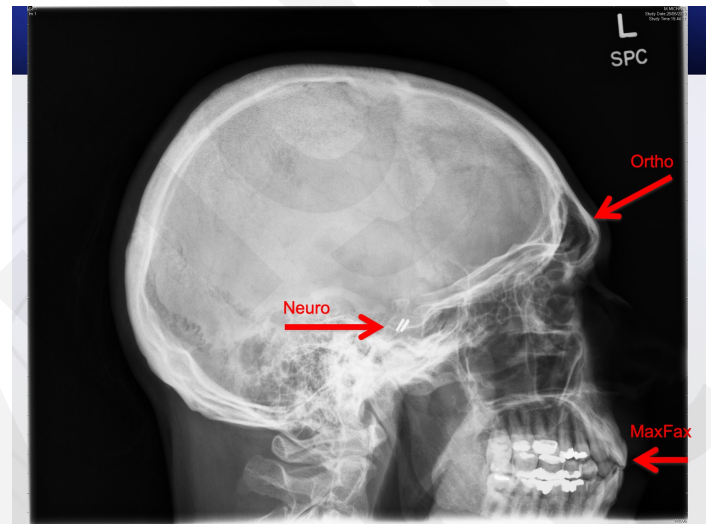




**First Rule of Globus Spine Club**

You don't talk, discuss, converse, chat, confer, deliberate, gab or gossip about Globus Spine Club

- What Goes on Tour Stays on Tour!

*Life moves us ➤*

**GLOBUS MEDICAL**

*Understanding and Applying Sagittal Balance in Degenerative Surgery*

Mr Michael J H McCarthy  
Consultant Spinal Surgeon  
University Hospitals of Wales, UK

Fusion Portfolio Minimally Invasive Surgery Biomaterials Motion Preservation

*Life moves us ➤*

**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")

**Require Instrumentation**  
All may require fusion  
Instrumentation increases fusion

*Life moves us ➤*

**Indications for Surgery**

- **What are you trying to achieve?**
  - Non-maleficence - "first, do no harm" (primum non nocere).
- **DO THE APPROPRIATE OPERATION FOR THE PATIENT AND THEIR PATHOLOGY AND YOUR SKILL / ABILITY**

*Life moves us ➤*

## Real Purpose of Surgery



Life moves us ➤

## Causes of Sagittal Malalignment

- Congenital anomaly
- Ankylosing spondylitis
- Iatrogenic:
  - Flatback Syndrome
  - Kyphotic Decompensation Syndrome
  - Adjacent segment pathology
- Post-traumatic
- Infectious
- Neoplastic
- Osteoporotic Compression Fractures
- Degenerative Spinal disorders

Life moves us ➤

## Iatrogenic Causes

- Posterior distraction instrumentation
- Anterior compression instrumentation
- Poor sagittal alignment in the instrumented segment
- Breakdown above long fusion

Life moves us ➤

## The 7 Ps

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

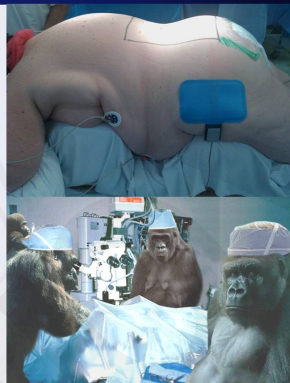


**Attention to detail  
Never let your guard down**

Life moves us ➤

## The other 3 Ps

- Personality - Patient
- Personality - Pathology
- Personality - Practitioner



Life moves us ➤

## Sagittal Balance Parameters

- Pelvic Incidence
- Pelvic Tilt
- Sacral Slope
- Lumbar Lordosis
- Thoracic Kyphosis
- Cervical Lordosis
- Centre of Gravity
- C7 Plumb Line
- Sagittal Vertical Axis
- Sacro Femoral Distance
- T1 Spino Pelvic Inclination
- T1 Pelvic Angle
- T1 Sagittal Angle



You better think!

