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Original Research Article

EFFECTIVENESS OF CALIPER TECHNIQUE IN RESTORING LIMB LENGTH IN PATIENTS UNDERGOING TOTAL HIP ARTHROPLASTY

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ABSTRACT

Background: The most popular adult reconstructive hip operation is total hip arthroplasty. Maximizing impingement free range of motion, recreating the proper offset, and equating limb length disparities are the objectives of a successful total hip arthroplasty (THA), which should result in a pain-free and dynamically stable THA. Both lengthening and shortening of the limb can occur after THA. Limb length discrepancy is a known problem which can cause altered hip biomechanics, dysfunctional gait, sciatica, lower back pain, instability, and a higher chance of dislocation. It is the main factor contributing to patients' dissatisfaction after total hip arthroplasty. After THA, the limb is typically lengthened rather than shortened, and in up to 50% of cases, LLD is recorded to be less than 1 cm. Any residual LLD of less than 10mm on AP radiographs is usually clinically acceptable. LLD can be measured radiologically and clinically. Although numerous preoperative and intraoperative techniques have been documented in the literature, there is currently a lack of universally accepted, simple-to-use, reproducible, and efficient techniques for reducing LLD after THA. The Caliper dual pin retractor (CDPR) used in our study is based on Charnley's pin retractor design. Through the same incision, we use two pins to prevent intraoperative pin loosening. It also acts as a retractor to the gluteal muscles. The pelvic pins are placed just proximal to the superior margin of the acetabulum, and hence, it is close to the centre of rotation of the hip, and thereby, readings are more accurate.

Materials and Methods: This prospective observational study was carried out in the Department of Orthopaedics, ABVIMS & DR. RML Hospital, New Delhi, from 1st January 2021 to 30th June 2022.A total of 21 patients aged 18 to 70 years scheduled for uncemented THA were studied. Caliper dual pin retractor was used intraoperatively to correct limb length discrepancy. Primary Outcome was the limb length discrepancy measurement corrected clinically and radiologically. Secondary Outcome was the Modified Harris hip score filled by the patient at time frames: pre operatively, post operatively at 2nd week, 4th week, 6th week.

Results: The mean (SD) of the age (years) was 34.33 (10.42). Out of 21 patients, the majority were male (66.7%). Fourteen patients were diagnosed with avascular necrosis (AVN) of the hip, five patients with osteoarthritis (OA) of the hip, one patient with tuberculosis sequelae, and one patient with

septic sequelae. Preoperatively and postoperatively, clinical limb length discrepancy (LLD) was measured in all these patients. The preoperative clinical LLD mean (SD) in mm was 16.19 ± 8.80, with subgroup values of 13.50 ± 6.80 in patients with AVN and 16.40 ± 6.73 in those with OA. Postoperatively, the clinical LLD mean (SD) in mm was 3.33 ± 1.98, with AVN patients showing 2.93 ± 2.13 and OA patients 3.80 ± 1.64. Preoperative radiological LLD mean (SD) in mm was 15.95 ± 8.772, with subgroup values of 13.21 ± 6.42 in AVN patients and 16.00 ± 5.52 in OA patients. Postoperatively, the radiological LLD mean (SD) in mm was 4.38 ± 1.532, with AVN patients showing 4.00 ± 1.62 and OA patients 4.80 ± 0.837. Intraoperative LLD correction was done using the caliper dual pin retractor (CDPR), and postoperative radiological LLD correction, when compared, showed that CDPR has 75.238% accuracy. Preoperatively and postoperatively, the modified Harris Hip Score (MHHS) was recorded. The preoperative mean MHHS (SD) was 35.9 ± 8.024. Postoperative 2nd, 4th, and 6th week mean MHHS (SD) were 57.9 ± 2.7, 75.52 ± 5.715, and 85.1 ± 5.281, respectively. In patients with AVN hip, the preoperative MHHS mean (SD) was 37.43 ± 7.88, while postoperative 2nd, 4th, and 6th week MHHS (SD) were 58.71 ± 2.73, 77.0 ± 4.78, and 86.14 ± 4.452, respectively. In patients with OA hip, the preoperative MHHS mean (SD) was 34.40 ± 9.21, while postoperative 2nd, 4th, and 6th week MHHS (SD) were 55.80 ± 1.79, 71.40 ± 7.06, and 83.40 ± 4.72 respectively.

