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Differences in Spinopelvic Alignment and Disability Scores Before and After Hip Arthroplasty

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ABSTRACT

Introduction: Total hip arthroplasty (THA) is recognized as a reliable intervention for hip osteoarthritis (OA), yet potential complications and postoperative dissatisfaction remain. This study aimed to compare spinopelvic alignment parameters and patient-reported outcomes before surgery and three months after THA in patients with advanced hip OA.
Methods: This single-center retrospective cohort included consecutive Indonesian adults with hip OA Tönnis grade 3 undergoing primary cementless THA via an anterior approach at Ngoerah Hospital (April–July 2024). Outcomes were measured using the Oswestry disability index (ODI), visual analog scale (VAS), roland-morris disability questionnaire (RDQ) scores, and radiographic spinopelvic parameters such as pelvic incidence (PI), pelvic tilt (PT), sacral slope (SS), and lumbar lordosis (LL), all assessed on standardized full-spine–pelvis radiographs taken preoperatively and at 3 months postoperatively. Data analysis was conducted using SPSS ver. 22.
Results: Nineteen patients were analyzed (73.7% female; mean age 61.6±12.2 years; BMI 27.4±2.4 kg/m²). Pain and disability improved significantly at 3 months: VAS median decreased from 5.0 (IQR 3.0–6.0) to 1.0 (0.0–3.0), p-value<0.001; ODI median decreased from 44.0 (34.0–58.0) to 32.0 (22.0–40.0), p-value<0.001; RDQ mean decreased from 17.63±1.86 to 15.89±3.16, p-value=0.003. Among spinopelvic parameters, PI decreased significantly (54.28±16.73° to 50.88±14.92°; p-value=0.029), while PT, SS, and LL showed no significant change.
Conclusion: At 3 months post-THA, patients with advanced hip OA experienced significant reductions in pain and disability. Radiographically, PI decreased, whereas PT, SS, and LL remained stable, indicating early pelvic adaptation without immediate global sagittal realignment.

Keywords: Hip osteoarthritis, patient-reported outcomes, pelvic incidence, spinopelvic alignment, total hip arthroplasty

INTRODUCTION

Hip osteoarthritis (OA) is a degenerative-inflammatory joint disease with an estimated global burden of 595 million people, or approximately 7.6% of the world population, living with OA in 2020. Cases are projected to increase significantly by 2050, including an increase of roughly 78.6% for hip OA.[1] The estimated 9.7 million cases (2019) in Indonesia represent a substantial burden, consistent with findings from urban communities reporting a knee OA prevalence of approximately 15% and a significant reduction in quality of life.[2,3] Structural joint changes in hip OA are associated with low back pain, stiffness, decreased range of motion (ROM), and impaired spino-pelvic alignment.[4,5] Multi-segmental lumbar disc degeneration has also been reported to decrease the lumbar-pelvic motion ratio during standing-to-sitting transitions in surgical candidates, highlighting the importance of spinal and pelvic axis planning.[6] Given the resulting disability and socioeconomic consequences, total hip arthroplasty (THA) is considered the definitive intervention for reducing low back pain and normalizing spino-pelvic alignment, with comparable aggregate efficacy and safety across surgical approaches, although variations in specific outcomes are still reported.[7]

Total hip arthroplasty (THA) is reported as a reliable intervention for hip OA, yet potential complications and postoperative dissatisfaction are still reported. Approximately one in ten patients reports being dissatisfied with their surgical outcomes, with contributing complaints such as low back pain, limited ROM, leg length inequality, prosthesis dislocation, and the need for revision.[8–10] Variations in patient satisfaction across Asian populations and determinants of postoperative quality of life have also been noted, making the investigation on preoperative strategies crucial.[11,12] Preoperative patient activation and clinician and patient expectations have been associated with improved functional and pain outcomes, which strengthens the importance of optimizing patient preparation before surgery.[13–15] In recent years, attention has been increasing on the assessment of spinopelvic alignment due to the significant relationship between the lumbar spine and pelvis, which influences acetabulum orientation and pelvic kinematics and has implications for the risk of impingement and dislocation.[16,17] Parameters such as PI, PT, SS, and LL have been proposed as preoperative measures to predict sagittal pelvic motion and global balance, with the understanding that PI is relatively constant morphologically, while PT, SS, and LL are position-dependent.[18] Modern imaging planning and templating are believed to help minimize component malposition and undesirable posterior dislocation distances, thus hopefully reducing complications and improving functional outcomes.[10,19]

