



**GLOBUS
MEDICAL**

Expandable Interbody Implants

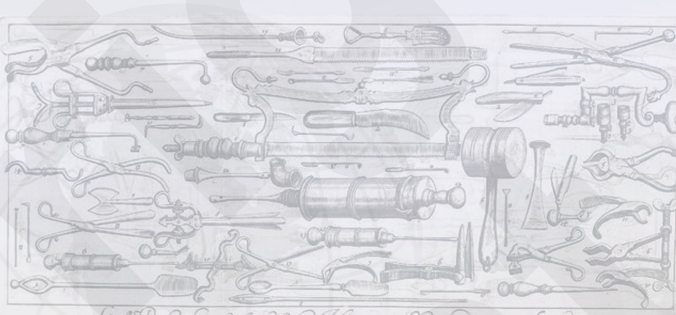
Mr M J H McCarthy
Consultant Spinal Surgeon

Fusion Portfolio Minimally Invasive Surgery Biomaterials Motion Preservation

Life moves us¹



Armamentarium



Life moves us²



Indications for Surgery

- **What are you trying to achieve?**
- **MISS is a Tool in Surgical Armamentarium**
 - Use when appropriate to achieve your goals
 - Non-maleficence - "first, do no harm" (primum non nocere).

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Indications for Surgery - DRS

- **Decompression**
 - Spinal cord / nerve roots
- **Realignment**
 - Correct deformity
- **Stabilisation**
 - Prevent / Treat
 - Neurological deficit / deformity / pain
 - (Non fusion technology form of "stabilisation")

All may require fusion

Require Instrumentation

Instrumentation increases fusion

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Fusion

- **Fusion – think:**
 - α contact surface area ($1/\alpha$ subsidence)
 - $\uparrow$ compression $\downarrow$ tension
 - autograft > allograft > synthetic
 - vascular > avascular
 - structural graft > non structural
 - BMP...
 - And unfortunately fusion may not be α clinical outcome

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The 7 Ps

- Proper
- Planning and
- Preparation
- Prevents
- Piss
- Poor
- Performance



Attention to detail
Never let your guard down

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Why MIS?

1. Less blood loss
2. Less infections
3. Less post-op pain
4. Shorter hospital stay
5. Strong patient demand
6. Intense technology development
7. Cost effectiveness?
8. Long-term benefits?

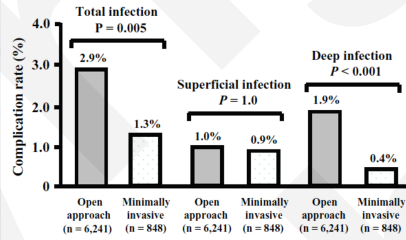
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Spine

DEFORMITY

Rates of Infection After Spine Surgery Based on 108,419 Procedures

A Report from the Scoliosis Research Society Morbidity and Mortality Committee



MIS:
Less Pain
Less Infection
Less Bleeding
Short stay

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Armamentarium - TLIF

- Auto / allograft
- Threaded / Cylindrical cages
- Banana cages
- Oblique cages
- Articulated cages
- Expandable cages

Life moves us 

- Support biomechanical loads without supplemental fixation
- Provide immediate stability
- Resist subsidence and migration
- Restore anatomic alignment
- Minimize exposure and nerve retraction
- Preserve native anatomy
- Contain substantial graft volume
- Provide view of fusion