Conclusion: There was a significant decrease in LLD in the patients and clinical improvement (MHHS) in patients (p value < 0.001). The study has shown Caliper dual pin retractor is an effective method in restoring limb length in these patients.

Keywords: LLD, THA.

INTRODUCTION

LLD following THA can be divided into two categories: true and apparent, or structural and functional. The lengthening of the prosthetic head-neck distance and component malpositioning are the two factors that contribute to the structural or real leg-length discrepancy, which is broken down into two categories. First, circumstances where limb lengthening is a direct result of component positioning, such as when a high femoral cut or a limited femoral canal cause incomplete stem insertion and an excessively proud stem, or when the acetabular cup is positioned too low. Second, circumstances where limb lengthening is an indirect result of component positioning, such as when a surgeon increases the neck length to improve soft tissue restraints and to overcome intraoperative instability due to a retroverted acetabular component.[7]

The apparent or functional leg-length inequality (FLLI) is the amount of leg length inequality that can be attributed to other factors, such as degenerative disease with scoliosis of the lumbar spine, which causes obliquity of the pelvis and tightness of the anterolateral soft tissues about the hip.[8]

LLD can be measured radiologically and clinically. There are two common methods for clinical measurement of limb length. The “indirect method” is performed in standing position by placing lift blocks under the short leg and visually examining the level pelvis. The “direct method” is performed in supine position by measuring the distance between two fixed bony landmarks, the anterior superior iliac spine (ASIS) and the lateral or medial malleolus.[11]

The radiological approaches include: (A) on X-ray of bilateral hips with pelvic AP view, the distance between the most inferior point of the ischia and the lesser trochanter is measured,[13] and (B) on X-ray of bilateral hips with pelvic AP view, the distance between the inferior tip of the acetabular tear drop and the lesser trochanter is measured.[14]

Intraoperative techniques are based on two reference points marked on the pelvis and femur. Several intraoperative methods have been described by various authors, including rulers, pins, and calipers.[10] Intraoperative techniques are found to be more reliable.[10]

In our study, we used the intraoperative caliper technique to restore limb length in patients undergoing uncemented THR. It used two pins to prevent intraoperative pin loosening through the same incision, and it also acted as a retractor to gluteal muscles. The pelvic pins were placed just proximal to the superior margin of the acetabulum, hence close to the centre of rotation of the hip, and thereby, readings were more accurate. We measured limb lengths postoperatively using both clinical and radiological methods. The modified Harris Hip Score was also assessed at 2, 4, and 6 weeks.

2. Objectives

Primary Objective: Outcome will be measured by the limb length discrepancy corrected clinically and radiologically.

Secondary Objective: Modified Harris Hip Score filled by patients at time frames: preoperatively,

postoperatively, at 2nd week, 4th week, and 6th week

3. Research Hypothesis

The Caliper technique is effective in restoring limb length in patients undergoing Total Hip Arthroplasty.

MATERIALS AND METHODS

Place of Study: The study was carried out in the Department of Orthopaedics, ABVIMS & DR. RML Hospital, New Delhi, after getting clearance from the Ethical Committee of the institute

Study design: Prospective Observational Study

Study period: 1st January 2021 to 30th June 2022

1. Eligibility Criteria

Inclusion Criteria

1. All patients aged 18–70 with osteoarthritis (OA) presenting to the hospital for Total Hip Arthroplasty.

Exclusion Criteria

1. Patients suffering from bone neoplasms
2. Patients with active infection
3. First operation in patients of staged bilateral Total Hip Arthroplasty
4. Severe pathology that would affect postoperative participation, such as neurologic, psychiatric, or other confounding pre-existing musculoskeletal disorder.

2. Sample Size

The sample size was determined by assuming a minimum of 5 mm reduction in the mean limb length inequality postoperatively (IoriTakigami et al 23). Thus,a sample size of 21 patients per group is calculated to detect statistical significance with an effect size of 0.71 at alpha 0.05 and a power of 90%.

$$n = \frac{(Z_\alpha + Z_\beta)^2}{(E/S(\Delta))^2} = \frac{(1.96 + 1.282)^2}{(0.71)^2} = \frac{10.51}{0.51} = 20.6 \approx 21$$

3. Statistical Methods

Statistical analysis was performed by the SPSS program for Windows, version 17.0(SPSS, Chicago, Illinois). Continuous variables were presented as mean ± SD, and categorical variables were presented as absolute numbers and percentages. Data was checked for normality before statistical analysis. For within-group comparisons, continuous variables, a paired t-test was used to determine the significant change pre to post treatment. P<0.05 was considered statistically significant

4. Methodology

Patient Enrollment: Patients presenting to ABVIMS &Dr RML Hospital Orthopedics OPD aged 18–70 years requiring hip arthroplasty, fulfilling eligibility criteria, and providing consent were enrolled in the study.

