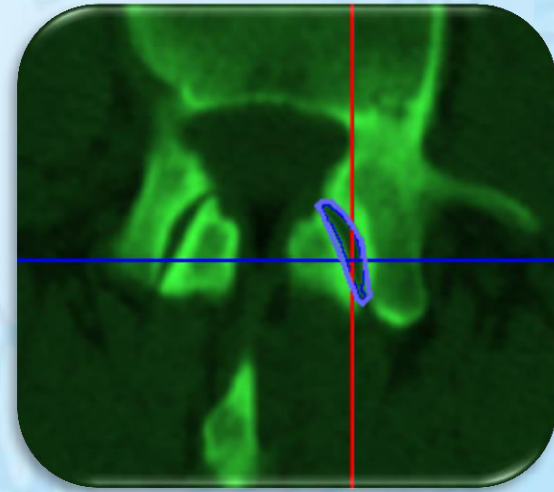
Anterior column realignment from a lateral approach for the treatment of severe sagittal imbalance: a retrospective radiographic study

Pedro Berjano¹ · Riccardo Cecchinato¹ · Aldo Sinigaglia¹ · Marco Damilano¹ ·
Maryem-Fama Ismael¹ · Carlotta Martini² · Jorge Hugo Villafañe³ ·
Claudio Lamartina¹



Conclusions Preliminary data show that ACR allows corrections similar to those obtained with a Pedicle Subtraction Osteotomy, avoiding risks related to this technique.

ACR v PSO

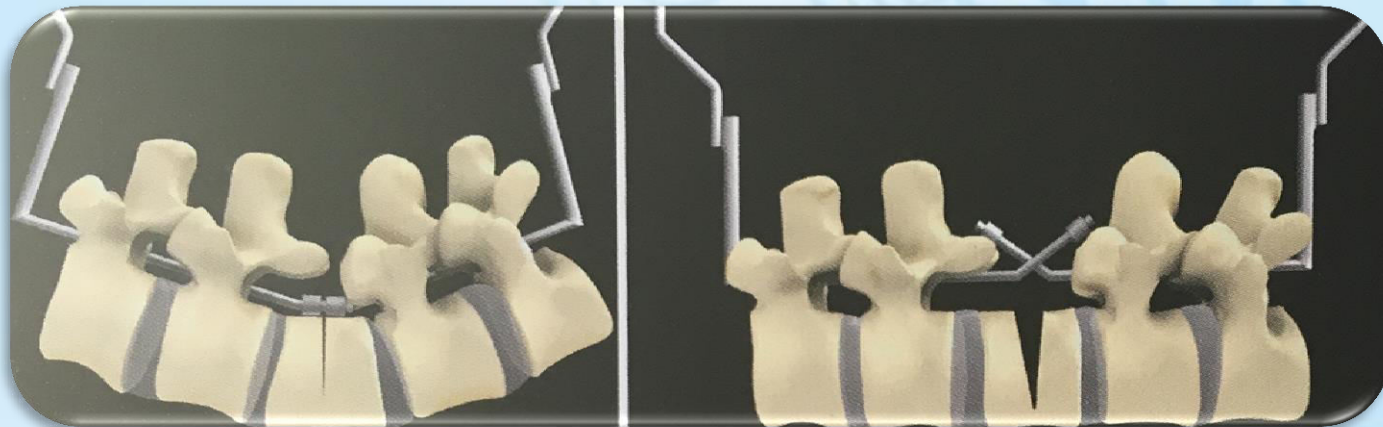
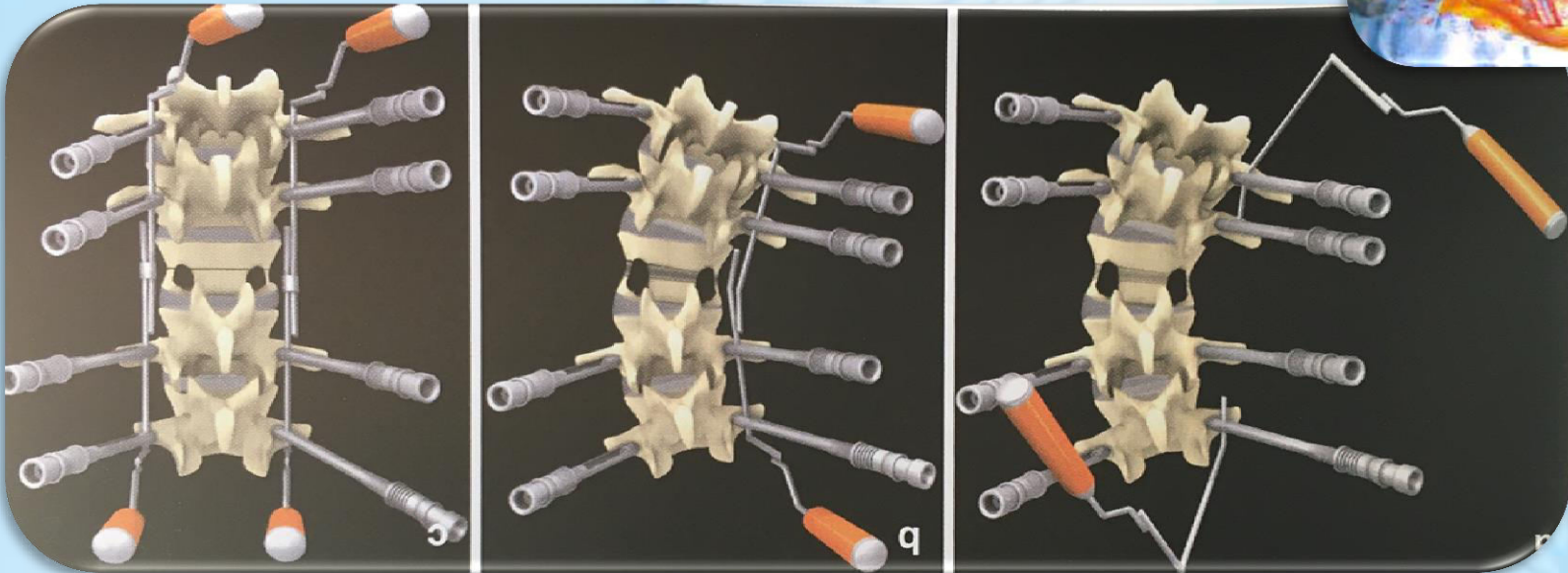