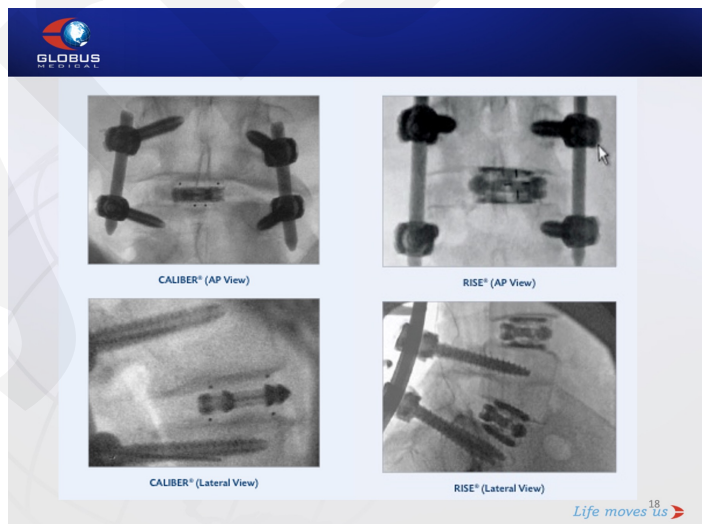
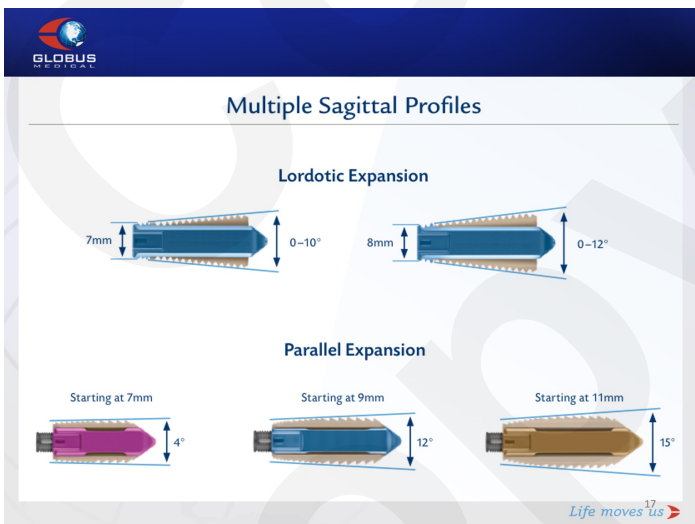
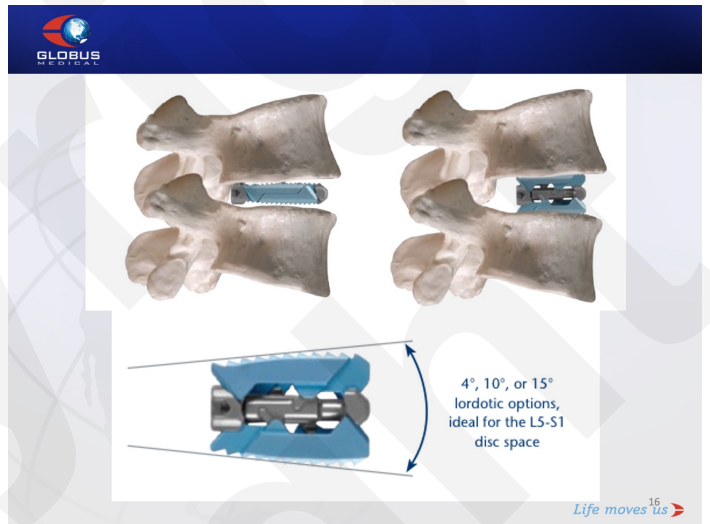
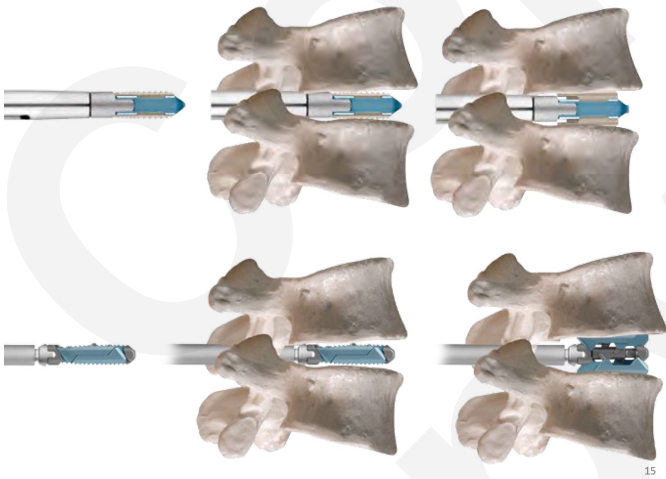
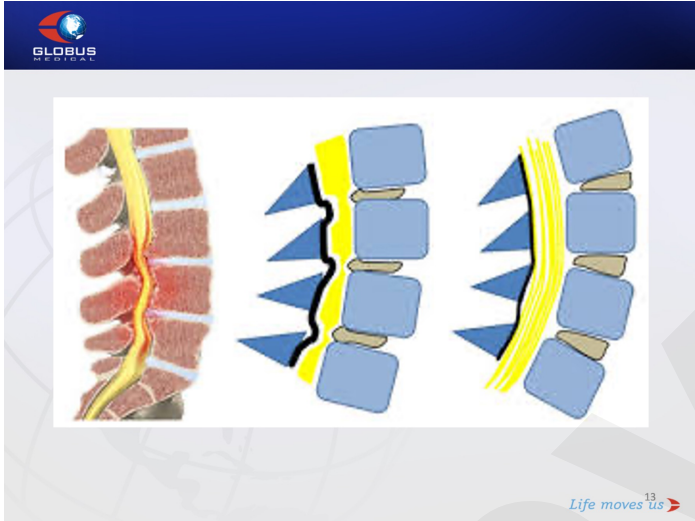
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Clinical and Radiological Outcomes of Minimally Invasive Versus Open Transforaminal Lumbar Interbody Fusion

Chan Weam Benedict Peng, MD, Wai Mun Yue, MD, Seng Yew Poh, MD, William Yeo Mphity, and Seang Beng Tan, MD

Conclusion. MIS TLIF has similar good long-term clinical outcomes and high fusion rates of Open TLIF with the additional benefits of less initial postoperative pain, early rehabilitation, shorter hospitalization, and fewer complications.