Preoperative Assessment:

1. Routine investigations for pre-anaesthetic check-up were performed.
2. Anteroposterior (AP) view of pelvis and AP and lateral views of the hip were obtained.
3. Limb length discrepancy was noted by examination.
4. The modified Harris Hip Score proforma was filled by the patient.

Postoperative Assessment:

1. Anteroposterior (AP) view of pelvis and AP and lateral views of the hip were obtained at each follow-up.
2. Limb length discrepancy was noted by examination.
3. Modified Harris Hip Score proforma was filled by the patient at 2nd, 4th, and 6th weeks.

5. Caliper Technique

The retractor consists of two 4-inch pins joined by a "shoulder," which carries a guide pin. The base of the measuring ruler arm fits over the guide pin. The dual pins are inserted into the pelvis about 2 to 3 cm proximal to the acetabulum within the operative site and before the femoral head is dislocated. The femoral reference point is then marked over the most lateral prominent point of the greater trochanter using electrocautery. The baseline measurement of the distance is made with the adjustable caliper in the hip neutral position. The neutral position is determined by maintaining the thigh parallel to the body axis and the lower thigh parallel to the operating table, with the knee 90° flexed. The caliper is removed after the measurement, and the dual pins in the ilium are left to serve as a retractor. The hip is then dislocated, and arthroplasty is performed. After reduction with the trial components in place, the caliper is attached to the pins in the hip neutral position, and intraoperative limb-length measurement is done by measuring the change in distance.[22]

6. **Measurements**

Clinically: True length is the measurement taken from anterior superior iliac spine to tip of medial malleolus while both lower limbs are in identical positions and the pelvis is square.[2]

Radiologically: On an anteroposterior view of x-ray bilateral hip with pelvis, a horizontal line is drawn connecting both the ischial tuberosities/tear drop and difference between the limb length were measured using the relationship of this line and the most prominent point on lesser trochanter.[13]

7. Outcome Measures

Primary outcome was measurement of limb length discrepancy corrected clinically and radiologically.

Secondary Outcome was Modified Harris hip score filled by patient at time frames: pre operatively, post operatively at 2nd week, 4th week, 6th week.

8. Statistical Analysis

- Statistical analysis was performed by the SPSS program for Windows, version 17.0(SPSS, Chicago, Illinois).
- Continuous variables were presented as mean ± SD, and categorical variables were presented as absolute numbers and percentage.

- Data was checked for normality before statistical analysis.
- For within the group comparisons, continuous variables, paired t test was used to determine the significant change pre to post treatment.
- P<0.05 was considered statistically significant

RESULTS

13.1 Patient Demographics

Table 1 shows that the age distribution provides a comprehensive basis for evaluating the calipertechnique's efficacy across a spectrum of adult patients, from younger individuals to those in older age brackets typically associated with hip osteoarthritis.

Table 1: Age Distribution of Cases

Age Group	Frequency	%
19-20 years	2	9.5
21-30 years	6	28.6
31-40 years	7	33.3
>40 years	6	28.6
Total	21	100
Mean (S.D.)	34.33 (10.42)	
Notes: Among the 21 patients evaluated, the majority were male (66.7%), while females accounted for 33.3%.		
Source: Author's calculation		

13.2 Clinical Indications for Surgery

Avascular Necrosis (AVN) was the predominant diagnosis, affecting 67% of the patients undergoing total hip arthroplasty. Osteoarthritis (24%) was the second most common indication, whereas post-infectious sequelae were minimal, suggesting that the technique's efficacy was evaluated primarily in non-inflammatory degenerative conditions.