Life moves us ➤

ACTA ORTOP BRAS 14(4) - 2006

ORIGINAL ARTICLE

### LUMBAR LORDOSIS: A STUDY OF ANGLE VALUES AND OF VERTEBRAL BODIES AND INTERVERTEBRAL DISCS ROLE

LUZ HELENE FONSECA DIAMANTINO<sup>1</sup>, SILVIO RICARDO GUIMARAES CATAPÊ<sup>2</sup>, ANTONIO DONALDO CAMPOS<sup>3</sup>, HILTON LUIS ANNECIDO DORTCH<sup>4</sup>

|       | Mean Angle (°) | Standard Deviation | Range (°)     | % participation in curvature L1-S1 (range) |
|-------|----------------|--------------------|---------------|--------------------------------------------|
| L1-L2 | -4.99 *        | 2.9                | 4.0 to -12.0  | 8.16 (-8.57 to 24.00)                      |
| L2-L3 | -6.89 *        | 2.73               | 0.0 to -15.0  | 11.35 (0.00 to 27.27)                      |
| L3-L4 | -9.25 *        | 2.54               | -2.0 to -20.0 | 15.38 (3.03 to 30.95)                      |
| L4-L5 | -12.29 *       | 3.39               | -2.0 to -26.0 | 20.43 (3.81 to 42.86)                      |
| L5-S1 | -15.58 *       | 5.43               | -4.0 a -35.0  | 26.07 (5.80 a 56.52)                       |

(\*)Averages different from each other with p<0.001

**Tabela 2 - Intervertebral discs measurements**

**>50% LL @ L4-S1 (21deg vs 28deg)**

Life moves us ➤

### Cone of Economy

Life moves us ➤

- CoG and gravity line goes through hips
- C7PL always behind CoG in a balanced spine

Life moves us ➤

SS sacral slope  
PT pelvis tilt  
I incidence

$PI = PT + SS$

**Fig. 10** Pelvic parameters: pelvis tilt, sacral slope, incidence angle. SS sacral slop, PT pelvis tilt and I incidence