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Lateral windows allow for maximizing graft in and around the implant

Life moves ¹⁹ us ➤



Life moves ²⁰ us

- Posterior – **Close at the Back**
 - Osteotomies +/- cages
- Anterior / Lateral – **Open at the Front**
 - Wedged cages (take down the ALL)
- Anterior and Posterior
- Do expandable cages “restore” lordosis...?

Life moves ²¹ us ➤

Figure 1 illustrates the steps of a minimally invasive surgical approach for a lumbar disc herniation. The diagrams show the progression from the initial tubular retractor placement to the final stabilization of the disc space.

- Bilateral facetectomies
- Improved lordosis

Journal of Clinical Neuroscience 21 (2014) 441–444

Life moves ²² us

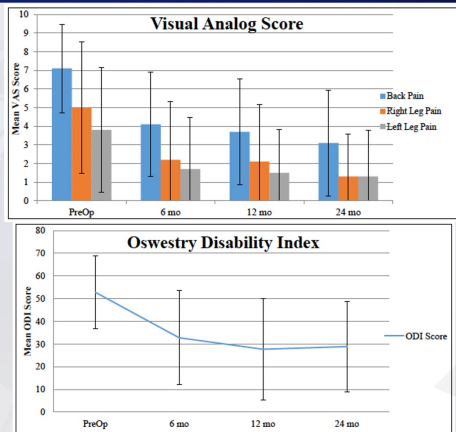
- Minimize tissue trauma during insertion
- Minimize endplate trauma during insertion
- Minimize cage back out (wedged)
- Fill the front and the back of the disc space
 - ? Improve load sharing / fusion...
- Maintain lordosis with lordotic implant
- ? Improve lordosis...

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- Multicentre retrospective
- Caliber – 202 patients – 2 year FU
- No device failures
- Asymptomatic migration subsidence = 12 (6%)
- Reoperations same level = 6 (3%)
 - screw failure pseudarthrosis
- Significant and maintained restoration disc and foraminal height
- No change lordosis



Life moves ²⁴ us



Life moves us 25

Expandable Polyaryl-Ether-Ether-Ketone Spacers for Interbody Distraction in the Lumbar Spine

Marjan Alimi^{1,*} Benjamin Shin^{1,*} Michael Macielak¹ Christoph P. Hofstetter¹ Innocent Njoku, Jr.¹
Apostolos J. Tsiouris² Eric Elowitz¹ Roger Härtl¹

- 49 patients

Variable	Preoperative	Latest follow-up	p Value
Disk height ^a	6.5 ± 0.62	8.2 ± 0.61	0.037 ^b
Foraminal height ^a	15.6 ± 0.67	18.5 ± 0.57	<0.001 ^b
Listhesis ^a	5.1 ± 0.77	3.1 ± 0.36	0.005 ^b
Local disk angle ^a	6.5 ± 0.85	8.1 ± 0.93	0.122
Lumbar lordosis ^a	45.8 ± 2.73	48.0 ± 2.14	0.248

Conclusions Midterm results indicate that expandable PEEK spacers can effectively and durably restore disk and foraminal height and improve the outcome without significant subsidence.

Global Spine J 2015;5:169-178.

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Global Spine J 2015;5:169-178.

Table 8. Different expandable cages used for TLIF

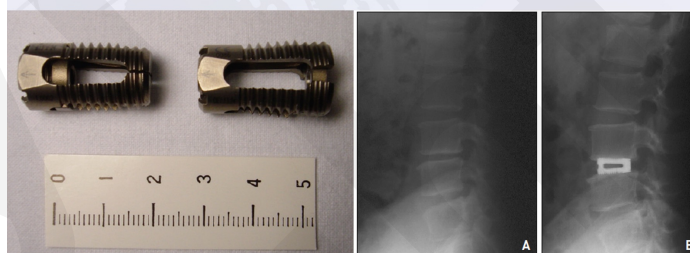
Device	Cage	Substance	Types	Height size	Footplates
StAxS XD Expandable Device (Spine Wave, Inc., Shelton, CT, United States)		PEEK	Convex/ lordotic	Starts at 7 mm; expands in situ in 1-mm increments, up to 15 mm	Width 9 and 11 mm; length 22, 25, and 29 mm
CAUBER expandable lumbar fusion device (Globus Medical, Inc., Audubon, PA, United States)		PEEK and titanium	Parallel and lordotic options	Starts at 8 mm; expansion options from 8 to 17 mm	Width 10 and 12 mm; length 22, 26, and 30 mm
AccuLIF TL (CoAlign Innovations, Allendale, NJ, United States)		Titanium	Lordotic	Starts at 6 mm; expansion options from 6 to 16 mm	Width 11 mm; length 30 mm
SmArtCage-L Expandable and self-positioning interbody fusion cage dedicated to TLIF (SmartSpine SAS, Saint Victor, France)		PEEK-Optima (with the addition of BioSs)	Biconvex	Starts at 7 mm; four different heights: 7, 9, 11, and 13 mm	Width 15 mm; length 30 mm

