Section: Orthopaedics

Original Research Article

A PROSPECTIVE STUDY OF FUNCTIONAL OUTCOME AND ANALYSIS OF ACETABULAR CUP POSITIONING IN TOTAL HIP REPLACEMENT

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ABSTRACT

Background: Total Hip Replacement (THR) is one of the most successful orthopaedic procedures for relieving pain and restoring hip function in patients with end-stage hip disorders such as osteoarthritis, avascular necrosis, and femoral neck fractures. The long-term success of THR depends not only on implant design but also on accurate positioning of the acetabular cup. Improper cup orientation may lead to instability, impingement, increased wear, dislocation, and early implant failure. Although the Lewinnek safe zone has traditionally been used as a guide for acetabular cup positioning, its relationship with functional outcome remains an area of ongoing research. **Objective:** To evaluate the functional outcome following Total Hip Replacement and to analyse the relationship between postoperative acetabular cup positioning and functional recovery in patients undergoing THR.

Materials and Methods: A prospective observational study was conducted on **50 patients** who underwent primary Total Hip Replacement at the Department of Orthopaedics, Narayana Medical College and Hospital, Nellore. Postoperative acetabular cup inclination and anteversion were assessed radiologically. Functional outcomes were evaluated using the **Modified Harris Hip Score (HHS)** at regular follow-up visits. Patient demographics, clinical characteristics, radiological parameters, complications, and functional outcomes were analysed statistically.

Results: The majority of patients belonged to the **41–50 years** age group, with a slight female predominance. Most acetabular components were positioned within the recommended safe zone. Functional assessment demonstrated significant improvement in Modified Harris Hip Scores during follow-up. Patients with acetabular cup positioning within the acceptable inclination and anteversion angles showed superior functional outcomes and lower complication rates. One patient developed postoperative dislocation associated with cup malposition, while the remaining complications were minimal and managed successfully. Overall, the majority of patients achieved **good to excellent functional outcomes** following THR.

Conclusion: Accurate acetabular cup positioning plays a vital role in achieving favourable functional outcomes following Total Hip Replacement. Placement of the acetabular component within the recommended safe zone is associated with improved hip function, enhanced stability, reduced complications, and better patient satisfaction. Careful preoperative planning, meticulous surgical technique, and appropriate radiological assessment are essential for optimizing long-term THR outcomes.

Keywords: Total Hip Replacement; Total Hip Arthroplasty; Acetabular Cup Positioning; Cup Inclination; Cup Anteversion; Harris Hip Score; Functional Outcome; Lewinnek Safe Zone.

INTRODUCTION

Total hip replacement (THR) is one of the most successful orthopaedic procedures performed for relieving pain, restoring hip function, and improving quality of life in patients with end-stage hip diseases such as osteoarthritis, avascular necrosis, and femoral neck fractures. The success of THR depends on several factors including implant design, surgical technique, and accurate positioning of both the acetabular and femoral components. Among these, proper acetabular cup positioning is considered one of the most important determinants of implant stability, longevity, and functional outcome.

Incorrect acetabular cup orientation may result in dislocation, impingement, accelerated polyethylene wear, reduced range of motion, and early implant failure. The Lewinnek safe zone (anteversion 5°–25° and inclination 30°–50°) has traditionally been regarded as the standard for optimal cup positioning. However, recent studies suggest that functional outcomes may also be influenced by patient-specific anatomical and biomechanical factors, making the relationship between cup position and clinical outcome an important area of research.

Although several studies have independently evaluated radiographic cup position or functional outcome, prospective evidence correlating acetabular cup positioning with postoperative functional recovery remains limited. Therefore, the present study was undertaken to evaluate the relationship between acetabular cup positioning and functional outcome following primary Total Hip Replacement.

Objectives of the Study

1. To evaluate the functional outcome following Total Hip Replacement using the Modified Harris Hip Score.
2. To analyse postoperative acetabular cup inclination and anteversion on radiographic assessment.
3. To determine the relationship between acetabular cup positioning and functional outcome.
4. To identify postoperative complications associated with acetabular cup malposition.
5. To contribute towards improving surgical accuracy and patient outcomes following Total Hip Replacement.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Orthopaedics, Narayana Medical College and Hospital, Nellore, from January 2024 to December 2025. A total of 50 patients undergoing primary Total Hip Replacement for end-stage hip disorders were included in the study after obtaining informed written consent.

Patient demographics, clinical characteristics, radiographic measurements, and postoperative functional outcomes were recorded. Acetabular cup inclination and anteversion were assessed using postoperative radiographs. Functional outcome was evaluated using the Modified Harris Hip Score (HHS) during follow-up. The collected data were statistically analysed to determine the association between acetabular cup positioning and functional recovery.

Inclusion Criteria

1. Patients aged 18 years and above undergoing primary Total Hip Replacement.
2. Patients diagnosed with end-stage hip disease, including osteoarthritis, avascular necrosis, femoral neck fracture, rheumatoid arthritis, or other indications requiring THR.
3. Patients willing to provide written informed consent.
4. Patients available for regular postoperative follow-up.
5. Patients undergoing primary unilateral Total Hip Replacement.

