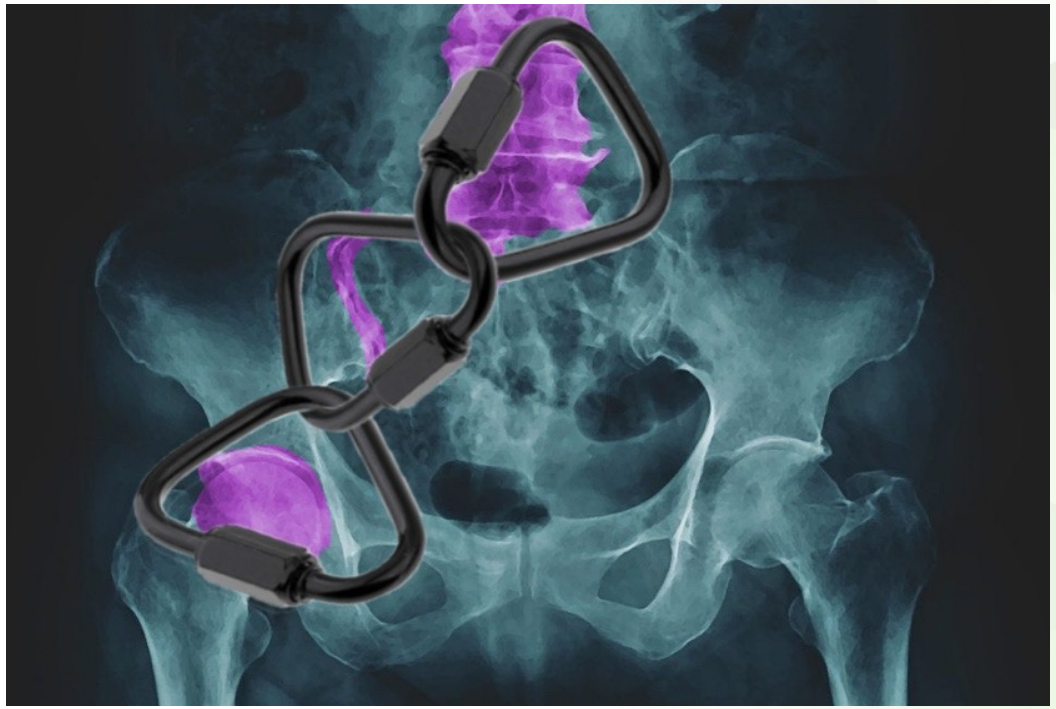
Continuing Education

Understanding the Link:
The Hip, The Spine, and The SI Joint



Bio: Name

- CV/Education

- Practice

❖Disclosures – No relevant financial relationship exists.

Learning Objectives

At the completion of this educational activity, the course participant will:

1. Understand the prevalence of SI joint dysfunction
2. Understand the biomechanics & anatomy of the SI joint
3. Learn the standard protocol for SI joint diagnosis
4. Know the basic steps of MIS SI joint fusion surgery
5. Review the published clinical results of MIS SI joint fusion surgery
6. Understand reimbursement considerations for MIS SI joint fusion

Hip Spine Syndrome

Lumbar Spinal Stenosis

"A Cause of Continued Pain and Disability in Patients after Total Hip Arthroplasty"

William R. Bohl, MD and Arthur D. Steffee, MD

- Spine, Volume 4: Number 2 1979

Hip – Spine Syndrome

- **Two ways hip and spine symptoms overlap**
  - **Referred pain**
    - Radicular spine pain felt around hip
    - Hip pain felt over lower back / buttock
- **Postural Alteration**
  - **Hip joint pain / contracture**
    - Altered spine mechanics
  - **Spine pain / hypolordosis**
    - Altered acetabular orientation

Referred Pain in Hip Patients

Hip-spine syndrome: the effect of total hip replacement surgery on low back pain in severe osteoarthritis of the hip.

- All 25 THA patients treated for severe hip DJD were also found to have LBP with VAS (5) and ODI (36.7)
- All had continued improvement of LBP post-THA up to 2 yr. f/u with VAS (3.6) and ODI (19.8)

Ben-Galim P. Spine 2007

Referred Pain in Hip Patients

Hip joint pathology: clinical presentation and correlation between magnetic resonance, arthrography, ultrasound, and arthroscopic findings in 25 consecutive cases.

- **25 Hip arthroscopy patients**
- **All found to have hip pathology**
- **72% had lumbar spine pain**
- **36% had buttock pain**

Clin J sports Med 2003

Patients with Back Pain Have Inferior Results Following Hip Arthroscopy: A Minimum Two-Year Follow-Up Match-Paired Study

Benjamin Domb MD, NASS poster 2013

Hip – Spine Syndrome

- **Simple hip – spine syndrome**
  - Examination allows obvious diagnosis as to whether it is hip or spine pathology
- **Secondary hip – spine syndrome**
  - Spine pathology leads to hip pathology
  - Hip pathology leads to spine pathology
- **Complex hip – spine syndrome**
  - Both hip and spine are causing symptoms