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J Korean Neurosurg Soc 42 :251-257, 2007

10.3340/jkns.2007.42.4.251

A Multi-center Clinical Study of Posterior Lumbar Interbody Fusion with the Expandable Stand-alone Cage (Tyche® Cage) for Degenerative Lumbar Spinal Disorders



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	Pre-OP*	Post-OP	Final (24 months)	p value
Total number of exam	56		39	
Sagittal alignment (°)				
Segmental lordosis				
Flexion	1.02 ± 3.81	—	4.77 ± 3.96	<0.001
Neutral	3.54 ± 3.70	—	6.37 ± 3.97	<0.001
Extension	4.44 ± 4.01	—	7.07 ± 4.01	<0.001
Total lumbar lordosis	20.37 ± 11.30	—	24.71 ± 11.70	0.011
Intervertebral disc height (mm)	9.94 ± 2.69	12.23 ± 3.31	11.43 ± 2.23	<0.001

*OP : operation

4 DEGREES

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Original Article Clinics in Orthopaedic Surgery 2008;1:207-213 • doi:10.4090/cons.2008.1.4.207

Radiographic Results of Single Level Transforaminal Lumbar Interbody Fusion in Degenerative Lumbar Spine Disease: Focusing on Changes of Segmental Lordosis in Fusion Segment

Sang-Bum Kim, MD, Taek-Soo Jeon, MD, Youn-Moo Heo, MD, Woo-Suk Lee, MD, Jin-Woong YL, MD, Tae-Kyun Kim, MD, Cheol-Mog Hwang, MD*

Department of Orthopaedic Surgery, *Radiology, Konyang University College of Medicine, Daegu, Korea

Table 2. Changes in the Radiographic Parameters Affecting the Sagittal Balance (Mean ± SD)

	SLL (°)	WLL (°)	DH (mm)
Preoperative	14.59 ± 9.81	39.10 ± 11.10	9.13 ± 2.92
Postoperative	18.21 ± 6.54	39.01 ± 8.48	11.64 ± 1.94
3 month follow-up	17.00 ± 7.21	42.05 ± 11.77	11.37 ± 1.92
Final follow-up	16.22 ± 7.39	42.55 ± 12.17	10.90 ± 2.02
Mean error	1.07 (0 - 3.86)	2.31 (0.03 - 5.76)	0.65 (0.03 - 1.85)
p-value*	0.069	0.000	0.002

SLL: Segmental lumbar lordosis, WLL: Whole lumbar lordosis, DH: Disc height. *The mean values for each parameter obtained before surgery and at the last follow-up were compared using a paired sample t-test.

**NOT EXPANDABLE
N=26
3 DEGREES**

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Orthopaedic Surgery (2012), Volume 4, No. 1, 15-20

CLINICAL ARTICLE

Restoration of lordosis and disk height after single-level transforaminal lumbar interbody fusion

Christopher K Kepler MD, MBA, Jeffrey A Rihn MD, Kristen E Radcliff MD, Amar A Patel MD, D Greg Anderson MD, Alexander R Vaccaro MD, PhD, Alan S Hilibrand MD, Todd J Albert MD

Variable	Preoperative	Immediate postoperative	Final postoperative	P value*
Entire Cohort				
Lumbar lordosis	39.2°	43.9°	42.8°	P < 0.001
Disc height (mm)	5.3	10.3	9.8	P < 0.001
Spondylolisthesis subgroup				
Percent translation	20%	—	13.6%	P < 0.001

- **NOT EXPANDABLE**
- **N = 45**
- **3.6 DEGREES**

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Improvement of sagittal balance and lumbar lordosis following less invasive adult spinal deformity surgery with expandable cages and percutaneous instrumentation

Clinical article J Neurosurg Spine 18:4-12, 2013 ©AANS, 2013

MICHAEL Y. WANG, M.D.
Department of Neurological Surgery, University of Miami Miller School of Medicine, Miami, Florida

- 25 pts with ASD
- MIS technique / facet osteotomies
- Expandable TLIF cages
- Mean Improvement of Lumbar lordosis (L1-S1)
 - 27.8 to 42 degrees
- Sagittal vertical axis improved
 - 7.4cm to 4.3cm
- **BUT DEFORMITY CORRECTION IS DIFFERENT**