Table 2: Distribution of Diagnosis in Cases

Diagnosis	Frequency	Percentage
AVN	14	67
OA	5	24
Post-TBsequelae	1	5
Septic sequalae	1	5
Total	21	100
Notes: AVN: Avascular Necrosis; OA: Osteoarthritis; TB: Tuberculosis		
Source: Author's calculation		

13.3 Clinical limb length discrepancy

Table 3 shows the preoperative and postoperative measurements of clinical limb length discrepancy (LLD) across all patients. The overall preoperative mean (SD) LLD was 16.19 ± 8.80 mm, with subgroup values of 13.50 ± 6.80 mm in patients with avascular necrosis (AVN) and 16.40 ± 6.73 mm in those with osteoarthritis (OA) of the hip. Postoperatively, the overall mean (SD) LLD decreased to 3.33 ± 1.98 mm, with AVN patients showing 2.93 ± 2.13 mm and OA patients 3.80 ± 1.64 mm.

Table 3: Preoperative vs. Postoperative Clinical LLD

	Preoperative clinical LLD			Postoperative clinical LLD			p value
	Mean ± SD	Min–Max	Median (Q1-Q3)	Mean ± SD	Min – Max	Median (Q1-Q3)	
Overall (n=21)	16.19 ± 8.80	5 – 39	15 (10 - 22.5)	3.33 ± 1.98	0 – 5	4 (2 - 5)	<0.001
AVN (n=14)	13.50 ±6.70	5 – 25	12.5 (9 - 18.5)	2.93 ± 2.13	0 – 5	3.5 (0 - 5)	0.001
OA (n=5)	16.40 ±6.73	7 – 25	16 (10.5 - 22.5)	3.80 ± 1.64	2 – 5	5 (2 - 5)	0.043
Source: Author's Calculation.							

13.4 Radiological limb length discrepancy

Table 4 presents a comparison of preoperative and postoperative radiological limb length discrepancy (LLD) in all patients. The overall preoperative mean (SD) radiological LLD was 15.95 ± 8.77 mm, with subgroup values of 13.21 ± 6.42 mm in patients with avascular necrosis (AVN) and 16.00 ± 5.52 mm in those with osteoarthritis (OA) of the hip. Postoperatively, the overall mean (SD) radiological LLD decreased to 4.38 ± 1.53 mm, with AVN patients showing 4.00 ± 1.62 mm and OA patients 4.80 ± 0.84 mm. This demonstrates a marked reduction in radiological LLD following surgery across both diagnostic groups.

Table 4: Comparison of preoperative and postoperative radiological limb length discrepancy

	Preoperative radiological LLD			Postoperative radiological LLD			p value
	Mean ± SD	Min – Max	Median (Q1-Q3)	Mean ± SD	Min - Max	Median (Q1-Q3)	
Overall (n=21)	15.95 ± 8.772	5 – 40	16 (9 - 21)	4.38 ± 1.532	1 - 7	4 (4 - 5)	<0.001
AVN (n=14)	13.21 ± 6.42	5 – 25	11.5 (8.5 - 18.25)	4.00 ± 1.62	1 - 7	4 (2.75 - 5)	0.001
OA (n=5)	16.00 ± 5.52	8 – 23	17 (11 - 20.5)	4.80 ± 0.837	4 - 6	5 (4 - 5.5)	0.042
Source: Author's Calculation.							

13.5Comparison of Intraoperative and Postoperative Limb Length Discrepancy Correction

The comparison between intraoperative limb length discrepancy (LLD) correction achieved using the caliper dual pin retractor (CDPR) and postoperative radiological correction demonstrates that the intraoperative measurements closely approximated the final radiological outcomes. With a mean intraoperative correction of 15.24 mm and a postoperative correction of 11.52 mm, the CDPR technique achieved an accuracy of 75.24%. This finding highlights the reliability of the caliper method in predicting postoperative limb length restoration, underscoring its clinical utility in minimising residual discrepancy following total hip arthroplasty.

Table 5: Comparison of Intraoperative and Postoperative Limb Length Discrepancy Correction

Pair	Variable	Mean	N	Std. Deviation	Std. Error Mean
1.	Intraoperative correction	15.24	21	8.173	1.783
	Postoperative correction	11.52	21	8.334	1.819
Source: Author's Elaboration					

13.6 Clinical outcome (Modified HarrisHip Score)

Preoperatively and postoperatively, the modified Harris Hip Score (MHHS) was recorded to assess functional improvement following surgery. The mean preoperative MHHS was 35.9 ± 8.02, reflecting significant disability before intervention. At the second postoperative week, the mean MHHS improved to 57.9 ± 2.7, indicating early functional recovery. By the fourth week, the mean score further increased to 75.52 ± 5.72, and at the sixth week reached 85.1 ± 5.28, demonstrating progressive and substantial improvement in hip function over time.