Life moves us ➤

Life moves us ➤

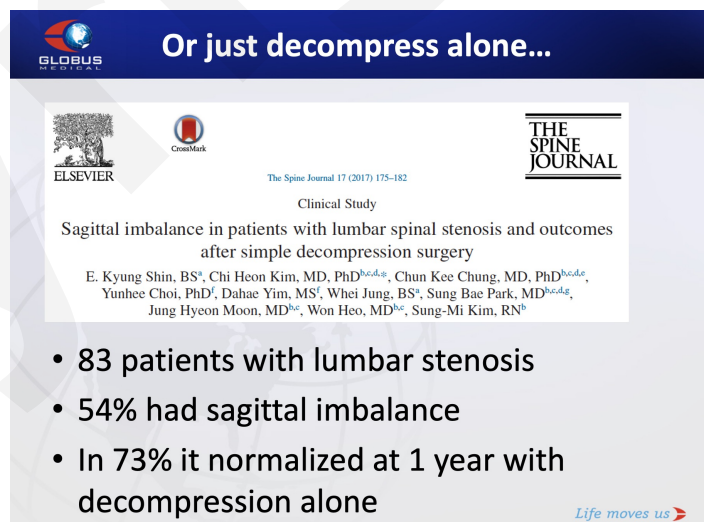
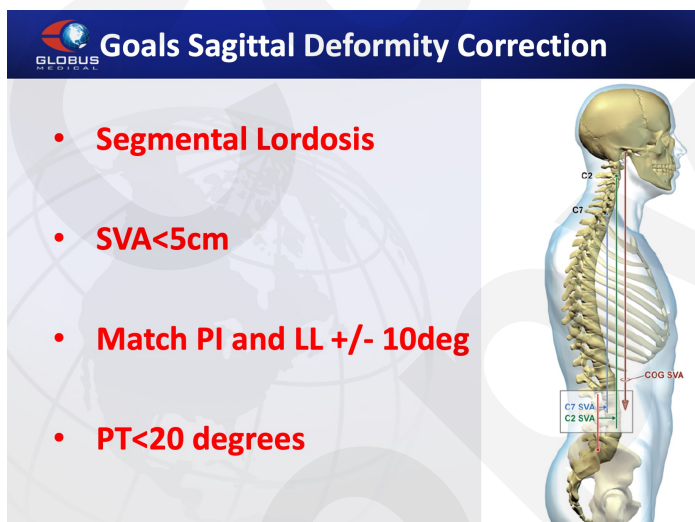
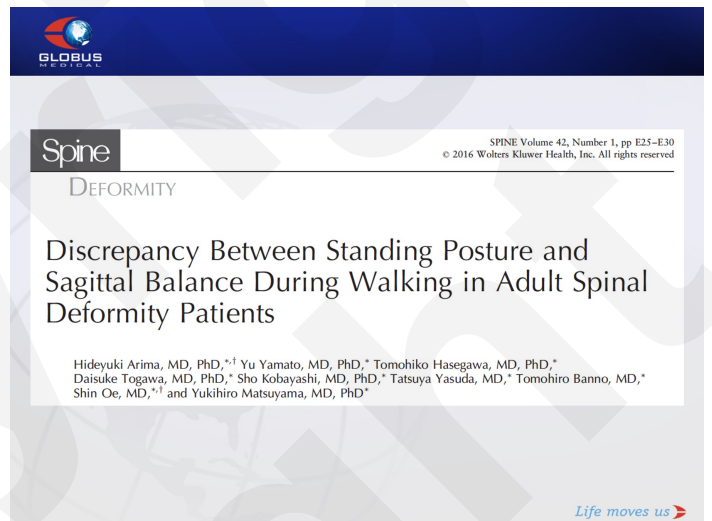
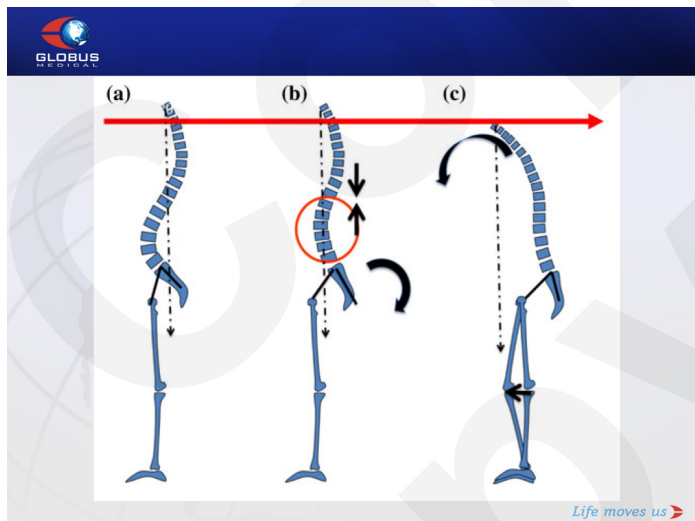
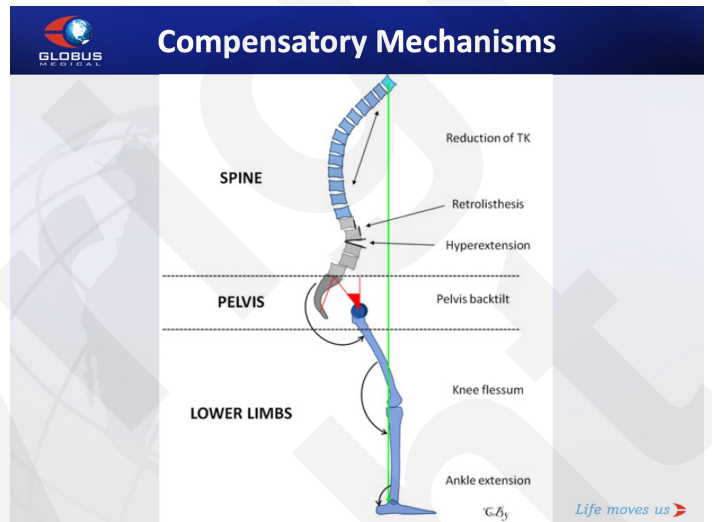
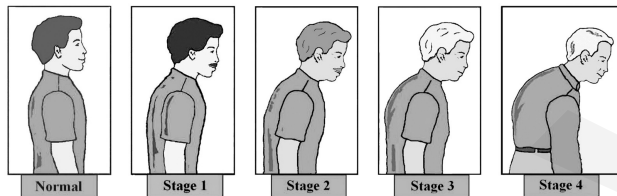
### Roussouly