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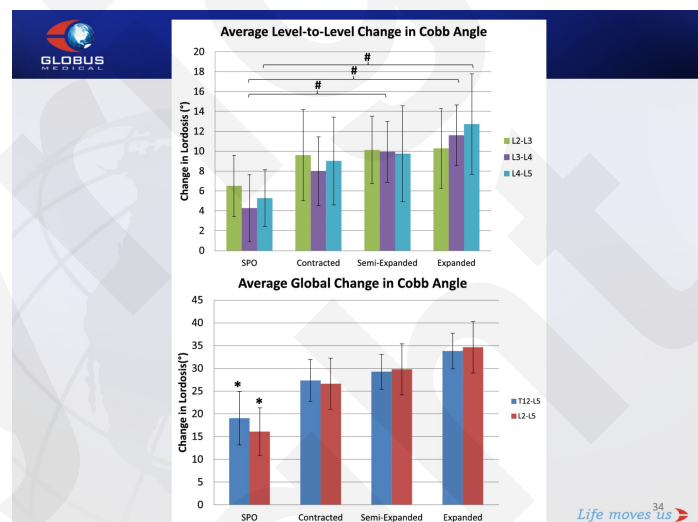
ELSEVIER The Spine Journal ■ (2014) ■ Basic Science

Additional sagittal correction can be obtained when using an expandable titanium interbody device in lumbar Smith-Peterson osteotomies: a biomechanical study

Nicholas A. Qandah, DO^a, Noelle F. Klocke, MS^{b,*}, Jordan J. Synkowski, DO^c, Suresh R. Chinthakunta, MS^d, Mir M. Hussain, BS^b, Kanaan G. Salloum, BS^b, Eric A. Marvin, DO^c, Brandon S. Bucklen, PhD^b

N=7 Cadavers

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Do I have any evidence?

- Cardiff experience 2013-2015
- 5 Surgeons: 106 Patients
- 55 expandable cages (74 levels; 64 cages)
- 29 Caliber (PEEK) 26 Rise (Ti)
- 51 conventional cages (70 levels; 55 cages)
- 36 Oblique (22 Ti 14 PEEK) and 15 Banana (all Ti)
- FU 8 and 10 months respectively