Table 6: Comparison of preoperative and postoperative MHHS Scores

	Modified Harris Hip Score			p value
	Mean ± SD	Min – Max	Median (Q1-Q3)	
Preop	35.9 ± 8.024	26 – 50	32 (28 - 43)	<0.001
2nd Week	57.9 ± 2.7	53 – 63	58 (56 - 60)	<0.001
4th Week	75.52 ± 5.715	60 – 86	76 (71.5 - 79)	<0.001
6th Week	85.1 ± 5.281	73 – 91	86 (83 - 90)	<0.001
Source: Author's Calculation.				

13.7 Modified Harris Hip Score in Patients with AVN

In patients with avascular necrosis (AVN) of the hip, the modified Harris Hip Score (MHHS) demonstrated significant improvement following surgery. The mean preoperative MHHS was 37.43 ± 7.88, reflecting considerable functional limitation. At the second postoperative week, the mean score increased to 58.71 ± 2.73, indicating early recovery. By the fourth week, the mean MHHS rose further to 77.0 ± 4.78, and at the sixth week reached 86.14 ± 4.45, highlighting progressive and substantial functional gains. All improvements were statistically significant ($p < 0.001$).

Table 7: Comparing preoperative and postoperative MHHS in pts with AVN

	Modified Harris hip score			p value
	Mean ± SD	Min – Max	Median (Q1-Q3)	
Preop	37.43 ± 7.88	27 – 50	41 (28.75 - 43)	<0.001
2nd Week	58.71 ± 2.73	55 – 63	58 (56 - 61)	<0.001
4th Week	77.0 ± 4.78	71 – 86	76.5 (72.75 -80.75)	<0.001
6th Week	86.14 ± 4.452	75 – 91	86 (83.75 - 91)	<0.001
Source: Author's Calculation.				

13.8 Modified Harris Hip Score in Patients with OA

In patients with osteoarthritis (OA) of the hip, the modified Harris Hip Score (MHHS) showed

progressive improvement following surgery. The mean preoperative MHHS was 34.40 ± 9.21, reflecting significant functional limitation. At the second postoperative week, the mean score increased to 55.80 ± 1.79, indicating early recovery. By the fourth week, the mean MHHS rose to 71.40 ± 7.06, and at the sixth week, reached 83.40 ± 4.72, demonstrating substantial functional gains over time. All improvements were statistically significant ($p < 0.001$).

Table 8: Comparison of preoperative and postoperative MHHS in patients with OA hip

	Modified Harris hip score			p value
	Mean ± SD	Min – Max	Median (Q1-Q3)	
Preop	34.40 ± 9.21	26 – 46	32 (26 - 44)	<0.001
2nd Week	55.80 ± 1.79	55 – 58	56 (54.5 - 57)	<0.001
4th Week	71.40 ± 7.06	60 – 78	73 (65 - 77)	<0.001
6th Week	83.40 ± 4.72	78 – 89	85 (78.5 - 87.5)	<0.001
Source: Author's Calculation.				

13.9 Comparison of Postoperative LLD with Modified Harris Hip Score at 6 Weeks

The relationship between postoperative radiological limb length discrepancy (LLD) and functional outcome, measured by the modified Harris Hip Score (MHHS) at six weeks, was analysed using Tukey HSD. Patients with residual LLD >4 mm had a mean MHHS of 82.40, those with 3–4 mm discrepancy had 87.13, and those with 0–2 mm discrepancy achieved the highest mean score of 88.67. Although the trend suggests better functional outcomes with smaller residual LLD, the difference between groups was not statistically significant ($p = 0.109$).

Table 9: Comparison of Postoperative Radiological LLD with Modified Harris Hip Score at 6 Weeks (Tukey HSD)

Postoperative Radiological LLD	N	Mean MHHS
>4mm	10	82.40
3-4 mm	8	87.13
0.2 mm	3	88.67
Notes: Subset for α = 0.05; Sig.: 0.109; Means for groups in homogeneous subsets are displayed; Analysis performed using Tukey HSD; Harmonic mean sample size = 5.373; Group sizes were unequal; therefore, Type I error levels are not guaranteed.		
Source: Author's Calculations.		