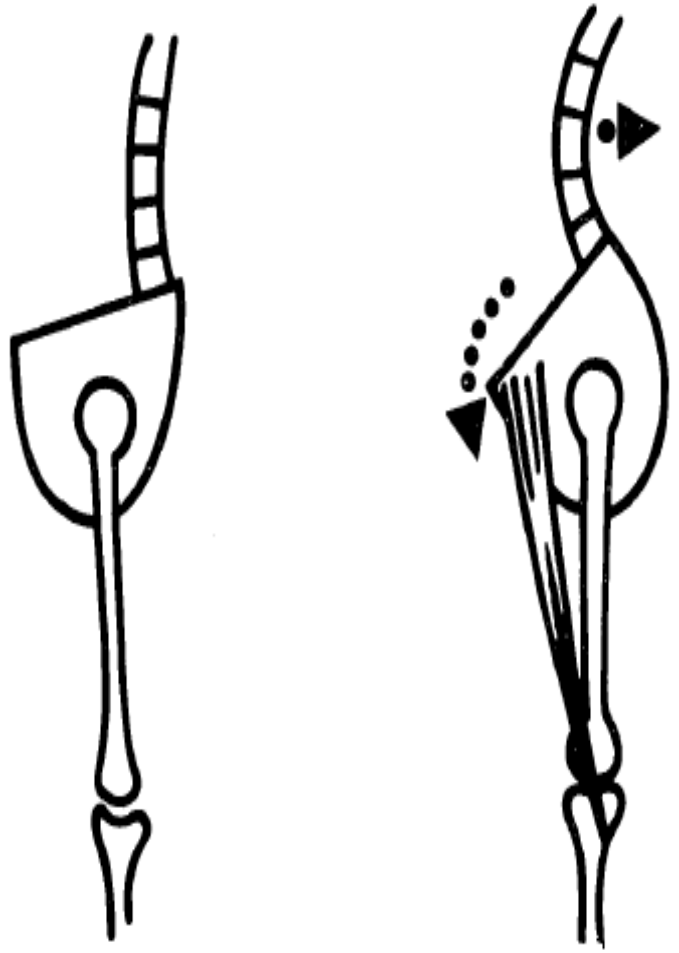
Offierski and Macnab, Spine 1983

Hip-Spine Syndrome

Postural Adaption

Flexion deformity (of the hip) may rotate the pelvis forwards and exaggerate the normal lumbar lordosis. This results in the further subluxation of the posterior facets and may give rise to low back pain and foraminal stenosis.

Offierski and MacNab. Spine 1983

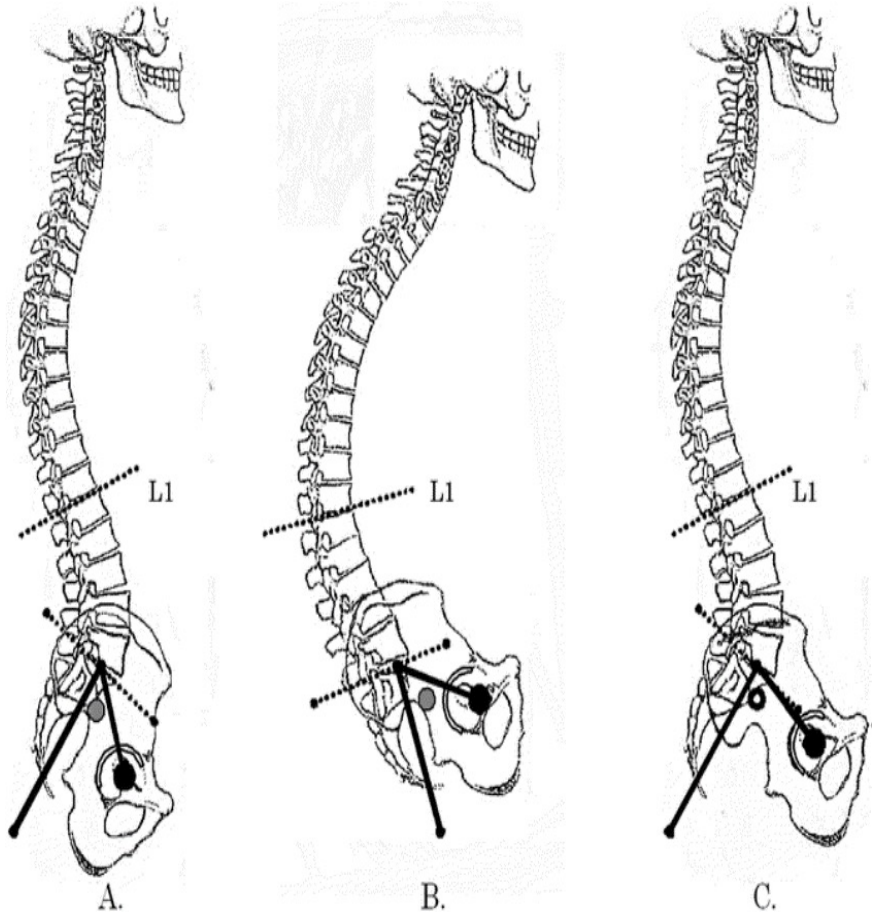


Hip – Spine Syndrome

Postural Adaption

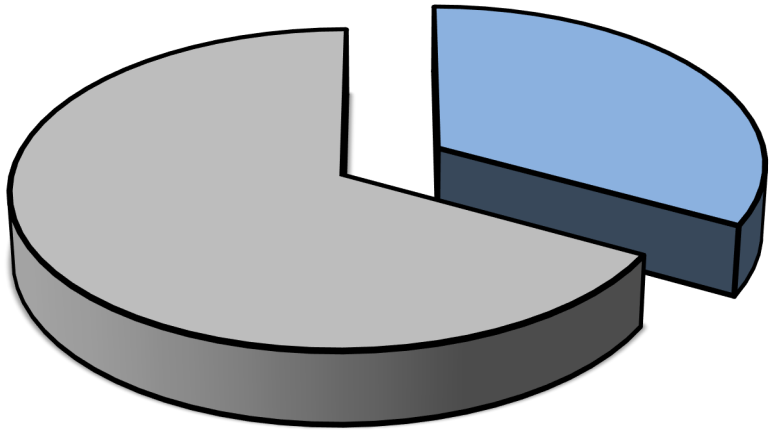
Spinal pathology leads to lumbar hypolordosis which in turn leads to posterior pelvic tilt resulting in anterior uncoverage of hip leading to hip FAI and ultimately to hip DJD.