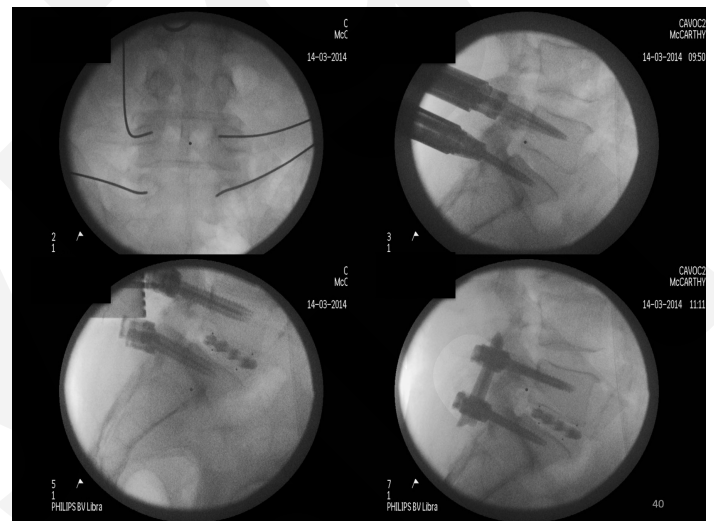
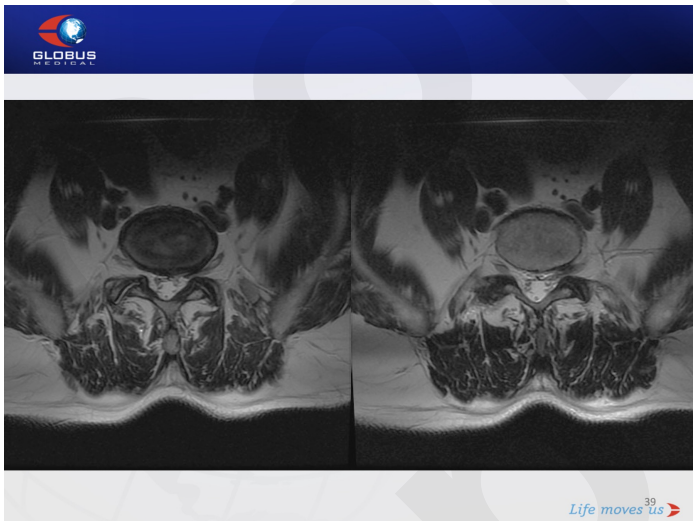
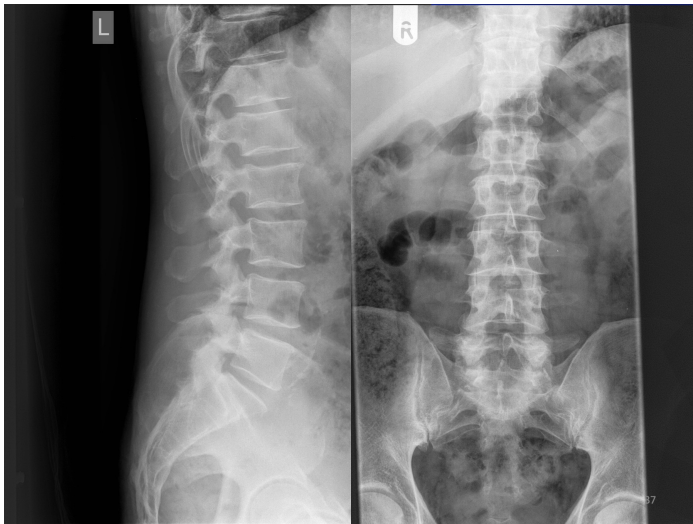
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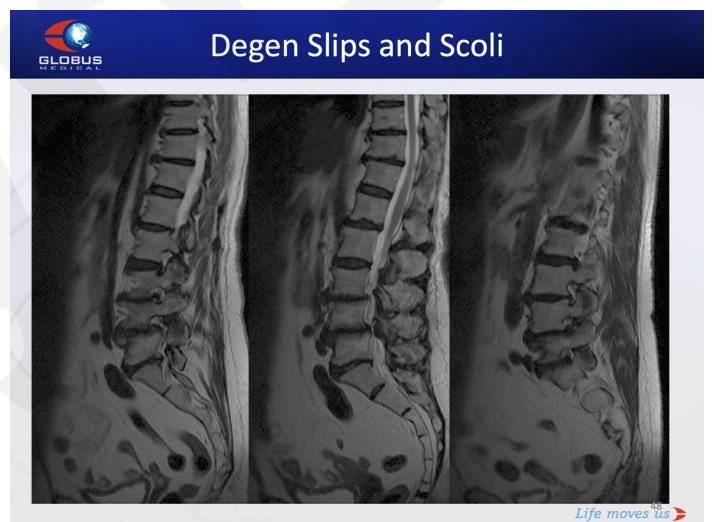
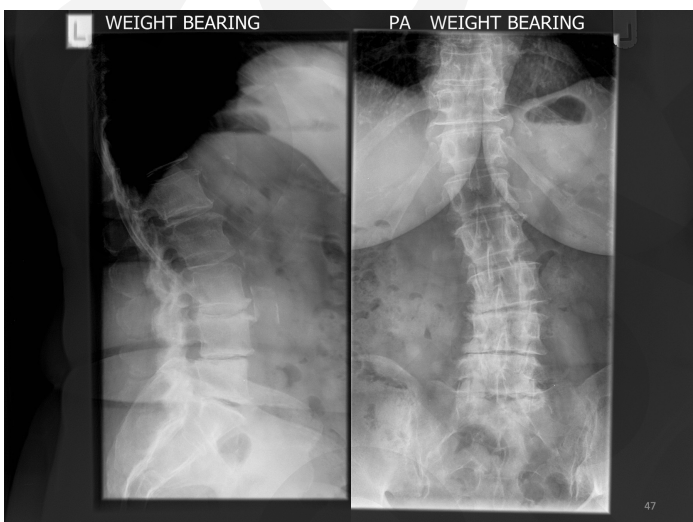
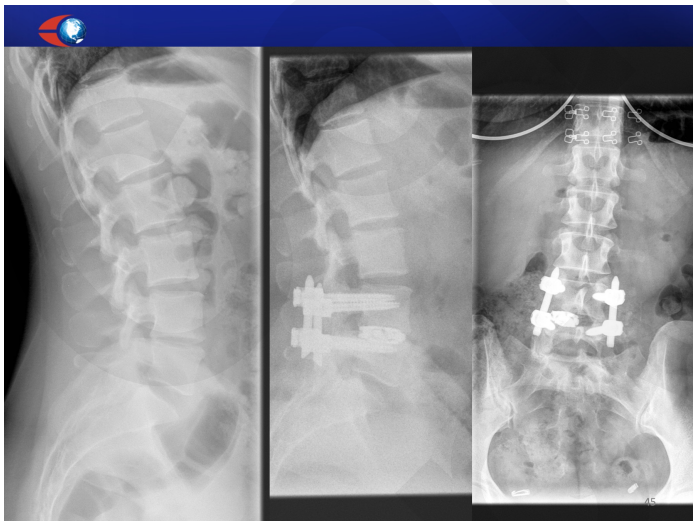
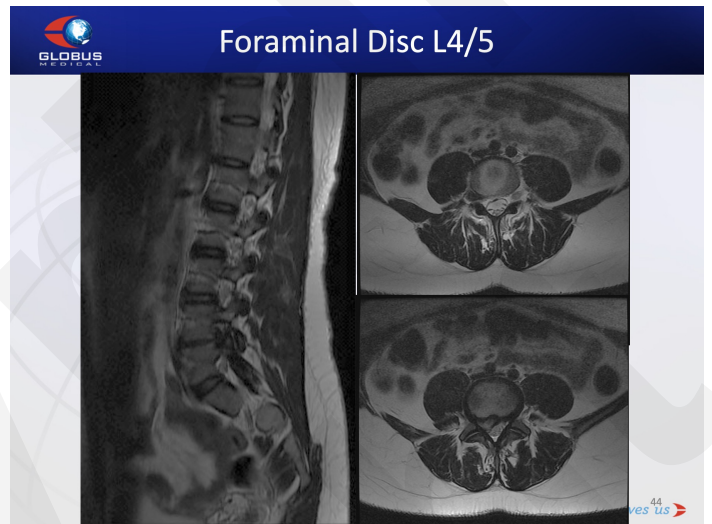
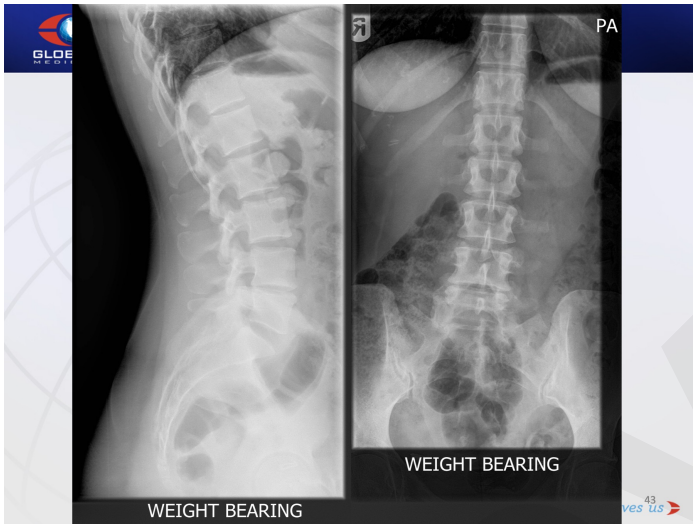
Cardiff Experience 2013-2015

