

Changes in Sagittal Spinal Deformity and Spinal stiffness After Total Hip Arthroplasty

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INTRODUCTION:

Dislocation after THA is a common cause of revision surgery. Recent studies reported that spinal deformity and stiffness can be risk factors for dislocation and proposed the optimal alignment of the acetabular component according to the spinal deformity and stiffness classification instead of the Lewinnek safe zone. Post-operative evolution of these spinopelvic parameters, however, remains poorly characterized. The aim of this study is to evaluate the postoperative change of sagittal spinal alignment and stiffness after THA.

METHODS:

In this prospective clinical–radiographic study, 194 consecutive hips (150 women; mean age 65 years, range 30–88) met the inclusion criteria of complete pre- and post-operative lateral spinopelvic radiographs in both standing and sitting positions (Table). According to the previously proposed algorithm, the patients were classified into four groups (1A – 2B) based on the preoperative spinopelvic parameters (Figure). The classification was determined by the presence of spinal deformity and spinal stiffness. Spinal deformity is defined by the difference between pelvic incidence (PI) and lumbar lordosis (LL), which is greater than 10°. Spinal stiffness is defined by a less than 10° change in sacral slope (ΔSS) from the standing to seated positions. Then, THA was performed through a fluoroscopy-assisted direct anterior approach. Primary outcomes were the change in PI–LL and in ΔSS from before surgery to three months post-operatively.

RESULTS:

After radiographic classification, there were 51 (26.3%) Group 1A, 37 (19.1%) Group 1B, 72 (37.1%) Group 2A, and 34 (17.5%) Group 2B patients. Demographic and radiographic data on the subjects are shown in Table.

The overall postoperative change in PI – LL was from 9.9 to 8.3 and in ΔSS was from 14.2 to 12.4.

Group-specific responses were:

1A — normal alignment / mobile pelvis: PI–LL changed minimally ($-1.5^\circ \rightarrow -1.2^\circ$), while pelvic mobility fell significantly ($\Delta SS 21.7^\circ \rightarrow 16.1^\circ$, $p = 0.0002$).

1B — normal alignment / stiff pelvis: PI–LL was stable ($-1.0^\circ \rightarrow -0.8^\circ$); pelvic mobility increased ($\Delta SS 3.3^\circ \rightarrow 8.3^\circ$, $p = 0.0001$).

2A — flat-back deformity / mobile pelvis: sagittal malalignment improved ($18.5^\circ \rightarrow 15.7^\circ$, $p = 0.0077$); mobility decreased ($\Delta SS 18.5^\circ \rightarrow 14.1^\circ$, $p = 0.0001$).

2B — flat-back deformity / stiff pelvis: PI–LL improved ($20.9^\circ \rightarrow 17.0^\circ$, $p = 0.0310$) and mobility increased ($\Delta SS 4.5^\circ \rightarrow 7.8^\circ$, $p = 0.0072$).

DISCUSSION AND CONCLUSION:

This study investigated the postoperative change of sagittal spinal deformity and stiffness after THA. Flat-back deformity groups exhibited meaningful sagittal realignment, whereas pelvic mobility changed bidirectionally—diminishing when pre-operative mobility was high and increasing when it was low. These findings suggest that THA lessens the need for compensatory spinal mechanisms and that anticipated post-operative spinopelvic evolution should be considered when formulating patient-specific cup-positioning strategies aimed at minimizing the risk of dislocation.

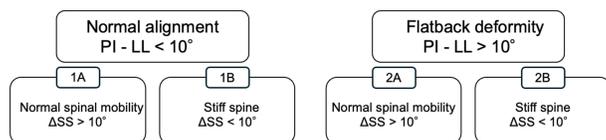


Table Patient characteristics

	1A (n = 51)	1B (n = 37)	2A (n = 72)	2B (n = 34)
Age (years)	59.9 (11.85)	58.7 (15.45)	65.6 (11.37)	68.6 (11.67)
Sex (female), n (%)	37 (72.5)	34 (91.9)	57 (79.2)	24 (68.6)
BMI (kg/m ²)	24.2 (4.14)	22.3 (3.37)	25.5 (4.91)	23.9 (3.74)
Diagnosis, n (%)				
OA	34 (66.7)	24 (64.9)	61 (84.7)	30 (88.2)
ONFH	15 (29.4)	9 (24.3)	9 (12.5)	3 (8.8)
RA	2 (3.9)	4 (10.8)	2 (2.8)	1 (2.9)
Pre- PI – LL	-1.5 (8.29)	-1 (8.51)	18.5 (8.52)	20.9 (10.15)
Pre- ΔSS	21.7 (9.23)	3.3 (5.06)	18.9 (8.21)	4.5 (4.01)
Post- PI – LL	-1.2 (10.91)	-0.8 (8.85)	15.7 (11.42)	17.0 (13.54)
Post- ΔSS	9.6 (9.61)	8.3 (7.93)	14.1 (10.52)	7.8 (5.80)

OA, osteoarthritis; ONFH, osteonecrosis of femoral head; RA, rheumatoid arthritis

PI – LL, pelvic incidence – lumbar lordosis; SS, sacral slope; ΔSS, change in SS from the standing to seated positions.