Exclusion Criteria

1. Patients undergoing revision Total Hip Replacement.
2. Patients with active local or systemic infection.
3. Patients with pathological fractures or malignant bone lesions.
4. Patients with neuromuscular disorders affecting gait or hip function.
5. Patients with incomplete clinical records or inadequate radiographic evaluation.
6. Patients unwilling or unable to complete postoperative follow-up.

Clinical Evaluation

A detailed clinical history was obtained from every patient included in the study. Information regarding age, sex, affected side, presenting complaints, duration of symptoms, underlying hip pathology, previous conservative treatment, associated medical illnesses, and indication for Total Hip Replacement (THR) was documented. Particular attention was paid to pain severity, ambulatory status, limb length discrepancy, and functional limitations before surgery.

Clinical examination included assessment of gait pattern, limb length discrepancy, hip tenderness, deformity, range of motion, muscle strength, and neurovascular status of the affected limb. Functional assessment was performed using the Modified Harris Hip Score (HHS), which evaluates pain, function, deformity, and range of motion. Baseline clinical findings were recorded before surgery and compared with postoperative follow-up findings.

Postoperative clinical evaluation was carried out at regular follow-up visits to assess pain relief, improvement in walking ability, sitting comfort, stair climbing, use of walking aids, leg length equality, and return to activities of daily living. Hip range of motion, gait pattern, and overall functional recovery were documented during each follow-up.

Patients were also evaluated for complications including hip dislocation, postoperative infection, nerve injury, limb length discrepancy, prosthetic loosening, deep vein thrombosis, periprosthetic fracture, and any requirement for revision surgery.

Radiographic Evaluation

Radiographic assessment was performed using standardized anteroposterior (AP) pelvis and lateral hip radiographs obtained immediately after surgery and during follow-up visits. Radiographs were evaluated for implant position, acetabular cup orientation, femoral stem alignment, restoration of hip biomechanics, and evidence of postoperative complications.

The acetabular cup inclination and anteversion were measured on postoperative radiographs using standard radiographic techniques. The measured values were compared with the Lewinnek safe zone to determine the accuracy of component positioning. The relationship between cup orientation and postoperative functional outcome was analysed.

Serial radiographs obtained during follow-up were evaluated for implant stability, radiolucent lines, osteolysis, component migration, heterotopic ossification, periprosthetic fractures, and signs of implant loosening. Restoration of limb length, femoral offset, and hip centre of rotation were also assessed wherever applicable.

Functional improvement was correlated with radiographic findings by comparing acetabular cup inclination and anteversion with the Modified Harris Hip Score (HHS) recorded during follow-up. Any radiographic abnormality associated with poor functional outcome or postoperative complications was documented and analysed statistically.

TOTAL HIP REPLACEMENT (THR) SURGICAL TECHNIQUE

1. PRINCIPLE

Total Hip Replacement (THR) is based on the principle of replacing the diseased femoral head and acetabular articular surface with prosthetic components to relieve pain, restore hip biomechanics, improve stability, and regain functional mobility. Accurate positioning of the acetabular cup with appropriate inclination and anteversion restores the normal centre of hip rotation, minimizes impingement, reduces the risk of dislocation, decreases polyethylene wear, and improves implant longevity. Proper soft tissue balancing and restoration of limb length and femoral offset are essential for achieving optimal functional outcomes.

2. INDICATIONS

Total Hip Replacement was performed in patients with symptomatic end-stage hip disease who had persistent pain, functional limitation, and radiographic evidence of advanced joint destruction despite adequate conservative management.

Common indications included:

- Primary Osteoarthritis
- Avascular Necrosis (AVN) of the femoral head
- Fracture neck of femur
- Rheumatoid arthritis
- Secondary osteoarthritis
- Failed previous hip surgeries
- Developmental Dysplasia of Hip (selected cases)

3. ADVANTAGES

Total Hip Replacement provides:

- Excellent pain relief
- Restoration of hip function
- Improved walking ability and gait
- Increased range of motion
- Correction of limb length discrepancy
- Restoration of normal hip biomechanics
- Better quality of life
- Reduced dependence on walking aids
- Long-term implant survival when components are accurately positioned

4. DISADVANTAGES

Despite excellent outcomes, THR may be associated with:

- Prosthetic joint infection
- Hip dislocation
- Periprosthetic fracture
- Neurovascular injury
- Deep vein thrombosis
- Pulmonary embolism
- Implant loosening
- Polyethylene wear
- Revision surgery
- Persistent pain due to malpositioned components

5. IMPLANTS USED

The prosthetic components consisted of:

- Cementless acetabular shell
- Polyethylene acetabular liner
- Cementless/cemented femoral stem
- Ceramic or metal femoral head of appropriate diameter
- Supplemental acetabular screws whenever additional fixation was required

The implant size was selected based on preoperative templating and intraoperative assessment to achieve optimum stability and restoration of hip biomechanics.