Yoshimoto H. Spine 2005



Hip Degeneration

Spinal Stenosis 33%



- 33% of patients have hip DJD coexistent with spinal stenosis[1]
- True incidence of the combination of lumbar spinal stenosis and hip arthritis is unknown[2]

[1] *Swezey RL, Orthopedics 2003*
[2] *Fogel GR, Esses SI, Spine J 2003*

Pelvic Parameters

Increased PT Correlates with HRQOL
Increased PT is a result of compensatory pelvic retroversion

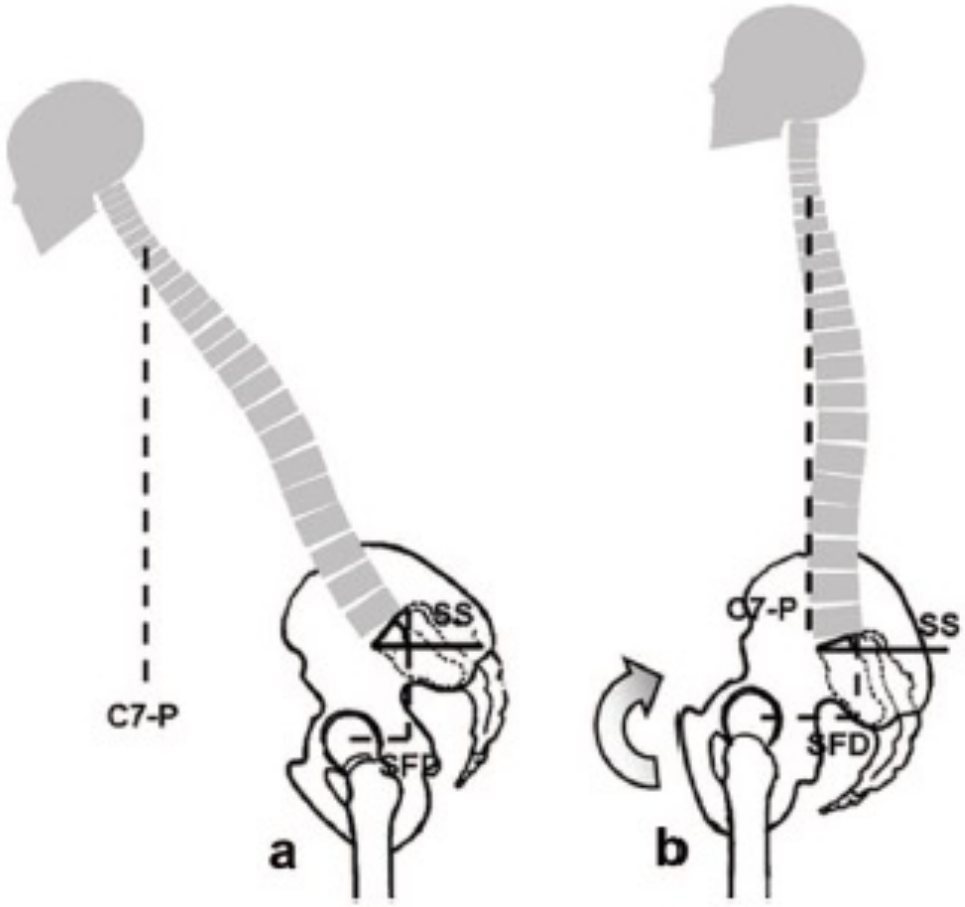
Schwab, et al Spine 34(17) 2009

SPINE Volume 35, Number 16, pp E792–E798

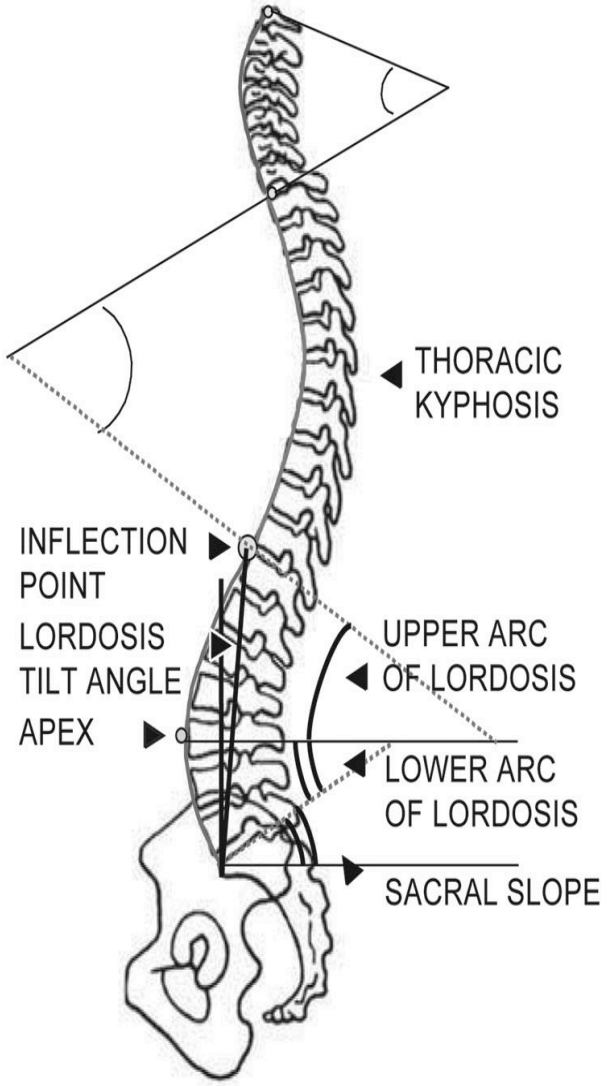
Natural History of Spinopelvic Alignment Differs From Symptomatic Deformity of the Spine