Impact on spinal parameters

- LLIF: segmental and regional lordosis
- LLIF + ALL release and hyper-lordotic cages: SVA and LL corrections
- Results improved with posterior

Mini-open PSO

The



Complications: MIS v Open

	MIS	Open	p value
Dural tear	1.9%	2.1%	0.57
Infection	1.1%	2.2%	0.09
Root injury	2.9%	0%	
Screw mal-position	2.8%	1%	0.48
Revision operation	3.8%	3.2%	0.93

MIS v Hybrid

Hybrid shows better overall corrections, at the expense of higher complication rates.

MIS

Hybrid

33%

55%

Park Spine 2015

14%

40%

Wang Neursurg Focus 2014

Proximal junctional kyphosis

- Disruption of posterior ligaments, lamina, faces, disc
- MIS 31.3% v Hybrid 52.9%

Kelleher Spine 2010

Mummaneni Neurosurg 2016

- 176 patients (105 > 2 levels)
- PJK @ 5 years 3.8% (2/4 needed re-operation)

Anand SMISS 2012

Pseudarthrosis risk with MIS

- Percutaneous long instrumentation
- In-adequate attention to fusion
- In-sufficient de-cortication / facetectomy

cMIS

31.3%

Hybrid

71.6%

.....unless anterior inter-body fusion

Cost implications with MIS

- Implants
- Retractor systems
- Fluoroscopy / Navigation
- Neuro-monitoring

Cost savings:

- Reduced hospital costs
- Reduced morbidity

Radiation exposure with MIS

- AP & Lat Xray 1.8 mSv
- 4 Percutaneous screws 0.5 mSv
- CT 10 – 20 mSv

Risks:

1. Cataracts
2. Cancers

Prevention:

1. Shielding
2. Distance
3. Reduce fluoroscopy time

MIS Spinal deformity algorithm

- Class I: Neural compression, mild flexible deformity
Decompression, short fusion
- Class II: Back pain, compression, deformity (fixed or flexible)
cMIS (LLIF, TLIF) or Hybrid
- Class III: Severe multi-planar fixed deformity
Open surgery, osteotomies
ACR and posterior

Guidelines for predicting failure of CMIS

MIS Section of ISSG survey of experienced surgeons

- $SVA > 6 \text{ cm}$
- $PI - LL > 30^\circ$
- $PT > 25^\circ$
- $Cobb > 20^\circ$

MIS in ASD

An evolutionary change based on individual enthusiasm, skill, training opportunities, education, patient demands and technological advances!

MIS in ASD: Magic or Gimmick!



Sagrada Familia, Barcelona

Work in Progress!

Focus on surgical goals, rather than technology