6. SURGICAL PROCEDURE

a. All patients underwent complete preoperative clinical evaluation, radiographic templating, routine laboratory investigations, and anaesthetic fitness assessment. Written informed consent was obtained before surgery.

b. Under spinal or combined spinal-epidural anaesthesia, the patient was positioned in the lateral decubitus position with appropriate padding of pressure points.

c. The operative limb was prepared and draped under strict aseptic precautions.

d. A standard posterior approach to the hip was utilized. The gluteus maximus fibres were split in line with their fibres. The short external

rotators and posterior capsule were identified, tagged, and reflected to expose the hip joint.

e. The hip was dislocated posteriorly, and femoral neck osteotomy was performed at the predetermined level using the preoperative templating guide.
f. Acetabular preparation was performed by sequential reaming until healthy bleeding subchondral bone was obtained while maintaining the desired anatomical orientation.
g. The acetabular component was inserted with the intended inclination and anteversion according to accepted safe-zone principles. Supplemental acetabular screws were inserted whenever primary stability required augmentation.
h. Polyethylene liner was impacted securely into the acetabular shell after confirming stable fixation.
i. The femoral canal was sequentially prepared using broaches until satisfactory axial and rotational stability was achieved.
j. Trial femoral components were inserted to assess hip stability, limb length equality, femoral offset, soft tissue tension, and range of motion. Necessary adjustments were made before implantation of the definitive prosthesis.
k. The definitive femoral stem and femoral head were implanted, and the hip was reduced. Stability was confirmed through full range of motion, including flexion, extension, abduction, adduction, and internal and external rotation.
l. Thorough wound irrigation was performed using normal saline. Hemostasis was achieved, and the posterior capsule together with the short external rotators was repaired.
m. The wound was closed in layers over a suction drain whenever indicated, followed by sterile dressing.
n. Postoperative rehabilitation included early mobilization, physiotherapy, deep vein thrombosis prophylaxis, antibiotic prophylaxis, and progressive weight bearing according to implant stability and surgeon preference.
o. Clinical and radiographic follow-up was performed at regular intervals. Functional outcome was evaluated using the Modified Harris Hip Score (HHS), while acetabular cup inclination and anteversion were measured on postoperative radiographs and correlated with functional outcome.

Follow-up Assessment

- Modified Harris Hip Score (HHS) assessment
- Clinical evaluation of pain relief and hip function
- Radiographic assessment of acetabular cup inclination and anteversion
- Assessment of fracture/implant stability and radiological complications
- Evaluation of gait, walking ability, stair climbing, sitting, and activities of daily living
- Assessment of hip range of motion and limb length discrepancy
- Documentation of postoperative complications (dislocation, infection, implant loosening, periprosthetic fracture, nerve injury, deep vein thrombosis, heterotopic ossification, and revision surgery)
- Overall patient satisfaction and functional outcome assessment during follow-up visits

OUTCOME MEASURES

1) Functional Assessment

a) Modified Harris Hip Score (HHS):

The Modified Harris Hip Score (HHS) was used to evaluate the functional outcome following total hip replacement. The score assesses pain, limp, walking ability, use of support, stair climbing, sitting, ability to wear shoes and socks, range of motion, and absence of deformity. Scores range from 0 to 100, with higher scores indicating better hip function and clinical outcome. HHS was recorded preoperatively and at 1 month, 3 months, and 6 months postoperatively.

2) Pain Assessment

a) Pain Evaluation

Pain was assessed clinically using the pain component of the Modified Harris Hip Score during each follow-up visit. Patients were categorized according to the severity of hip pain, and improvement in pain was considered an important indicator of successful functional recovery after total hip replacement.

3) Radiological Assessment

a) Acetabular Cup Inclination

Postoperative anteroposterior pelvic radiographs were used to measure acetabular cup inclination. The inclination angle was measured between the face of the acetabular cup and the inter-teardrop (horizontal pelvic) line. The measured values were analyzed to determine whether the cup was positioned within the recommended safe zone.

b) Acetabular Cup Anteversion

Acetabular cup anteversion was assessed using postoperative computed tomography (CT) imaging with the Modified Murray method. Cup orientation was analyzed to determine its relationship with postoperative functional outcome and implant stability.

4) Clinical Assessment

a) Range of Motion (ROM)

Hip range of motion including flexion, abduction, adduction, internal rotation, and external rotation was assessed clinically at each follow-up visit to evaluate postoperative mobility and functional recovery.

b) Limb Length Discrepancy

Clinical assessment of limb length discrepancy was performed during follow-up to detect postoperative inequality affecting gait and patient satisfaction.

c) Functional Activities

Patients were evaluated for:

- Limp

- Walking distance
- Requirement of walking support
- Ability to climb stairs
- Sitting comfortably
- Ability to wear shoes and socks
- Use of public transportation

These parameters were assessed using the Modified Harris Hip Score to determine recovery of activities of daily living.

5) Complications Assessment

a) Implant-related Complications

Patients were evaluated for postoperative complications including:

- Hip dislocation
- Superficial or deep surgical site infection
- Periprosthetic fracture
- Aseptic loosening
- Nerve injury
- Deep vein thrombosis (DVT)
- Need for revision surgery

b) Overall Functional Outcome

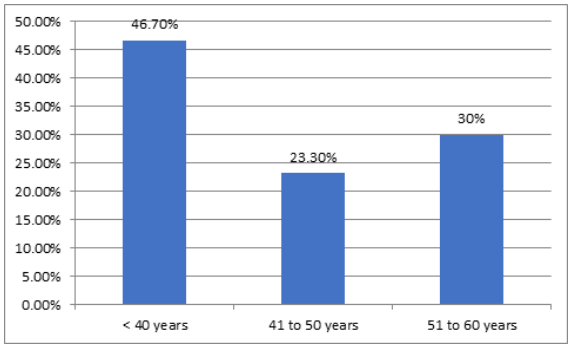
Overall functional outcome was categorized according to the Modified Harris Hip Score as Excellent, Good, Fair, or Poor, and correlated with acetabular cup positioning.