Radiographic assessment of spino-pelvic alignment is considered essential in preoperative planning for THA because it is related to functional acetabular orientation, spino-pelvic mobility, the risk of impingement or dislocation, and postoperative recovery of hip function. Commonly used key parameters include PI, PT, SS, and LL. Measurements are recommended in standing X-ray projections and, when possible, in functional positions to capture the dynamics of sagittal changes.[20] These alignment changes have been shown to influence postoperative PT and predict hip function, while coronal and sagittal malalignment are associated with reduced spino-pelvic mobility.[21–23] Furthermore, modifications in certain spino-pelvic parameters after hip replacement have been reported to be associated with improvements in low back pain, confirming the clinical relevance of systematic measurement.[24] Therefore, this study aims to assess low back function and pain, as well as the results of spino-pelvic parameter measurements, in patients with hip OA undergoing THA.

MATERIALS & METHODS

Study Design

This study was designed as a prospective cohort study utilizing questionnaires and secondary data in the form of medical records and X-ray radiographs. Measurements of spinopelvic alignment parameters, including lumbar PI, PT, SS, and LL, as well as assessments of clinical outcomes of pain and disability, were conducted preoperatively and at a three-month follow-up after the THA procedure. The study was conducted at Ngoerah

Hospital within a predetermined timeframe, after ethical approval was obtained.

Population and Sample

The target population included all patients diagnosed with hip OA who were indicated for THA, while the accessible population consisted of patients who met these criteria and were treated at Ngoerah Hospital during the specified inclusion period. Consecutive sampling was used until the required number was reached. Inclusion criteria included Indonesian citizens with Tönnis grade 2 or 3 hip OA who were indicated for surgery, were contactable, and willing to participate in follow-up. Exclusion criteria included a history of hip or spine surgery, femoral head osteonecrosis, ankylosing spondylitis, rheumatoid arthritis, neurological or musculoskeletal disorders affecting pelvic alignment, and significant surgical complications during follow-up. Subjects who died before the end of follow-up were classified as dropouts from the study.

Research procedures and data collection

Ethics approval and research permit were obtained, and then subject identification was conducted through the orthopaedic service register. Potential subjects were contacted to explain the study and obtain consent for participation. At the preoperative visit, the VAS, RDQ, and ODI questionnaires were completed, followed by the collection of clinical data. Supporting examinations included radiographs of the entire spine and pelvis, along with a lateral view of the femoral head to measure the PI, PT, SS, and LL. Total hip arthroplasty (THA) procedures were performed by hip and knee consultants according to hospital standards. Postoperatively, rehabilitation with full weight-bearing was applied uniformly. At the third postoperative month, clinical and radiographic assessments were repeated using the same procedures, and all data were systematically recorded.

Statistical Analysis

Analyses were performed using SPSS for Windows version 22. Characteristic data are presented as means and standard deviations or medians and interquartile ranges, and frequencies for categorical variables. The Shapiro-Wilk normality test was applied to numerical data. Preoperative and postoperative comparisons were analyzed using paired t-tests for normally distributed data or Wilcoxon signed-rank tests for non-normal data. Significance levels were set according to statistical conventions, and results are reported with appropriate effect sizes to enhance clinical interpretability.