**Low grade PI**      **High grade PI**

- **Sacrum:**
- **H**orizontal = **H**igh PI
- **V**ertical = **L**ow PI
- PI-LL normally within 10°

**Fig. 4** The shape of lumbar lordosis depends on SS orientation. Type 1 and 2 have SS < 35°; Type 3 has 35° < SS < 45°; Type 4 has SS > 45°. Generally Type 1 and 2 have a low PI and Type 3 and 4 have a high PI

Life moves us ➤



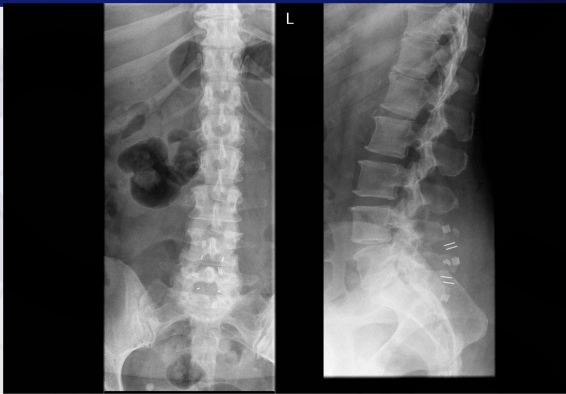
## Examples in Practice

- Keep it simple
  - Patient factors
    - Age / Fitness / Morbidities
  - Examination
    - Stand upright - legs straight
    - Walking
  - Erect Lumbar XRs
    - Compare to lying MRI
    - Look at L4 / look at Sacrum / look at Hips
    - Measure the PILL and observe the lordosis L4-S1
    - Get whole spine films...
  - Is Fusion Really Required / Number Levels