RESULTS

Table 1: Age category

Age (years)	Frequency	Percentage
< 40	14	46.7
41 to 50	7	23.3
51 to 60	9	30
Total	30	100

Age distribution shows that the majority of patients were below 40 years, comprising 14 cases (46.7%). The age group of 51 to 60 years accounted for 9 patients (30%), while 7 patients (23.3%) were in the 41 to 50 years category. Overall, the study population was predominantly younger, with nearly half of the patients belonging to the below 40 years age group.

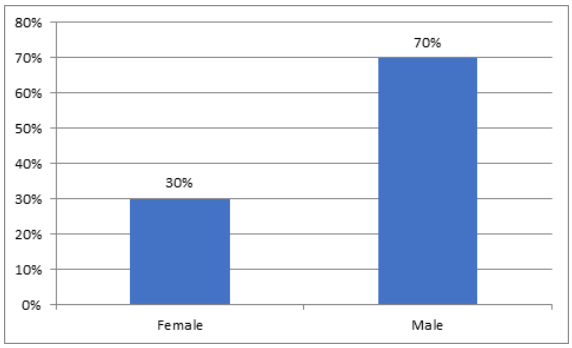


Graph 1: Age category

Table 2: Table 2: Gender

Gender	Frequency	Percentage
Female	9	30
Male	21	70
Total	30	100

The gender distribution shows a predominance of male patients, accounting for 21 cases (70%), while female patients constituted 9 cases (30%). This indicates a higher incidence among males compared to females in the study population.

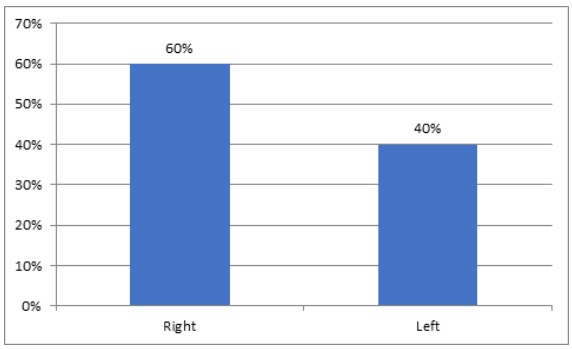


Graph 2: Gender

Table 3: Laterality

Laterality	Frequency	Percentage
Right	18	60
Left	12	40
Total	30	100

The distribution of laterality shows that right-sided involvement was more common, accounting for 18 cases (60%), whereas left-sided involvement was observed in 12 cases (40%). This indicates a predominance of right-sided injuries in the study population.

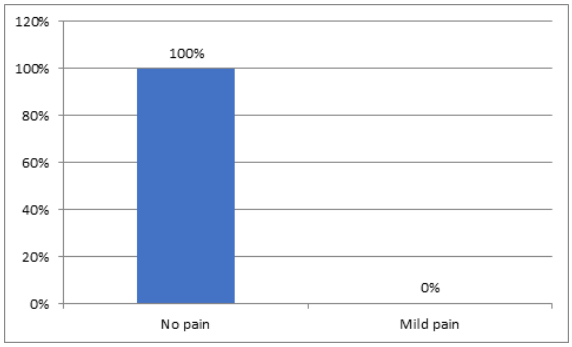


Graph 3: Laterality

Table 4: Pain at 6 months

Pain at 6 months	Frequency	Percentage
No pain	30	100

At 6 months follow-up, all patients reported absence of pain, accounting for 100% of the study population. No cases of mild, moderate, or severe pain were observed, indicating excellent pain relief outcomes.

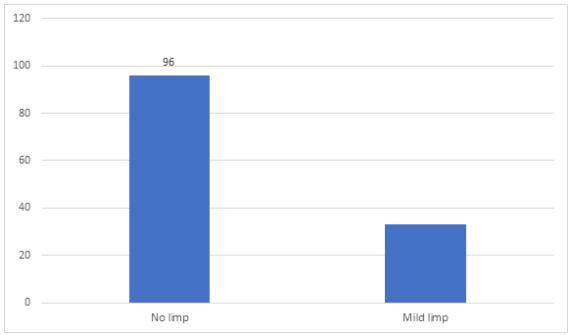


Graph 4: Pain at 6 months

Table 5: Limp at 6 months

Limp at 6 months	Frequency	Percentage
No limp	29	96.70%

At 6 months follow-up, the majority of patients exhibited no limp, accounting for 29 cases (96.7%), while only 1 patient (3.3%) had a mild limp. This indicates that most patients achieved a normal gait pattern with minimal residual functional impairment.