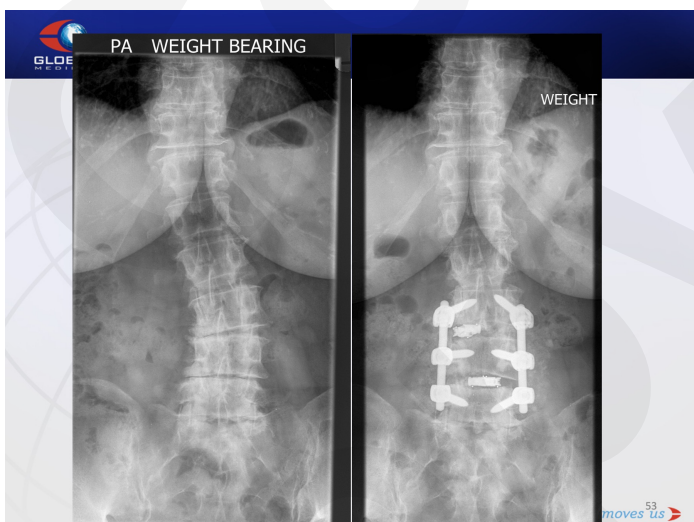
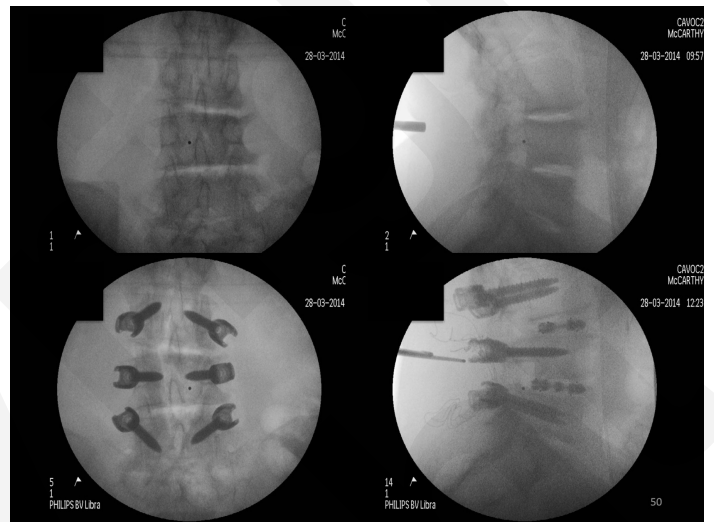
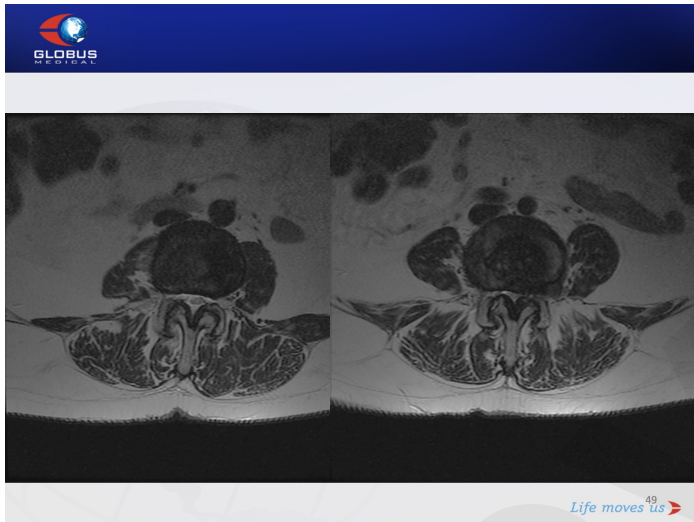
Cage Type	Endplate Penetration at Operation	Post Operative Worsening Subsidence	Cage Back Out	Screw Loosening	Return to Theatre for Revision Surgery
Expandable	16 / 64 (25%)	3 / 64 (5%)	0	4 / 55 (7%)	3 / 55 (5%) (none cage related)
Conventional	20 / 55 (36%)	6 / 55 (11%)	5 / 55 (9%)	3 / 51 (6%)	5 / 51 (10%) (3 cage related)