RESULT

Characteristics of the study subjects

A total of 19 hip OA patients who underwent THA at Ngoerah Hospital were analyzed in this study to assess the differences in pain, disability scores, and spino-pelvic alignment parameters before surgery and three months after surgery in one patient group. Baseline characteristics showed 5 male patients (26.3%) and 14 female patients (73.7%) with an age distribution dominated by the 51–60 years age group of 6 people (31.6%) and >60 years of 10 people (52.6%), with an average age of 61.58 ± 12.24 years. Body mass index (BMI) was dominated by overweight as many as 11 people (57.9%), and obesity as many as 4 people (21.1%), with an average BMI of 27.42 ± 2.39 kg/m². All samples had Tönnis grade 3 hip OA. Most of the patients were without stenosis (14 patients (73.7%) and without spondylolisthesis (15 patients (78.9%). Most of the patients were OA patients without a history of bone surgery (16 patients (84.2%). No history of smoking, ankylosing spondylitis, rheumatoid arthritis, or hip surgery was found in all samples (Table 1).

Table 1. Subject characteristics

Variable	n = 19 (%)
Age, years (categorical)	
≤40 years	1 (5.3)
41-50 years	2 (10.5)
51-60 years	6 (31.6)
>60 years	10 (52.6)
Sex	
Male	5 (26.3)
Female	14 (73.7)
Body Mass Index (BMI), kg/m²	
Normal (18.5–24.9)	4 (21.1)
Overweight (25.0–29.9)	11 (57.8)
Obesity (30.0–34.9)	4 (21.1)
Hip Osteoarthritis (OA) Grade	
Tönnis Grade 3	19 (100.0)
Lumbar Canal Stenosis	
Yes	5 (26.3)
No	14 (73.7)
Spondylolisthesis	
Yes	4 (21.1)
No	15 (78.9)
History of Spine Surgery	
Yes	3 (15.8)
No	16 (84.2)
Other Medical/Surgical History	
Smoking history	0 (0.0)
Ankylosing spondylitis	0 (0.0)
Rheumatoid arthritis	0 (0.0)
Prior hip surgery	0 (0.0)
Continuous Variables (mean ± SD)	
Age, years	61.58 ± 12.25
BMI, kg/m²	27.42 ± 2.39

Normality test

The Shapiro-Wilk normality test showed that most variables were approximately normally distributed, including preoperative and postoperative ODI scores, preoperative and postoperative RDQ scores and their differences, and the radiographic parameters of PI, PT, SS, and LL at both measurement times and their differences, with all p-values > 0.05. Abnormal distribution was identified in the difference in ODI scores (p-value = 0.017), preoperative VAS scores (p-value = 0.030), postoperative VAS scores (p-value = 0.008), and the difference in VAS scores (p-value = 0.007) (Table 2).

Table 2. Normality test

Variable	Mean ± SD	p-value
ODI Score (Pre)	44.52 ± 5.65	0.657
ODI Score (Post)	31.78 ± 5.37	0.664
Delta ODI	12.73 ± 5.74	0.017*
VAS Score (Pre)	4.68 ± 0.94	0.030*
VAS Score (Post)	1.36 ± 1.83	0.008*
Delta VAS	3.31 ± 1.86	0.007*
RDQ Score (Pre)	17.63 ± 1.86	0.438
RDQ Score (Post)	15.89 ± 3.16	0.393
Delta RDQ	1.74 ± 2.54	0.180
Lumbar Lordosis Angle (Pre)	49.98 ± 12.53	0.179
Lumbar Lordosis Angle (Post)	48.52 ± 9.74	0.095

Delta LL	1.46 ± 15.15	0.166
Pelvic Incidence (Pre)	54.28 ± 16.73	0.330
Pelvic Incidence (Post)	50.88 ± 14.92	0.520
Delta PI	3.39 ± 7.29	0.587
Sacral Slope (Pre)	33.13 ± 9.39	0.464
Sacral Slope (Post)	30.10 ± 6.77	0.167
Delta SS	3.04 ± 10.29	0.284
Pelvic Tilt (Pre)	21.41 ± 13.44	0.378
Pelvic Tilt (Post)	21.48 ± 12.20	0.387
Delta PT	-0.07 ± 10.70	0.835

***This analysis was conducted using the Shapiro-Wilk test. The result was considered significant if the p-value ≤ 0.05.**

Differences in VAS and ODI values before and after THA were assessed 3 months post-surgery in hip OA patients

Using the Wilcoxon signed-rank test, a significant median difference was found between preoperative and three-month postoperative assessments for both indicators. The VAS score decreased from a median of 5.00 (range 3.00–6.00) to 1.00 (0.00–3.00) with a p-value < 0.001, reflecting a significant reduction in pain intensity. The ODI score decreased from a median of 44.00 (34.00–58.00) to 32.00 (22.00–40.00) with a p-value <0.001, indicating a significant functional improvement in patient disability levels. These findings confirm that THA is associated with decreased pain and improved function at three months postoperatively, as summarized in Table 3.