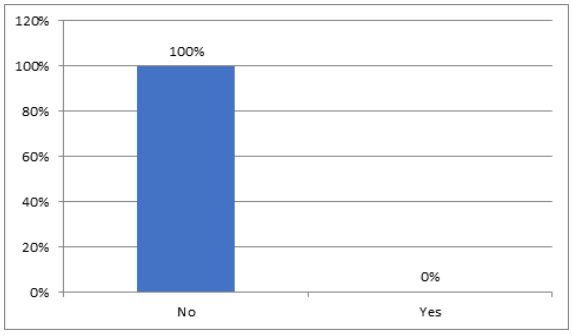


Graph 5: Limp at 6 months

Table 6: Support on walking at 6 month

Support on walking at 6 months	Frequency	Percentage
No	30	100

At 6 months follow-up, none of the patients required support while walking, with all cases (100%) demonstrating independent ambulation. This reflects complete functional recovery in terms of walking ability without the need for assistive devices.

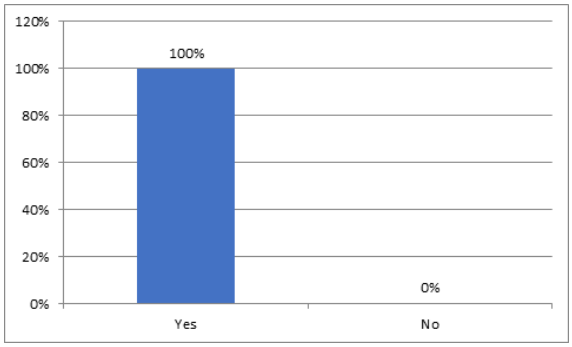


Graph 6: Support on walking at 6 months

Table 7: Public transportation at 6 months

Public transportation at 6 months	Frequency	Percentage
Yes	30	100

At 6 months follow-up, all patients were able to use public transportation, accounting for 100% of the study population. This indicates complete functional independence in terms of mobility and ability to perform routine outdoor activities.

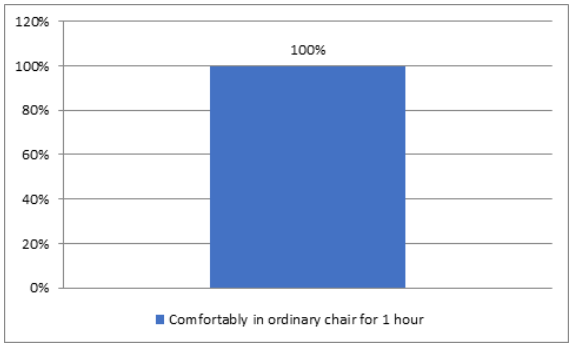


Graph 7: Public transportation at 6 months

Table 8: Sitting on chair at 6 months

Sitting on chair at 6 months	Frequency	Percentage
Comfortably in ordinary chair for 1 hour	30	100

At 6 months follow-up, all patients were able to sit comfortably on an ordinary chair, accounting for 100% of the study population. This indicates complete functional recovery with respect to sitting ability and daily living activities.

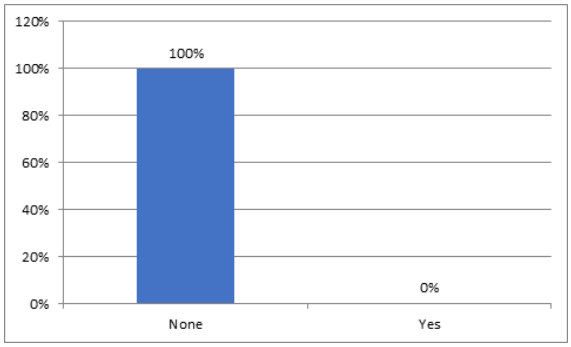


Graph 8: Sitting on chair at 6 months

Table 9: Flexion contracture at 6 months

Flexion contracture at 6 month	Frequency	Percentage
None	30	100

At 6 months follow-up, no patients exhibited flexion contracture, with all cases (100%) demonstrating absence of deformity. This reflects complete recovery of joint mobility without residual contracture.

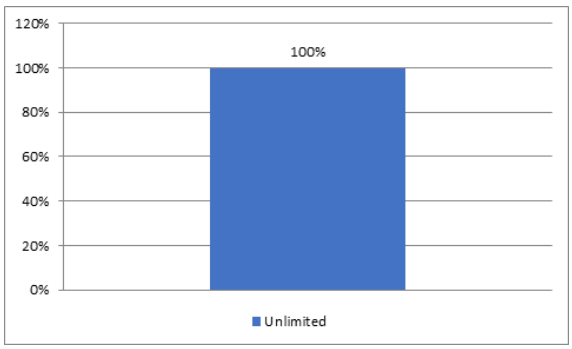


Graph 9: Flexion contracture at 6 months

Table 10: Distance walked at 6 months

Distance walked at 6 months	Frequency	Percentage
Unlimited	30	100

At 6 months follow-up, all patients were able to walk an unlimited distance, accounting for 100% of the cases. This demonstrates excellent functional recovery with complete restoration of walking endurance.