Sergio Mendoza-Lattes, MD, Zachary Ries, BSc, Yubo Gao, PhD, and Stuart L. Weinstein, MD

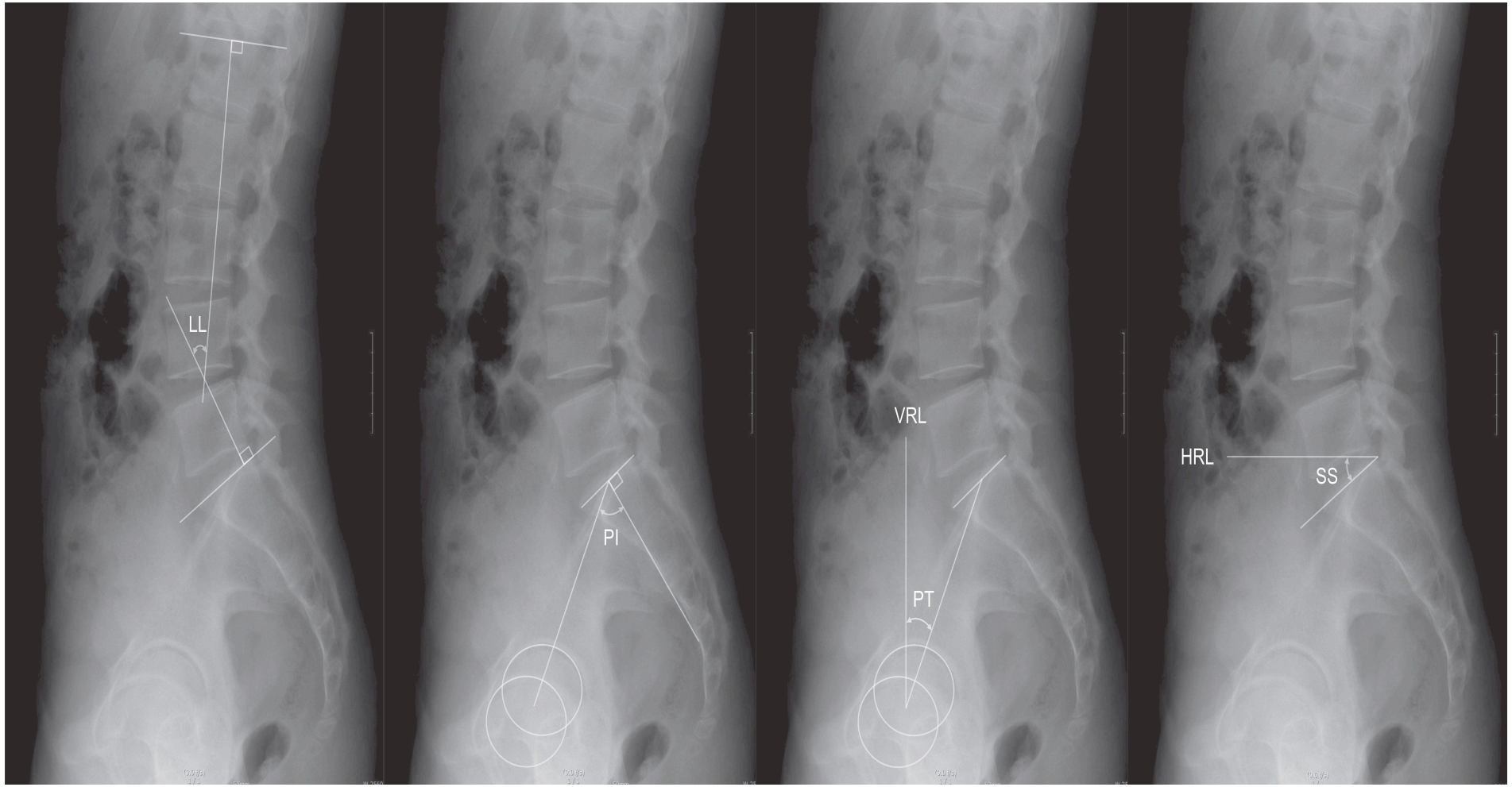
Pelvic Retriversion



Spinal Pelvic Parameters



The geometric relationships between the arcs of lumbar lordosis and the sacral slope are shown. The location of the inflection point between kyphosis and lordosis, the lordosis tilt angle, position of the apex, and the degrees of curvature of the lower arc of lordosis are important determinants of sagittal morphology. In this geometric construction, the angle of superior endplate of S1 with respect to the horizontal axis (sacral slope) is equal to the lower arc of lumbar lordosis.



LL Lumbar Lordosis

PI Pelvic Incidence

PT Pelvic Tilt

SS Sacral Slope

LBP in Total Hip Patients

The effect of total hip replacement surgery on low back pain in severe osteoarthritis of the hip.