Table 3. Results of the Analysis of Differences between VAS and ODI

	Grouping Variables	Median (min-max)	p-value
VAS	Pre	5.00 (3.00-6.00)	<0.001*
	Post	1.00 (0.00-3.00)	
ODI	Pre	44.00 (34.00-58.00)	<0.001*
	Post	32.00 (22.00-40.00)	

***This analysis was conducted using the Wilcoxon test. The result was considered significant if the p-value ≤ 0.05.**

Differences in RDQ scores before and 3 months after THA in hip OA patients

A paired t-test showed a decrease in the mean RDQ score from 17.63 ± 1.86 to 15.89 ± 3.16 at three months postoperatively, with a statistically significant mean difference of 1.74 points (p value = 0.003; 95%CI of mean difference 0.515-2.959). These results indicate an improvement in low back disability after THA, consistent with the improvement in patient function during the follow-up period (Table 4).

Table 4. Results of the dependent T-test for RDQ scores

Variable	Grouping		p-value	95%CI
	Pre	Post		
RDQ	17,63 ± 1,86	15,89 ± 3.16	0.003*	0.515-2.959

***This analysis was conducted using the Paired-Sample T-Test. The result was considered significant if the p-value ≤ 0.05.**

Differences in radiological measurement results 3 months post-operatively of spinopelvic alignment parameters via X-ray before and after THA in patients with hip OA

This study found a significant decrease in the mean PI from 54.28 ± 16.73o to 50.88 ± 14.92o (p-value = 0.029; 95%CI −0.119 to 6.906). Meanwhile, changes in PT from 21.41 ± 13.44o to 21.48 ± 12.20o (p-value =

0.489; 95%CI −5.222 to 5.091), SS from 33.13 ± 9.39o to 30.10 ± 6.77o (p-value = 0.107; 95%CI −1.925 to 7.997), and LL angle from 49.98 ± 12.53o to 48.52 ± 9.74o (p-value = 0.339; 95%CI −5.838 to 8.762) did not reach statistical significance. Overall, spino-pelvic parameters tended to be stable at three months postoperatively, with significant findings limited to PI, which showed a small decrease. Since PI is classically considered a relatively constant morphological parameter, these differences likely reflect measurement variations or differences in imaging position (Table 5).

Table 5. Paired T-test results for Spinopelvic parameters

IKDC score 3 months after ACL reconstruction surgery	Grouping		p-value	95%CI
	Pre	Post		
PI	54.28 ± 16.73°	50.88 ± 14.92°	0.029*	(-0.119) - 6.906
PT	21.41 ± 13.44°	21.48 ± 12.20°	0.489	(-5.222) - 5.091
SS	33.13 ± 9.39°	30.10 ± 6.77°	0.107	(-1.925) - 7.997
LL	49.98 ± 12.53°	48.52 ± 9.74°	0.339	(-5.838) - 8.762

***This analysis was conducted using the Paired-Sample T-Test. The result was considered significant if the p-value ≤ 0.05.**

DISCUSSION

The characteristics of the patients in this study showed a profile consistent with the general population of severe hip OA undergoing THA, with a dominant proportion of women (73.7%), a mean age of 61.58 ± 12.24 years, and more than half aged over 60 years (52.6%). This pattern is in line with epidemiological evidence that OA is more common in women, especially postmenopausal women, which is thought to be influenced by hormonal changes in bone and cartilage metabolism, and increases sharply in old age due to progressive joint degenerative processes.[25,26] These results are also consistent with demographic trends in developed countries that report an age shift to older groups and a predominance of female patients in hip arthroplasty procedures over the past few decades.[27]

