
Comparative Study of Lumbopelvic Sagittal Alignment Between Patients with and without Sacroiliac Joint Pain After Lumbar Interbody Fusion

**Department of neurosurgery, Spine Center
Seoul St. Mary's Hospital,
The Catholic University, Seoul, South Korea**

Myung-Hoon Shin, M.D., Kyeong-Sik Ryu, M.D., Ph.D., Chun-Kun Park, M.D., Ph.D.

1. SIJ pain after lumbar fusion

- a form of adjacent segment disease
- increased angular motion of sacrum
- increased stress across SIJ articular surfaces
- probable reason for low back pain after lumbar fusion

Ivanov et al. Spine (Philadelphia, Pa. 1976) 2009;34:E162-E9

2. Lumbopelvic sagittal alignment

- restoration of lumbar lordosis and balanced sagittal alignment
- lumbar flat back
- adjacent segment degeneration,
- persistent pain and inferior functional outcomes

3. The objectives

- the lumbopelvic parameters
- the role of changes of lumbopelvic sagittal alignment in the pathogenesis of SIJ pain after lumbar fusion

4. Patient Selection

- Between June 2009 and April 2012,
a total of 346 consecutive patients PLIF at our institution

5. SIJ pain

- pain begins with standing or sitting position after surgery
- differs from preoperative one; unilateral or bilateral prevalence
- compatible distribution with a sacroiliac joint (below the L5 spinous process, over the posterior aspect of one or both SIJs)
- with or without radiation to the posterior thigh or groin but not below the knee
- with or without tenderness of the sacroiliac sulcus at palpation; and no evidence of lumbar cause (no breach of screw and no residual nerve root impingement on postoperative CT scan)
- a fluoroscopically guided SIJ block
- patient with positive response : SIJ pain group.
- A positive response was defined as characteristic pain reduction of 75% or greater (presented as VAS) for 1-4 hours following the SIJ block

6. Exclusion

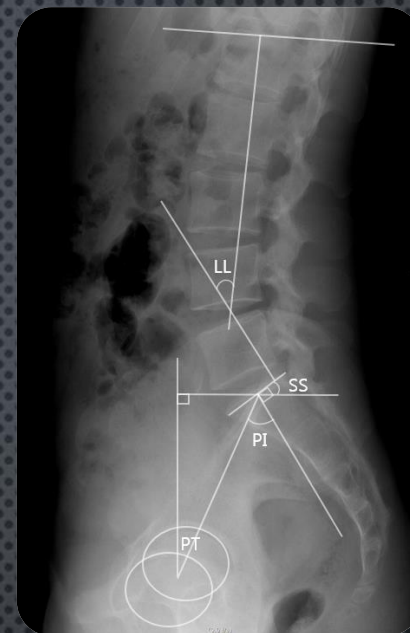
- clear nerve root compression sign (motor or sensory deficits),
- proven osteoarthritis of hip with clinical symptoms,
- pain related to disc or facet origin,
- signs of sacroilitis (ankylosing spondylitis, reactive arthritis, or enteropathic arthritis)

7. Control group

- one of spine fellows who was not informed of current study
- randomly selected, matched for sex, age group, the number of fused level and fusion to sacrum
- The ratio of case to control was 1 to 2

8. Lumbopelvic parameters

- LL (Lumbar Lordosis)
- PI (Pelvic Incidence)
- PT (Pelvic Tilt)
- SS (Sacral Slope)



9. Restoration LL and LL-PI mismatch

- Target LL ($= PI + 9^\circ$)
- Achievement rate of LL : $(\text{postoperative LL} / \text{target LL}) * 100$
- The LL-PI mismatch
 - indicator of appropriate patient-specific lumbar alignment

Schwab et al. Spine (Philadelphia, Pa. 1976) 2009;34:1828-33
Legaye et al. European Spine Journal 1998;7:99-103

10. Statistical Analysis

- Pearson's chi-square test
- Student's t-test after verification of normal distribution by the Kolmogorov-Smirnov test
- non-parametric Mann-Whitney U test
- paired t-test or Wilcoxon signed rank test was used depending on result of normality test
- Pearson's correlation coefficient (or Spearman's correlation coefficient when the size of the sample was less than 30)
- P value less than 0.05 was regarded to be statistically significant.

Results

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1. Patients population

	SIJ pain group	Non-SIJ pain group	<i>P</i>
No. of patients	23	46	NI
Mean age (year)	63.43 ± 8.82	61.17 ± 8.70	0.33
BMD (T-score)	-1.52 ± 2.04	-1.46 ± 0.85	0.90
BMI (kg/m ²)	25.78 ± 4.98	25.44 ± 3.16	0.76
No. of fused level	1.39 ± 0.78	1.39 ± 0.80	0.99
Fusion/non-fusion to sacrum	7/16	14/32	0.64
Diagnosis			
Spinal stenosis	8	19	
degenerative spondylolisthesis	7	12	0.95
spondylolytic spondylolisthesis	5	10	
lumbar degenerative kyphosis	3	5	

Results

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2. Lumbopelvic parameters and Changes of lumbopelvic parameters

	SIJ pain group	Non-SIJ pain group	<i>P</i>
Lumbar lordosis (°)			
preop	37.13 ± 15.65	38.82 ± 13.02	0.66
postop	42.14 ± 13.36	46.55 ± 9.57	0.17
Pelvic incidence (°)			
preop	56.80 ± 12.11	54.87 ± 10.15	0.51
postop	56.60 ± 11.52	54.81 ± 10.53	0.54
Pelvic tilt (°)			
preop	22.73 ± 11.53	20.18 ± 7.95	0.31
postop	19.88 ± 10.42	14.25 ± 7.68	0.03
Sacral slope (°)			
preop	34.06 ± 11.06	34.69 ± 8.96	0.81
postop	36.77 ± 9.21	40.56 ± 8.31	0.10

		postop-preop (Δ,°)	<i>P</i>
SIJ pain group	LL	5.01 ± 7.32	0.00
	PI	0.19 ± 1.25	0.67
	PT	-2.85 ± 7.08	0.66
	SS	2.71 ± 6.99	0.76
Non-SIJ pain group	LL	7.73 ± 6.91	0.00
	PI	0.06 ± 2.17	0.86
	PT	-5.93 ± 6.27	0.00
	SS	5.86 ± 5.98	0.00

3. Restoration of LL and LL-PI mismatch

	SIJ pain group	Non-SIJ pain group	<i>P</i>
Restoration of LL			
target LL (°)	65.80 ± 12.11	63.87 ± 10.15	0.51
achieved rate of LL (%)	64.3	73.2	0.02
LL-PI mismatch (°)			
preop	-19.66 ± 13.46	-16.05 ± 10.79	0.28
postop	-14.45 ± 12.16	-8.26 ± 9.12	0.03

4. Correlation analysis between PI and LL

	SIJ pain group		Non-SIJ pain group	
	preop	postop	preop	postop
Correlation coefficient (r)	0.569	0.601	0.591	0.856
<i>P</i>	0.003	0.002	0.000	0.000

Conclusions

- Lumbopelvic sagittal imbalance plays a central role for the development of SIJ pain after PLIF.
- Increased PT, reflecting pelvic retroversion, presents a maladaptive pathological process which leads to uneconomical position and inadequately restored LL could contribute to adjacent segment disease after PLIF.
- Thus, when planning a spinal fusion surgery, particular attention should be paid to achieve balanced pelvic parameters and it is important to evaluate PI to determine the ideal LL that needs to be restored to prevent SIJ pain after PLIF surgery.

Disclosure declaration

- None of the authors has any potential conflict of interest