- All 25 THA patients treated for severe hip DJD were also found to have LBP with VAS (5) and ODI (36.7)
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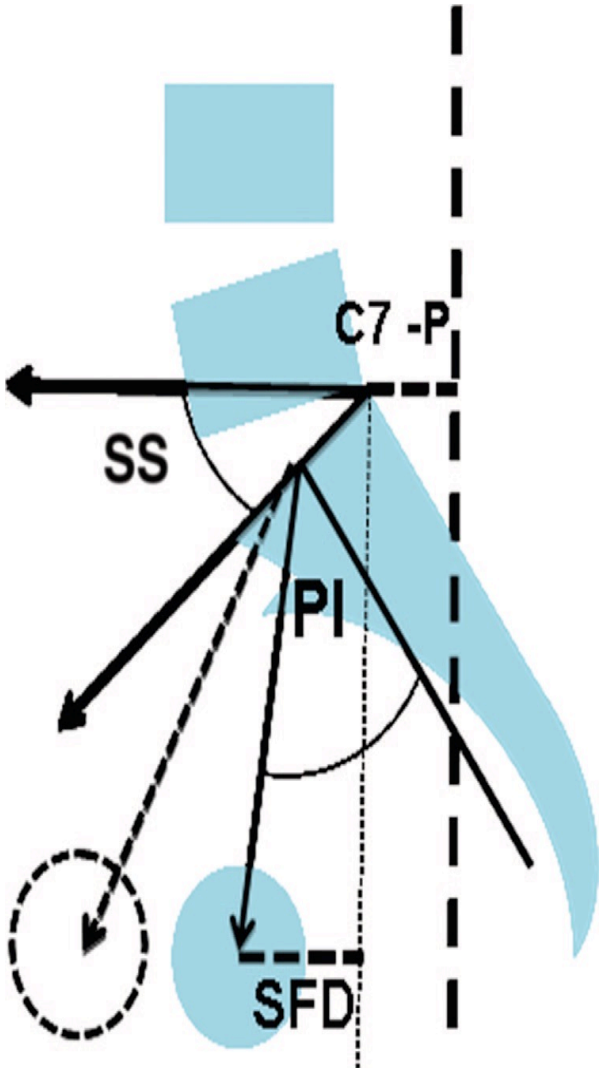
Ben-Galim P. Spine 2007

Spinopelvic Alignment

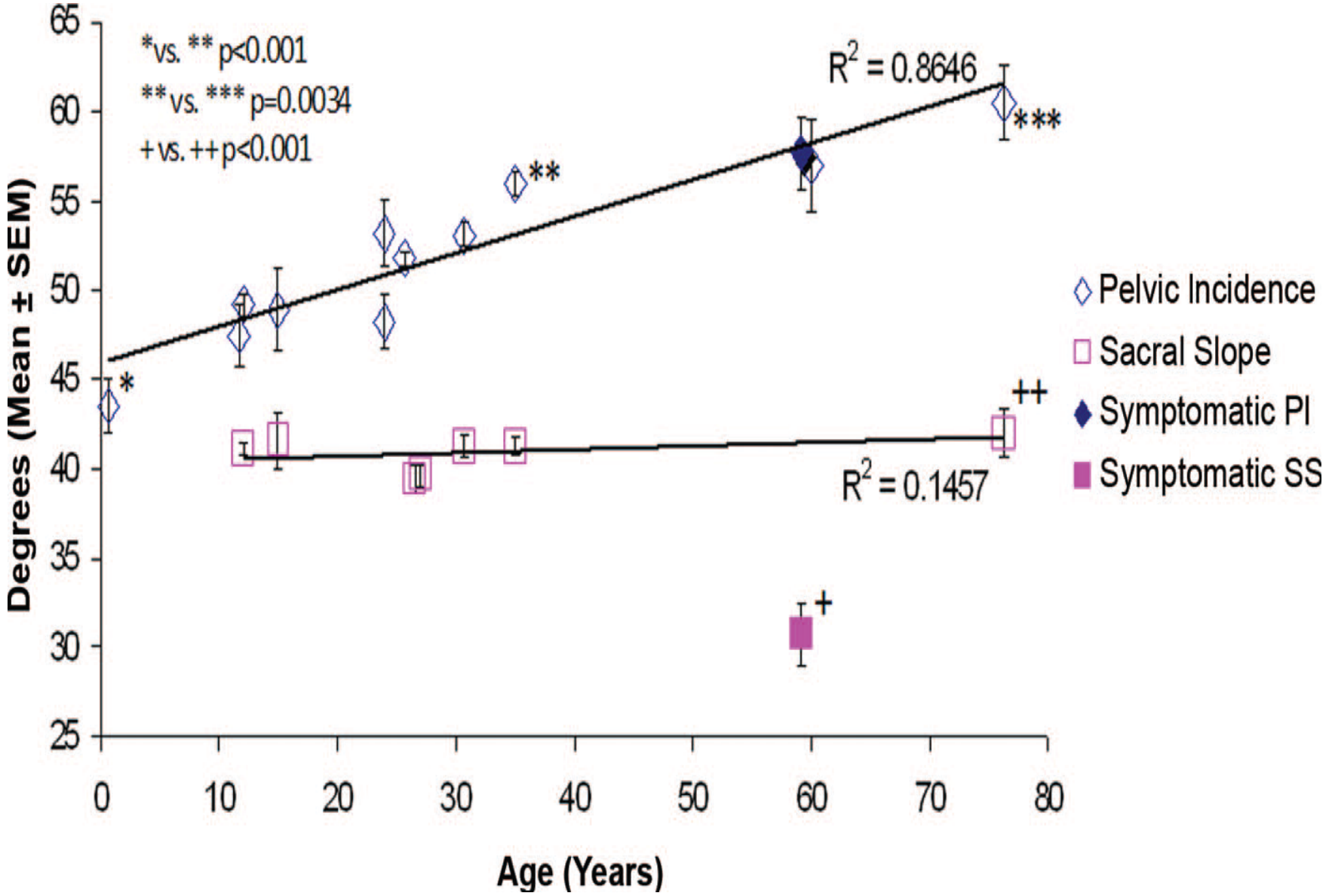
- **Morphologic changes in pelvis with age**
  - **PI** increases linearly with age
  - **SFD** increases linearly with age
- **Patients with symptomatic spinal deformity**
  - C7P Increased
  - Thoracic hypokyphosis
  - LL Decreased
  - Pelvic retroversion (d LL, d SS and I SFD)
  - PI Unchanged