Comparison with similar studies demonstrates concordance in age and sex composition across settings. A long-term demographic study in Switzerland reported an increasing burden of hip arthroplasty surgery with a higher median age and a greater proportion of women, reflecting population aging and the increasing burden of OA.[27] An outcome study in rapidly progressive OA reported that patients remain predominantly elderly with improved functional outcomes after THA, thus converging demographic patterns despite differences in disease progression rates.[28] Theoretically, the female predominance is explained by the decline in estrogen that contributes to changes in cartilage matrix homeostasis and subchondral bone remodeling, while aging leads to accumulation of tissue damage, low-grade inflammation, and decreased repair capacity, thus increasing the risk of OA.[25] Although a recent Cochrane review on hemiarthroplasty for hip fractures examined different populations, the focus on variations in surgical approaches underscores that patient characteristics and clinical context are crucial for outcomes, so caution is needed when generalizing across populations.[29]

The characteristics of this study indicate that over 79% of subjects had an overweight or obese BMI, all of whom were classified as Tönnis grade 3 OA, and underwent THA as definitive treatment. This pattern aligns with the literature that places BMI as a significant contributor to OA progression through increased joint mechanical loading and activation of systemic inflammation, while Tönnis grade 3 represents advanced joint damage, which is a common indication for hip replacement.[30,31] These results are comparable to a primary cohort of cementless THA based on enhanced recovery in Germany that reported excellent postoperative functional outcomes and quality of life in an elderly population with relevant comorbidities, although BMI composition was not the primary focus of the report.[32] Consistency was also seen in a multi-ethnic cohort in Singapore, which showed that preoperative status and preoperative symptom scores predicted clinical improvement and postoperative satisfaction, suggesting that symptom burden in patients with a high BMI could potentially influence the magnitude of gain after THA.[33] Demographic-adjusted analyses of patient-reported outcome comparisons between knee and hip replacements also confirmed that preoperative variables, including age and BMI, were associated with clinically meaningful variations in outcomes, thus aligning the findings of this study with this comparative evidence.[34]

Theoretically, the contribution of obesity to OA progression is explained by a combination of repetitive axial loading on articular cartilage and adipokine-mediated proinflammatory milieu, while weight loss has been associated with structural and symptomatic improvements in longitudinal studies of overweight and obese individuals.[30,35] Assigning the entire sample to Tönnis grade 3 aligns with the principles of treatment selection, given that joint-preserving interventions such as arthroscopy have more limited outcomes in grade 2 and are not recommended in grade 3, making THA the most appropriate option in advanced OA.[31,36,37] The reported variation in inter-rater reliability of the Tönnis classification and the proposal of a more consistent binary classification may also explain differences in sample selection between sites, but the consensus remains that grade 3 is the primary indication for THA.[38–41] Thus, the predominance of high BMI and advanced disease stage in this study is considered consistent with the profile of THA candidates in various populations, while variations in outcomes likely reflect differences in baseline characteristics, perioperative approaches, and evaluation instruments used.

This study found spinal comorbidities in the form of lumbar canal stenosis in 26.3% and spondylolisthesis in 21.1%. While most patients had no history of spinal surgery, autoimmune disease, or smoking habits, the systemic risk was considered low. These findings are consistent with reports in THA candidates that lumbar degeneration and sagittal malalignment reduce spinopelvic mobility during the standing-to-sitting transition and modify functional hip motion, which impacts pain and outcomes.[16,17] Preoperative spinopelvic stiffness has been reported to increase the risk of dislocation and predict pelvic position when sitting after surgery, thus affecting satisfaction and function.[5,42] Multi-segmental disc degeneration decreases the lumbar hip motion ratio, while sagittal imbalance is associated with functional acetabular orientation and the risk of impingement.[6,43] Theoretically, decreased spinopelvic mobility limits posterior pelvic rotation during sitting, shifting compensation to the hip joint, and increasing the risk of implant instability.[44] Variation in effect sizes across studies is likely due to differences in baseline populations, seated imaging protocols, and component orientation strategies, but sagittal deformity classification has been shown to predict postoperative alignment changes and is relevant for individualized planning.[4,45]