DISCUSSION

Total hip arthroplasty (THA) is the most commonly performed hip reconstruction surgery for adults, yet leg length inequality remains a frequent postoperative problem that can negatively impact otherwise excellent outcomes. It has been linked to patient discontent,[10] and in the postoperative period, LLD may contribute to limping and lower back pain.[2] Reported mean postoperative LLD in the literature ranges between 1 and 17 mm (44, 30). Love and Wright (45) observed an incidence of LLD greater than 15 mm in 18% of THA patients, while Turula et al. (46) reported mean discrepancies of 8.7 mm for unilateral THA and 11.5 mm for bilateral THA. Studies in which no intraoperative measures were employed consistently demonstrated mean clinical and radiological LLD greater than 5 mm (46, 47). These findings highlight the importance of reproducible intraoperative techniques to minimize residual discrepancy without increasing operative time.[10]

Several intraoperative methods have been described, including rulers, pins, and calipers.[10] The CDPR technique used in this study is based on Charnley's pin retractor design, modified to incorporate two pins to prevent loosening and to act as a gluteal retractor. By placing pelvic pins proximal to the superior acetabular margin, the technique ensures proximity to the hip's center of rotation, thereby improving measurement accuracy.[22]

Our results demonstrated that CDPR achieved significant correction of LLD, reducing mean clinical discrepancy from 16.19 mm preoperatively to 3.33 mm postoperatively, and radiological discrepancy from 15.95 mm to 4.38 mm. Intraoperative correction closely approximated postoperative radiological outcomes, with an accuracy of 75.24%. These findings are comparable to those of IoriTikagami et al,[22] who reported mean preoperative LLD of 14.2 ± 9.3 mm and postoperative LLD of 4.2 ± 3.2 mm. Notably, none of the patients in their study or ours required postoperative shoe lifts, underscoring the reliability of CDPR.

The diagnostic profile of our cohort differed from Tikagami et al,[22] who reported OA in 78.5% of patients, rheumatoid arthritis in 12.5%, and osteonecrosis in 8.9%. In contrast, our study included a younger population (mean age 34.33 years vs. 62 years) with a predominance of osteonecrosis (67%) and OA (24%). Despite these differences, the magnitude of LLD correction achieved was comparable, supporting the reproducibility of CDPR across different patient groups.Other studies using intraoperative calipers have reported similar mean postoperative LLD but with wider ranges. Jasty et al,[15] reported a mean postoperative LLD of 5.4 mm, but with a range from –70 mm to +4 mm, while Woolson and Harris,[14] reported <10 mm with a range from –20 mm to +20 mm. In contrast, our study achieved a narrower

range (1–7 mm), suggesting that CDPR provides more consistent correction compared to conventional caliper techniques.

Functional outcomes further support the effectiveness of CDPR. The modified Harris Hip Score (MHHS) improved significantly from a mean of 35.9 preoperatively to 85.1 at six weeks. Subgroup analyses in AVN and OA patients revealed similar trajectories, with statistically significant improvements at each postoperative interval. Although patients with smaller residual discrepancies (0–2 mm) achieved higher MHHS scores compared to those with >4 mm discrepancy, the differences were not statistically significant ($p = 0.109$). Nonetheless, the trend reinforces the importance of minimizing LLD to optimize functional recovery.The limitations of this study include its relatively small sample size and lack of blinding, which may introduce observer bias. Furthermore, as all procedures were performed through a posterior approach, the applicability of CDPR to anterior or supine approaches remains untested. Despite these limitations, the technique compares favorably to other intraoperative methods documented in the literature and produced consistent outcomes.

Taken together, these findings confirm that the CDPR technique is a reliable and effective intraoperative tool for restoring limb length in THA. By achieving high accuracy in LLD correction and facilitating significant functional recovery, CDPR addresses one of the most common sources of dissatisfaction in hip arthroplasty. The results of this study, consistent with those of Tikagami et al,[22]Jasty et al,[15] and Woolson and Harris,[14] support the broader application of CDPR in clinical practice, particularly in patients with AVN and OA, where restoration of biomechanics is essential for long term outcomes.

CONCLUSION

The study has shown that CDPRis an effective method in restoring limb length in these patients. Further, clinical prospective studies with a larger sample size are warranted to establish the robust effectiveness.

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