Mendoza-Lattes, Spine 2010



In asymptomatic individuals, the pelvic incidence (PI) increases throughout the lifespan and is paralleled by increasing sacral-femoral distance (SFD), without concomitant change in the sacral slope (SS). This can only be explained by morphologic changes in the pelvis where the femoral heads are shifted anterior, thus modifying the angular values of the PI.

Mendoza-Lattes, Spine 2010



Medoza-Lattes, Spine 2010

Symptomatic Spine patients

- **Positive sagittal balance**
- **Decreased LL**
- **Decreased TK**
- **Pelvic retroversion (d LL, d SS)**
  - These compensatory changes cause us to underestimate the real magnitude of the sagittal imbalance

Mendoza-Lattes, Spine 2010

SPINE Volume 30, Number 14, pp 1650–1657

Spinopelvic Alignment in Patients With Osteoarthrosis of the Hip

A Radiographic Comparison to Patients with Low Back Pain

Hisashi Yoshimoto, MD, Shigenobu Sato, MD, Takeshi Masuda, MD, Taiki Kanno, MD, Motoyuki Shundo, MD, Takahiko Hyakumachi, MD, and Yasushi Yanagibashi, MD

Spinopelvic Alignment; OA and LBP

- LL, SS, PO, Sharp angle significantly less in LBP compared to HOA
- PI significantly greater in the HOA patients
- Pelvic morphology (higher PI and sharp angles) in younger may contribute to HOA in later life
- Increased posterior pelvic tilt, which may be a contributing factor to secondary hip-spine syndrome leading to anterior acetabular hip uncoverage is associated with a high PI and a low pelvic lordosis

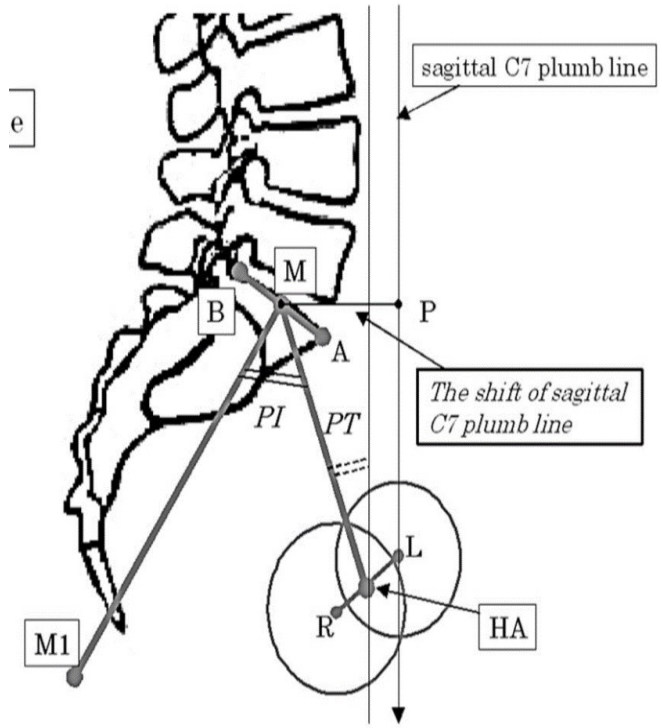
Yoshimoto H, Spine 2005

Spinopelvic sagittal parameters

Hip OA patients

- PI increased
- SS increased
- LL increased

PI correlated
(PT, SS, LL)



Symptomatic Spine patients

- PI decreased
- SS decreased
- LL decreased

Yoshimoto, Spine 2005

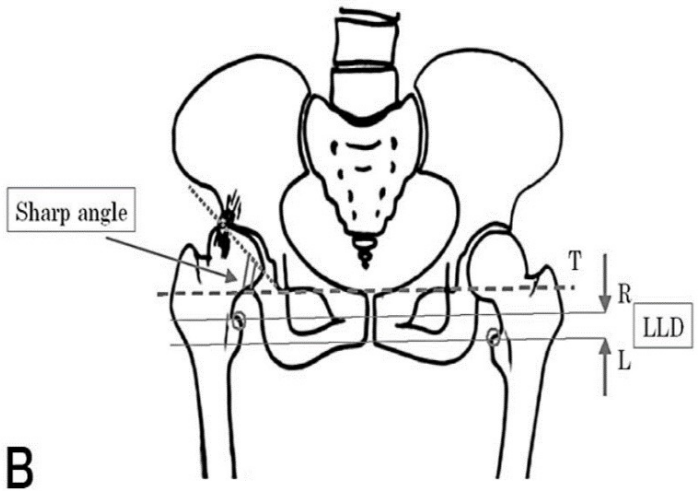
Spinopelvic coronal parameters

Hip OA patients

- Sharp angles increased
- PO greater
- LLD increased

Sharp angles correlated

(Age, LL, SS)