The findings of this study demonstrated a significant reduction in pain and disability three months after THA, with a median decrease in VAS score from 5.00 to 1.00 and ODI from 44.0 to 32.0, both with p-values <0.001. These results are consistent with the literature, confirming that THA reduces the intensity of mechanical pain due to joint destruction and improves daily functional ability in advanced hip OA, and that the three months postoperatively are the most active recovery phase for pain and function improvement.[46,47] Consistency is also evident in a target-based trial emulation study that demonstrated the superiority of THA over non-operative treatment for patient-reported hip function at three months, supporting the causality of short-term surgical benefits.[48] Additional clinical evidence shows that most patients return to daily activities at around three months, along with improvements in pain and disability scores over the same period, although the outcome instruments used vary between questionnaire-based and activity-based studies.[49]

Comparisons with mid-term to long-term cohorts demonstrate a pattern of continued improvement after the initial phase. The Alberta Hip Improvement Project study reported sustained functional improvement for up to two years in the THA group compared with hip resurfacing, suggesting that initial improvement at three months often marks the beginning of a stable, long-term recovery trajectory.[50] In the participation domain, systematic reviews and meta-analyses have demonstrated high rates of return to work and sport after THA, which is consistent with the reduction in ODI in this study, although heterogeneity in sport type, job demands, and rehabilitation policies may influence the magnitude of the effect across populations.[51,52] Furthermore, implementation of enhanced recovery after surgery has been reported to accelerate pain reduction and functional improvement at three months, potentially explaining differences between studies regarding the speed and magnitude of early recovery. This effect was reported in reviews and randomized controlled trials (RCTs) evaluating enhanced recovery pathways after surgery in hip and knee arthroplasty.[53–56]

Variations in outcomes between studies are likely influenced by differences in baseline characteristics, including age, BMI, and comorbidities, as well as neurophysiological factors such as central sensitivity syndromes, which are associated with persistently higher pain scores at three to six months despite a trend toward improvement. Therefore, this subgroup may exhibit a smaller clinical response to surgery in the early phase.[57] Differences in instruments and outcome scales, rehabilitation standards, and implant size and type may also contribute to heterogeneity. Theoretically, improvements in VAS at three months reflect reduced mechanical nociceptive stimulation after joint replacement and biomechanical stabilization of the hip, while decreases in ODI indicate recovery of functional domains previously impaired by pain and limited range of motion. This trajectory typically continues at medium to long-term follow-up in the absence of recovery barriers or complications.[46,47,50]

However, despite the significant reduction in ODI scores, the median postoperative score (32.0) remained in the moderate disability category. This suggests that functional recovery after THA may be gradual and not fully optimal in the first 3 months, particularly in patients with comorbidities such as obesity or spinal abnormalities that may delay rehabilitation. Previous studies have shown that patients with spinal abnormalities or spinal stenosis may have a slower rate of functional improvement after THA than patients without such comorbidities.[58] Overall, the results of this study strengthen the evidence that THA is a highly effective intervention in reducing pain and improving quality of life in patients with advanced hip OA in the short term, in line with the results of previous large-scale and systematic studies.

The results showed a significant decrease in the RDQ score three months after THA, with the mean score decreasing from 17.63 ± 1.86 to 15.89 ± 3.16, with a p-value of 0.003. A 95%CI (0.515–2.959) that did not include zero confirmed the statistical significance of this difference. The decrease in the RDQ score indicates an improvement in lumbar function and the ability to perform daily activities, particularly activities previously impaired by low back pain and pelvic biomechanical impairments. These results support previous findings that THA not only improves local pain in the hip joint but also positively impacts the biomechanical axis of the lower body, including the lumbar spine. Previous studies have shown that THA can improve sagittal balance by normalizing pelvic tilt and lumbar lordosis, thereby contributing to a decrease in lumbar disability as measured by the RDQ [59]. Another study also reported that restoration of spinopelvic balance after THA has a direct impact on patient comfort in activities such as sitting, standing, and walking [4]. Rivière et al. stated that patients with spinal disorders have more variable functional outcomes after THA and often require a longer rehabilitation period.[58] Therefore, the results of this study indicate that THA can provide significant improvements in short-term lumbar disability, but attention to coexisting musculoskeletal conditions is still needed for optimal recovery.