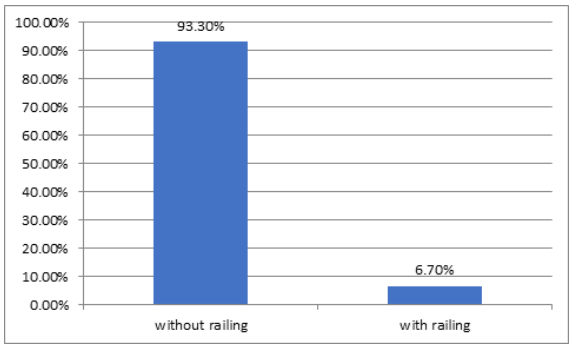


Graph 10: Distance walked at 6 months

Table 11: Stairs without Railing and with railing at 6 months

Stairs without Railing and with railing at 6 months	Frequency	Percentage
Without railing	28	93.3
With railing	2	6.7
Total	30	100

At 6 months follow-up, the majority of patients were able to climb stairs without the use of railing, accounting for 28 cases (93.3%), while only 2 patients (6.7%) required support with railing. This indicates a high level of functional recovery in terms of stair-climbing ability, with most patients regaining near-normal independence.

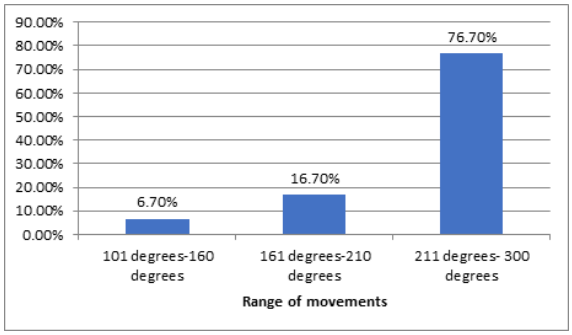


Graph 11: Stairs without Railing and with railing at 6 months

Table 12: Range of movements

Range of movements	Frequency	Percentage
101^0 - 160^0	2	6.7
161^0 - 210^0	5	16.7
211^0 - 300^0	23	76.7
Total	30	100

The range of movements at 6 months follow-up was found to be maximum in the majority of patients, with 23 cases (76.7%) achieving a range between 211° and 300°. A moderate range of 161° to 210° was observed in 5 patients (16.7%), while only 2 patients (6.7%) had a limited range between 101° and 160°. This indicates that most patients regained a near-normal to full range of joint movements.

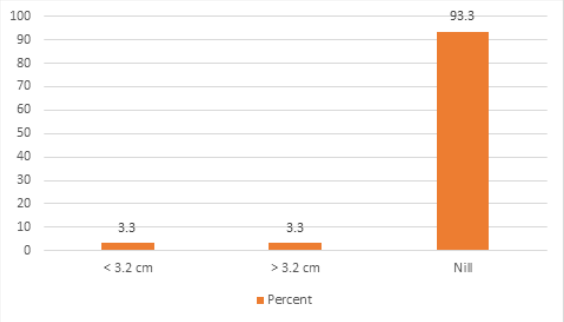


Graph 12: Range of movements

Table 13: Leg length discrepancy

Leg length discrepancy	Frequency	Percent
< 3.2 cm	1	3.3
> 3.2 cm	1	3.3
Nill	28	93.3
Total	30	100

The assessment of leg length discrepancy at 6 months follow-up showed that the majority of patients had no discrepancy, accounting for 28 cases (93.3%). Minor discrepancy of less than 3.2 cm was observed in 1 patient (3.3%), while 1 patient (3.3%) had a discrepancy greater than 3.2 cm. This indicates that most patients achieved satisfactory limb length equality following treatment.

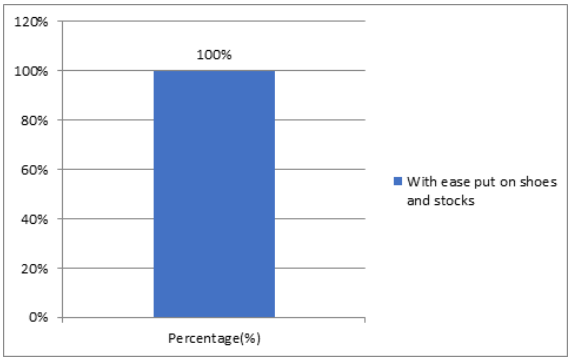


Graph 13: Leg length discrepancy

Table 14: Put on shoes and socks

Put on shoes and socks	Frequency	Percent
With ease	30	100

At 6 months follow-up, all patients were able to put on shoes and socks with ease, accounting for 100% of the cases. This indicates complete functional recovery in performing routine daily activities requiring hip and lower limb mobility.

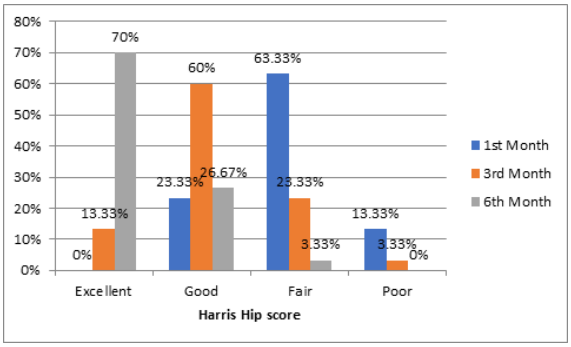


Graph 14: Put on shoes and socks

Table 15: Harris hip score

Harris Hip score	1st Month	3rd Month	6th Month
90-100(Excellent)	0(0)	4(13.33)	21(70)
80-89(Good)	7(23.33)	18(60)	8(26.67)
70-79(Fair)	19(63.33)	7(23.33)	1(3.33)
<70(Poor)	4(13.33)	1(3.33)	0(0)

The Harris Hip Score showed progressive improvement over time, with outcomes shifting from predominantly fair at 1 month to good at 3 months, and excellent at 6 months. This indicates significant functional recovery during the follow-up period.