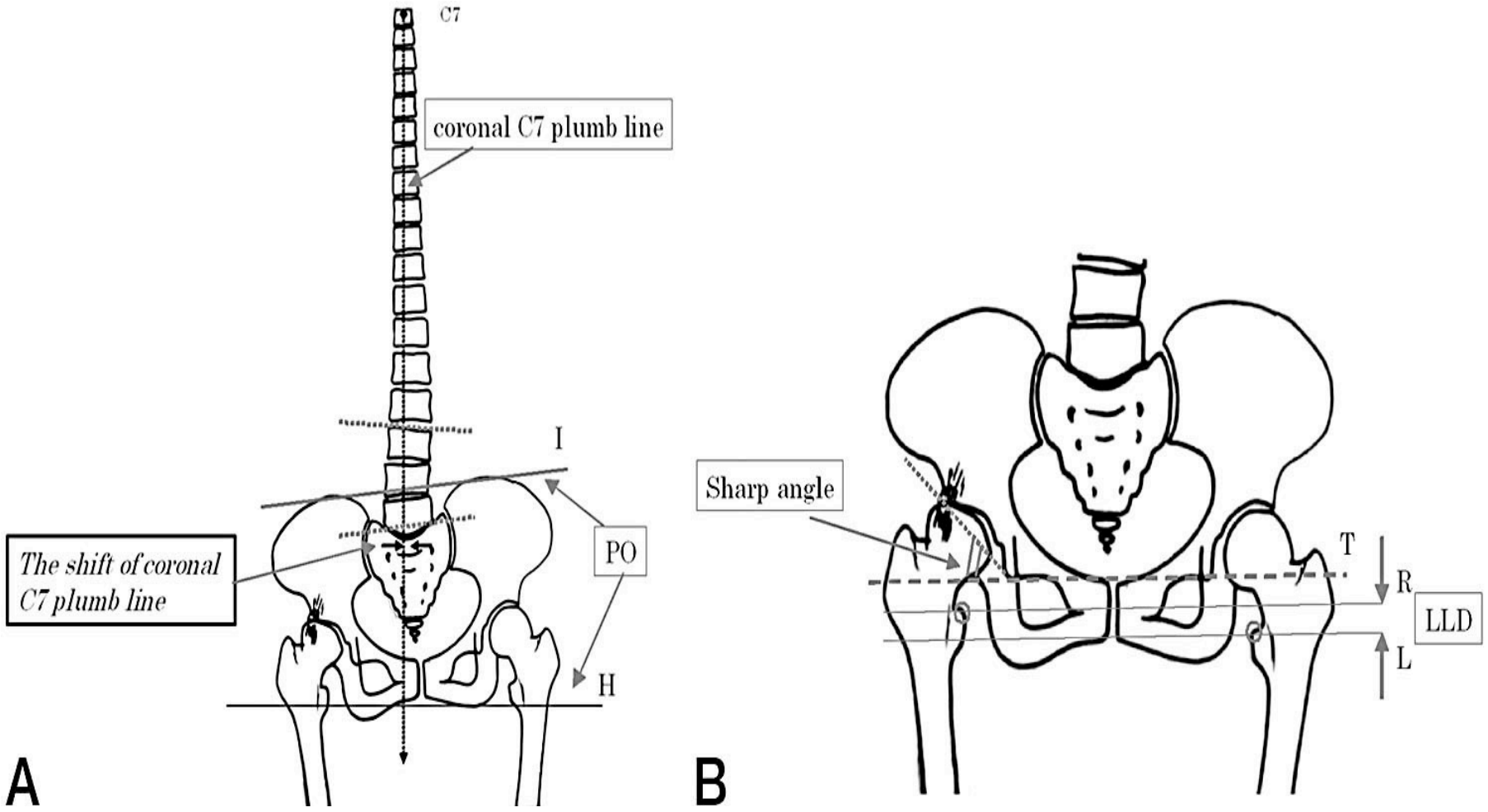


Symptomatic Spine patients

- Sharp angles decreased
- PO lower
- LLD lower

Yoshimoto, Spine 2005

Coronal Spinopelvic Parameters



Yoshimoto, Spine 2005

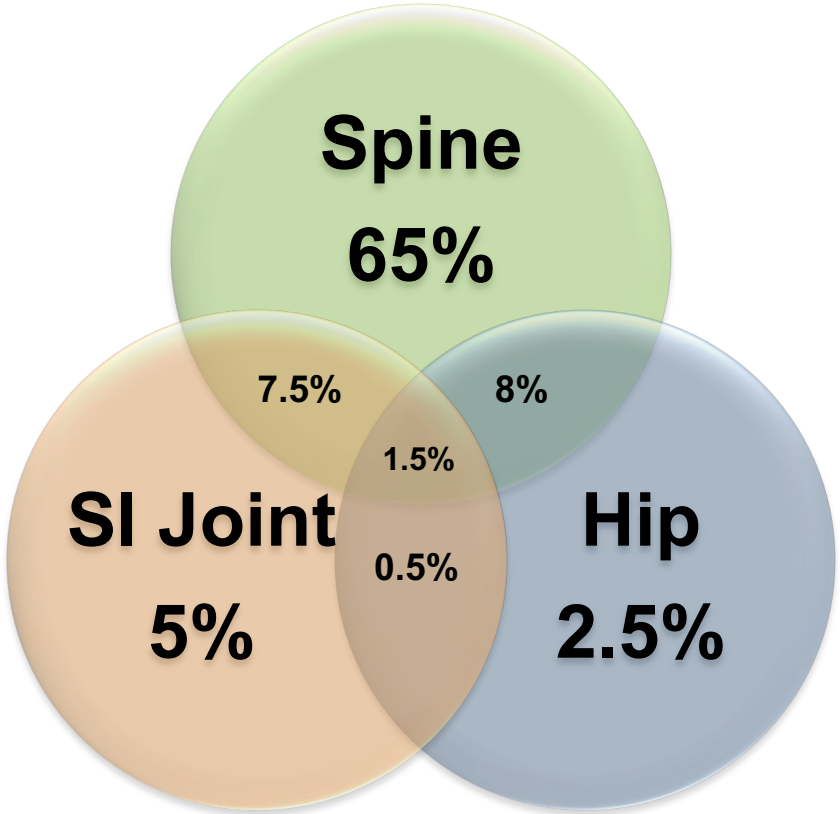
Hip Spine Syndrome

- **Hip OA patients**
  - PI increased
  - Sacrum tilts forward
  - SS increases
  - PT increases
  - LL increases
- **This leads to spinal stenosis**

- **Degenerative spine patients**
  - Positive sagittal balance
  - Thoracic hypokyphosis
  - LL decreases
  - SS decreases
  - Sacrum tilts back
- **This leads to pelvic retroversion which leads to FAI and ultimately hip OA**

Yoshimoto, Spine 2005

Hip – SI – Spine Syndrome



Sembrano and Polly, Spine 2009

SIJ and Hip

- **Hip and SI**

  76% (25 /33) patients with symptomatic SIJ pathology had at least one abnormal finding on hip radiograph, a significant number met the strict diagnostic criteria for FAI.

- **42%** Sig hip OA (Tonnis 2 +)
- **45%** Subchondral cyst
- **21%** Retroversion
- **12%** Lateral CE angle >40%
- **47%** Coxa profunda
- **33%** Cam impingement

Morgan, Hip Int 2013

SIJ and Adjacent Segment (Spine)

- **Comparative Study of Lumbopelvic Sagittal Alignment Between Patients with and without Sacroiliac Joint Pain after Lumbar Interbody Fusion**
- *Shin MH, Spine 2013*

- Target LL (=PI + 9°)
- LL-PI mis-match (Pre to Post)

- **"Lumbopelvic sagittal imbalance inferred from greater pelvic tilt and inadequately restored LL may play a central role in the development of SIJ pain after PLIF"**
- *Shin, Spine 2013*
  - **SIJ group**
    - Greater PT
    - Smaller achieved LL
    - Substantial residual LL-PI mismatch

(SS + PT = PI)

SI Joint and Total Hip Replacement

There is a relationship

- Nearly 30% of patients showed functional impairment of the sacroiliac joint after THA

  Pap, Int. Rehabil Med, 1987.

SIJ not even mentioned

- Unexplained pain after THR: what should I do?"

  Cuckler, Orthopedics, 2010