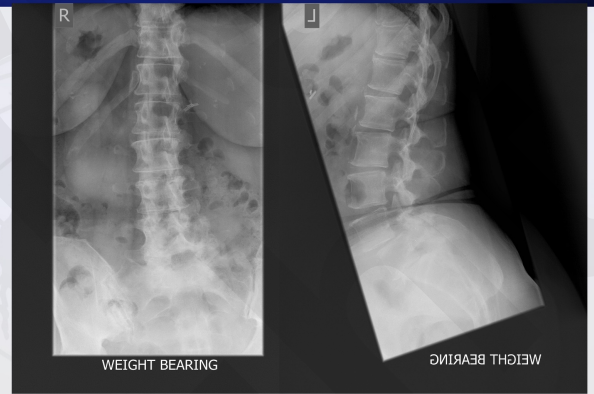
Life moves us ➤

- 60 year old female

Life moves us ➤

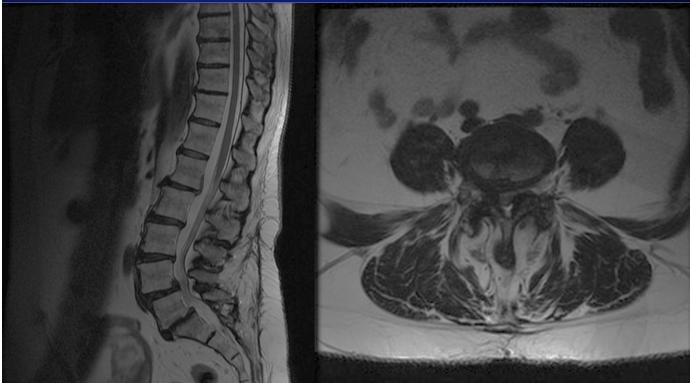


Life moves us ➤



Life moves us ➤

## What would you do?

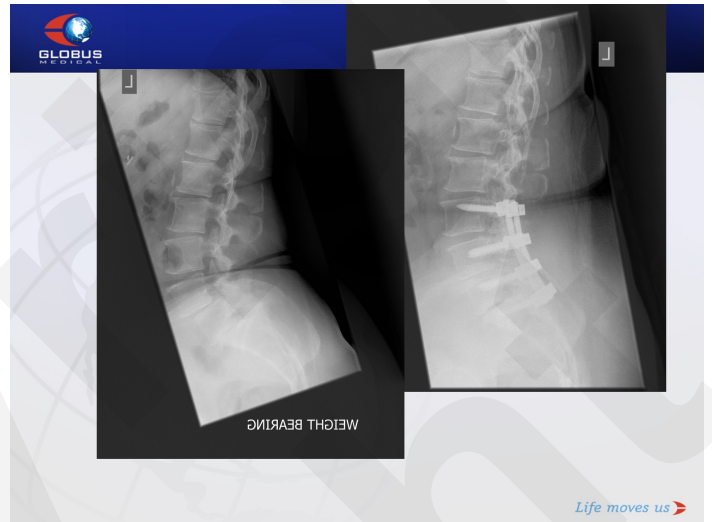


Life moves us ➤

## Mistake 1

- Taking on a revision case in my first year as a Consultant
- ...and doing the wrong operation...

Life moves us ➤



### Mistakes 2 and 3

- Thinking that L5 only innervates EHL
- Not paying attention to the LL, PI, Sag balance etc etc and fusing L3 to S1

Life moves us ➤

### The Interim

- Hysterectomy – massive fibroids ? Malignant
- Craniotomy – large meningioma
- Then the problem...

Life moves us ➤



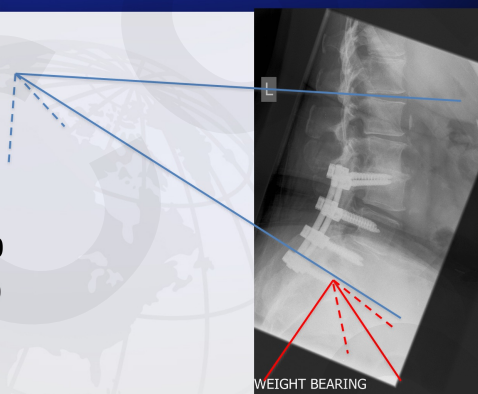


Life moves us ➤

## Symptoms

- Advanced DDD L2/3
- Clear and severe foraminal and lateral recess stenosis
- Back pain and fatigue standing
  - Loss sagittal balance
- Persisting Trendelenburg gait
- SIJ pain – responded to injection