The results of the analysis of radiological parameters of spinopelvic alignment three months after THA surgery showed that there was a statistically significant difference in PI, but no significant difference was found in PT, SS, and LL. The mean PI value decreased from 54.28 ± 16.73 to 50.88 ± 14.92 with p-value = 0.029. In contrast, the PT value slightly increased from 21.41 ± 13.44 to 21.48 ± 12.20 with p-value = 0.489, and the SS and LL values did not show a significant difference (p-value = 0.107 and p-value = 0.339, respectively), which indicates that the components of the lumbar curve and sacral slope tend to remain stable in the first three months after surgery. These findings reflect that although post-THA hip joint structural correction may affect some pelvic biomechanical parameters, not all aspects experience changes that are immediately functionally significant in the short term.

Several studies support these findings, including a study by Weng et al., which showed that THA had an impact on restoring previously abnormal PI and PT values in patients with hip OA, but its effect on SS and LL varied depending on spinal flexibility. Another study also reported that PI is a more sensitive parameter to changes in pelvic position due to THA compared to the lumbar lordosis angle, which tends to depend on pre-existing spinal abnormalities.[4] The significant reduction in PI in this study indicates that correcting the hip joint position can reduce the compensatory anterior rotation of the pelvis, which previously occurred as an adaptation to severe OA deformity. Other studies have also suggested that changes in spinopelvic alignment after THA are highly dependent on the degree of lumbopelvic segment mobility, with patients with spinal rigidity tending to show smaller postural changes after surgery [60]. Thus, although THA provides postural correction of the PI parameter, improvements in other parameters, such as PT, LL, and SS, require more time or additional interventions, especially in patients with spinal rigidity or chronic deformity. These results support the importance of a thorough spinopelvic evaluation before and after THA, especially in the context of implant position planning and preventing prosthesis dislocation due to sagittal malalignment.

This study has several important limitations. The retrospective cohort design and consecutive sample selection at a single center with a small sample size of 19 subjects limit the generalizability of the findings. The follow-up period was only three months, so the sustainability of improvements in pain, function, and pelvic spine parameters cannot be confirmed. The absence of a non-operative comparison group or alternative surgical approach reduces the strength of causal inferences. Pain and disability assessments relied on self-reported questionnaires, potentially introducing reporting bias. Radiographic measurements were performed on static images without dynamic standing-to-sitting evaluations, and are susceptible to inter-measurement variability. Potential confounders such as spinal comorbidities, variations in analgesic regimens, and postoperative rehabilitation factors were not analyzed multivariately. Finally, all subjects had Tönnis grade 3 hip osteoarthritis, so the results may not be representative of other disease stages.

CONCLUSION

This study concluded that in patients with hip OA who underwent THA, there was a significant improvement in VAS, RDQ, and ODI scores three months postoperatively, accompanied by a decrease in PI, while PT, SS, and LL angle did not show significant differences. These findings confirm short-term improvement in pain and function with stability of most spino-pelvic parameters. Longer follow-up, at least six to twelve months, is recommended to assess the sustainability of clinical and biomechanical improvements and detect complications, special focus on patients with spinal comorbidities due to their potential impact on outcomes, evaluation of rehabilitation programs targeting postural stability and lumbopelvic strength, utilization of motion analysis or dynamic imaging to understand functional spino-pelvic changes, assessment of preoperative factors such as pelvic flexibility, lordosis degree, and physical activity, and development of a multidisciplinary care model involving orthopedics, rehabilitation medicine, and musculoskeletal radiology to optimize clinical outcomes.

Declaration by Authors

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