No significant change in spinal alignment after unilateral THA. At baseline, patients with symptomatic spine complaints have less sacral slope than their hip arthroplasty counterparts.

Change in spinal alignment after total hip arthroplasty, Ortho Surgery. 2013

Clinical Article

Sagittal Sacropelvic Morphology and Balance in Patients with Sacroiliac Joint Pain Following Lumbar Fusion Surgery

Dong-Young Cho, M.D.,[1] Myung-Hoon Shin, M.D.,[1] Jung-Woo Hur, M.D.,[1] Kyeong-Sik Ryu, M.D., Ph.D.,[1] Chun-Kun Park, M.D., Ph.D.[2]

Department of Neurosurgery,[1] Seoul St. Mary's Hospital, The Catholic University of Korea, Seoul, Korea

Department of Neurosurgery,[2] Spine and Joint Research Institute, Gangdong Teun Teun Hospital, Seoul, Korea

"The patients with SIJ pain showed retroverted pelvis and vertical sacrum while the patients without SIJ pain have similar morphologic features with asymptomatic populations in the literature."

Eur Spine J
DOI 10.1007/s00586-014-3547-9

ORIGINAL ARTICLE

Sacroiliac joint syndrome 10 years after lumbar arthroplasty: the importance of spinopelvic alignment

Riccardo Ciarpaglini · Philippe Otten · Patrick Sutter · Vo Quoc Duy · Emanuel Gautier · Gianluca Maestretti

No change in sagittal parameters (PI,SS,LL,PT) at 10 years
4 patients (12%) with SIJD
- 2 patients required SIJ fusion
- Both patients had ankyloses of TDR at L5-S1
- Both patients had decreased LL (<40)

Questions

- Consider all three potential hip generators
  - Hip – SIJ – Spine
- Does fusing the SI joint affect
  - The spine
  - The hip
- Global 3D alignment: Inter-relationships
  - Sagittal plane
  - Coronal plane
  - Z plane

Conclusions

- **Hip – SI - Spine – Syndrome**
  - Relationships becoming better understood
  - Forces transferred between spine and hip go through the SIJ
- **Spinopelvic parameters**
  - Hip OA leads to Spinal Stenosis
  - Degenerative Spine leads to Hip OA
  - Changes in Hip and Spine have to go through SIJ