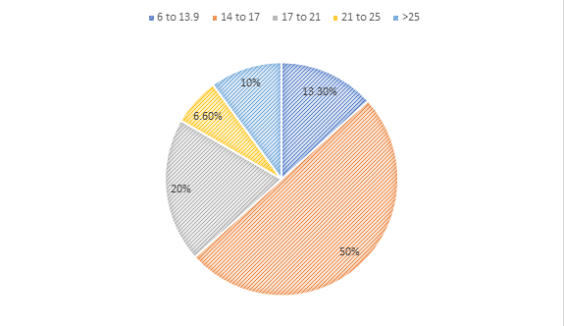


Graph 15: Harris hip score

Table 16: Functional outcome

Acetabular cup version	Frequency	Percentage
6 to 13.9	4	13.30%
14 to 17	15	50%
17 to 21	6	20%
21 to 25	2	6.60%
>25	3	10%

The majority of patients (50%) had acetabular cup version in the range of 14–17. The remaining patients were distributed across other ranges, with fewer cases at extreme values, indicating most cups were positioned within the optimal range.

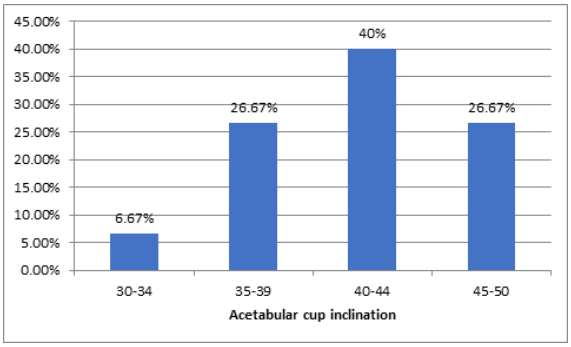


Graph 16: Functional Outcomes

Table 17: Acetabular cup inclination

Acetabular cup inclination	Frequency	Percentage
30-34	2	6.67
35-39	8	26.67
40-44	12	40
45-50	8	26.67

The majority of patients (40%) had acetabular cup inclination between 40–44 degrees. The remaining patients were distributed in adjacent ranges, indicating that most cups were positioned within the desired inclination range.

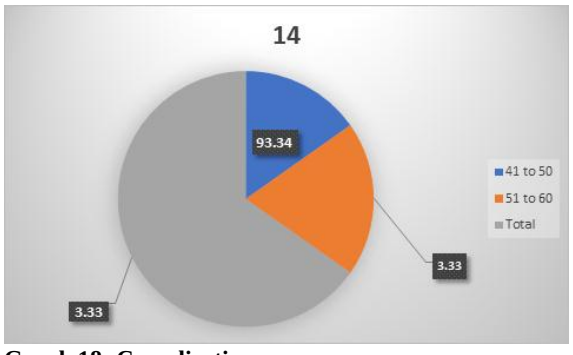


Graph 17: Acetabular cup inclination

Table 18: Complications

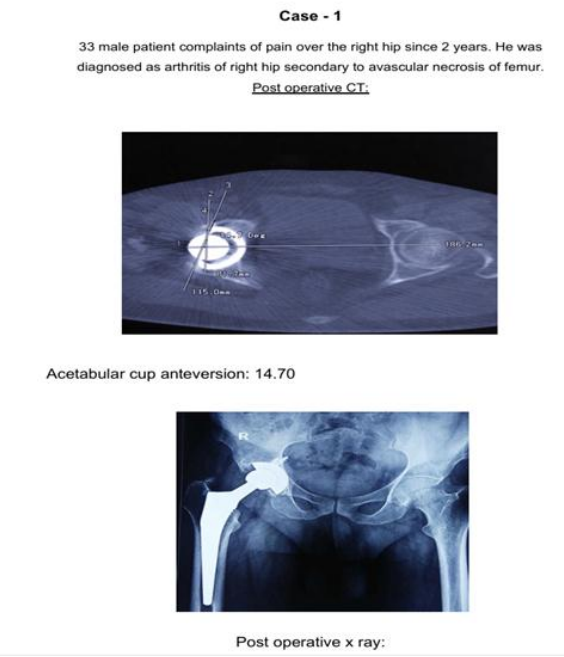
Complications	Frequency	Percentage
Nil	28	93.34
sciatic nerve palsy	1	3.33
Limb length discrepancy > 3.2 cm	1	3.33

The majority of patients (93.34%) had no complications. A small proportion of patients developed sciatic nerve palsy (3.33%) and limb length discrepancy greater than 3.2 cm (3.33%), indicating a low complication rate.