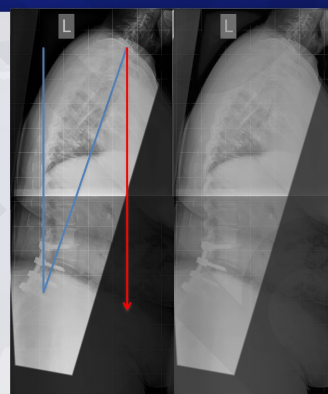
Life moves us <sup>38</sup> ➤



- LL 30
- PI 60

Life moves us ➤

## Eventually



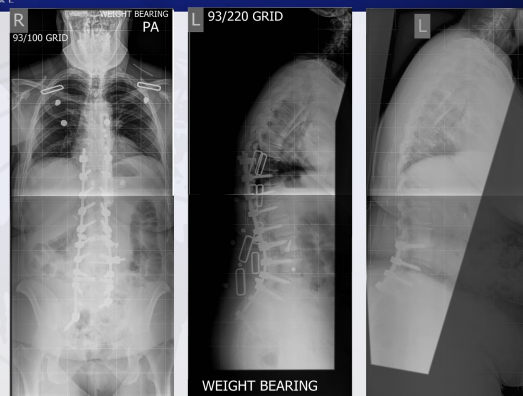
Need  
approx 30 deg

Life moves us ➤

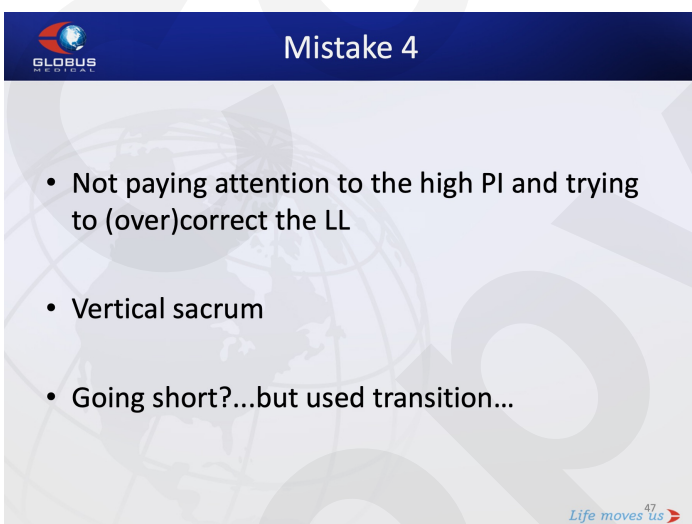
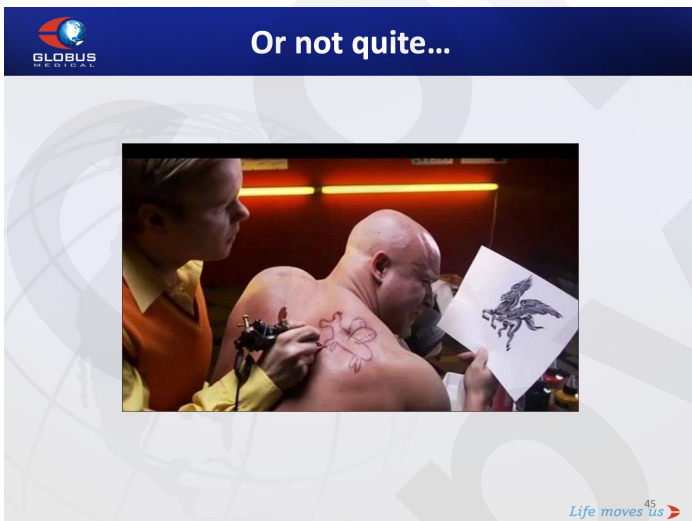
## The Plan

- Get 30 more degrees LL to equal PI
- Use precontoured rods
- ALL release with hyperlordotic cages to avoid PSO in fusion mass and to permit restoration of foraminal stenosis
- Ignore the SIJ pain for now (non believer)

Life moves us <sup>41</sup> ➤



Life moves us ➤





**Summary**

- Examine the patient!
  - Stand up straight - hips - lumbar – thoracic
- Get decent preop radiographs
  - Measure the PILL and you won't get caught out
  - Whole spine XRs...
- XR Warnings / Alerts:
  - Flat back / Hyperlordosis
  - Vertical / Horizontal Sacrum
  - (High grade slips)

Life moves us ➤