- Segmental and global lordosis maintained
- Banana cages no significant improvement in lordosis

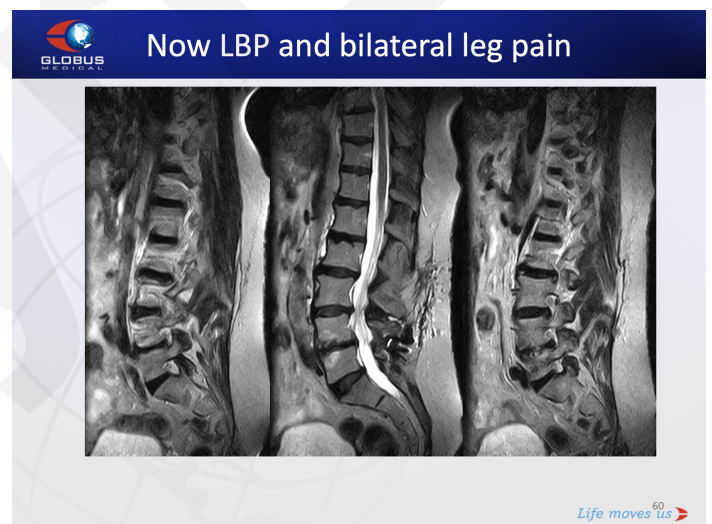
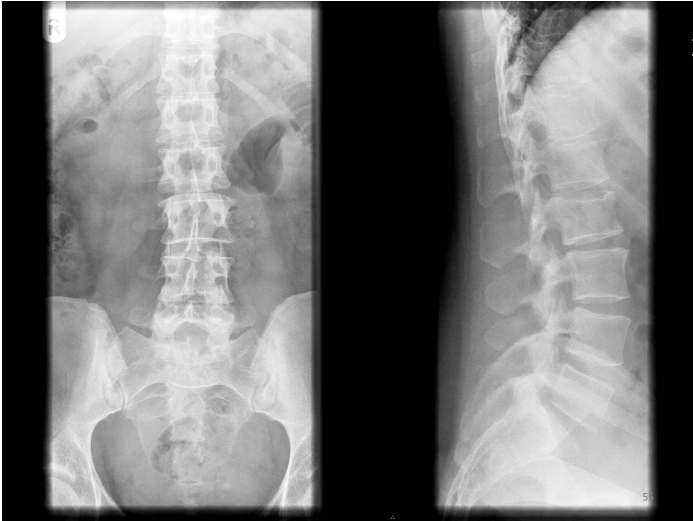
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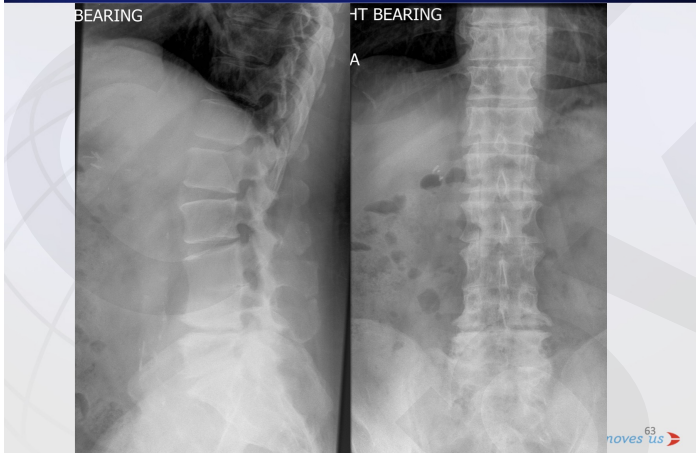
- 50 year old female
- Previous “kyphosis procedure” for stenosis



Stenosis 3/4/5, Facet Arthrosis, DDD



Grafting the disc space



Grafting the disc space