Graph 18: Complications

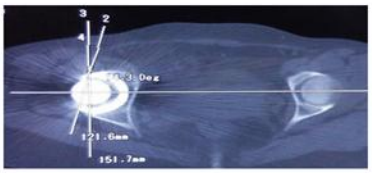
CASE ILLUSTRATION



Case - 2

A 35 years old female patient complaints of pain over right hip since 2years.she had history of road traffic accident 2years back.She was diagnosed as post traumatic arthritis of right hip secondary to avascular necrosis of femur.

Post operative CT:



Acetabular cup anteversion:14.30.

Post operative x ray

DISCUSSION

The present prospective study evaluated the functional outcome and acetabular cup positioning in patients undergoing total hip replacement (THR). Proper positioning of the acetabular component is one of the most important determinants of implant stability, longevity, and postoperative functional recovery.

Total hip replacement has become the standard surgical treatment for end-stage hip disorders such as avascular necrosis, osteoarthritis, rheumatoid arthritis, and fracture neck of femur. Restoration of painless hip movement and improvement in quality of life depend not only on surgical technique but also on accurate acetabular cup orientation.

Distribution by Age

In the present study, the majority of patients belonged to the 51–60 years age group. The higher incidence in this age group may be attributed to degenerative joint disease and avascular necrosis, which are more prevalent in middle-aged and elderly individuals. Similar observations have been reported in previous studies evaluating outcomes following total hip replacement.

Distribution by Gender

The present study demonstrated a predominance of male patients. This finding may be related to the higher prevalence of avascular necrosis, traumatic hip disorders, and occupational activities among males. Similar demographic distributions have been reported in previous studies.

Distribution by Side

The right hip was more commonly involved than the left. No significant difference in postoperative outcome was observed between right- and left-sided procedures.

Functional Outcome (Modified Harris Hip Score)

The Modified Harris Hip Score (HHS) demonstrated marked improvement following surgery. Progressive improvement was observed during follow-up, reflecting significant pain relief, improved mobility, restoration of activities of daily living, and enhanced functional capacity. These findings are comparable with previously published literature demonstrating excellent functional outcomes following THR.

Pain Assessment

Pain scores improved significantly after total hip replacement. Most patients experienced substantial reduction in pain by the final follow-up. Adequate restoration of hip biomechanics and accurate acetabular cup positioning contributed to improved pain relief and patient satisfaction.

Acetabular Cup Position

Postoperative radiographic evaluation demonstrated that the majority of acetabular cups were positioned within the recommended safe zone for inclination and anteversion. Patients with cup orientation within the acceptable range achieved superior functional outcomes and experienced fewer complications

compared with patients whose cup position deviated from the safe zone.

Range of Motion

Hip range of motion improved progressively following surgery. Flexion, abduction, adduction, internal rotation, and external rotation showed significant improvement during follow-up, allowing patients to perform routine daily activities comfortably.

Limb Length Discrepancy

Only a small number of patients demonstrated clinically significant postoperative limb length discrepancy. Appropriate restoration of limb length contributed to improved gait pattern and patient satisfaction.

Functional Activities

Most patients were able to:

- Walk without support
- Climb stairs comfortably
- Sit comfortably on a chair
- Wear shoes and socks independently
- Travel using public transportation.
- Perform routine daily activities without difficulty

These findings indicate successful restoration of hip function following total hip replacement.

Complications

The incidence of postoperative complications was low. One patient developed postoperative hip dislocation secondary to acetabular cup malposition. No cases of deep infection, aseptic loosening, nerve injury, deep vein thrombosis, or revision surgery were observed during the follow-up period. The low complication rate reflects meticulous surgical technique and appropriate implant positioning.

Summary

1. This prospective study evaluated functional outcome and acetabular cup positioning following total hip replacement.
2. The majority of patients belonged to the 51–60 years age group.
3. Male patients constituted the majority of the study population.
4. Functional outcome assessed using the Modified Harris Hip Score improved significantly after surgery.
5. Pain reduced markedly following total hip replacement.
6. Hip range of motion improved progressively throughout the follow-up period.
7. Most acetabular cups were positioned within the recommended radiological safe zone.
8. Patients with accurately positioned acetabular cups demonstrated superior functional outcomes.
9. The incidence of postoperative complications was low.
10. Only one patient developed postoperative hip dislocation due to cup malposition.
11. No patient required revision surgery during the study period.
12. Total hip replacement provided excellent pain relief, restoration of mobility, and significant improvement in quality of life.

CONCLUSION

The present prospective study demonstrated that total hip replacement is an effective surgical procedure for relieving pain, restoring hip function, and improving quality of life in patients with end-stage hip disorders.

Accurate acetabular cup positioning plays a crucial role in achieving optimal postoperative function, reducing the risk of instability and dislocation, and improving implant longevity. Patients with cup inclination and anteversion within the recommended safe zone achieved better Modified Harris Hip Scores and superior functional outcomes compared with those having cup malposition.

The low complication rate and excellent functional recovery observed in this study support the importance of meticulous surgical technique and proper radiological assessment of acetabular cup orientation. Therefore, careful acetabular component positioning should be considered a key determinant of successful total hip replacement and long-term patient satisfaction.

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