



Original Article

## Optimal Combined Anteversion in Total Hip Replacement for Indian Population: A Prospective Functional Outcome Study

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### ABSTRACT

**Background:** Combined anteversion (CA), defined as the sum of acetabular and femoral anteversion, is a key determinant of stability in total hip replacement (THR). Traditional “safe zones” have been derived from Western populations and may not reflect functional demands of Indian patients [1,2].

**Aim:** To determine the optimal combined anteversion range in Indian patients undergoing THR and its correlation with functional outcomes and lifestyle activities.

**Methods:** A prospective observational study was conducted on 82 patients undergoing primary THR. Patients were grouped based on CA (<25°, 25–50°, >50°). Functional outcomes were assessed using Harris Hip Score (HHS), WOMAC score, and lifestyle activities.

**Results:** Patients with CA between 25–50° demonstrated significantly better functional outcomes ( $p < 0.001$ ). Squatting ability was highest in this group. Dislocation occurred more frequently in extreme CA groups.

**Conclusion:** Optimal CA for Indian patients appear to lie between 30–55 degree, suggesting the need for population-specific targets.

**Keywords:** Optimal, Anteversion, Population, Functiona, Combined anteversion.

### INTRODUCTION

Total hip replacement (THR) is widely regarded as one of the most successful orthopaedic procedures [18]. Implant positioning plays a critical role in determining postoperative stability and function.

The concept of acetabular safe zones was first described by Lewinnek et al. [1]; however, dislocations continue to occur even within these zones [9]. This has led to increasing interest in combined anteversion (CA), which incorporates both acetabular and femoral components [2,3,5].

Studies have demonstrated that CA is a better predictor of impingement and dislocation than isolated cup positioning [7,13]. Furthermore, spinopelvic mobility has been shown to influence functional orientation of the acetabulum [8,10,11,15].

In the Indian population, cultural activities such as squatting and cross-legged sitting place additional biomechanical demands on the hip joint, which are not considered in traditional Western models.

### AIM

To determine the optimal combined anteversion range in Indian patients undergoing THR and correlate it with functional outcomes.

### MATERIALS AND METHODS

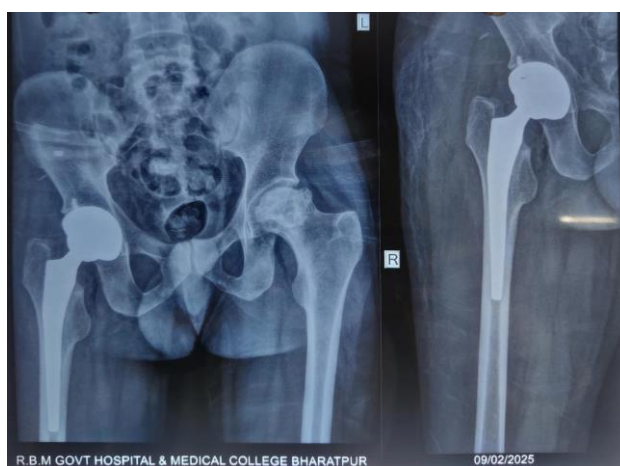
#### 1. Study Design

Prospective observational study.

2. Sample Size  
82 patients undergoing primary THR.
3. Inclusion Criteria
  - Age >18 years
  - Primary THR (AVN, OA, fracture neck femur)
4. Exclusion Criteria
  - Revision THR
  - Neuromuscular disorders
  - Severe deformities
5. Surgical Technique

All surgeries were performed using standard posterior approach. Component positioning followed conventional guidelines with intraoperative estimation of anteversion [12].

6. Measurement of Anteversion  
Acetabular anteversion measured radiographically using standardized methods [4,6,21]. Femoral anteversion assessed intraoperatively and radiologically.  
Combined Anteversion (CA) = cup + stem anteversion



#### Grouping

Group A: CA <25°

Group B: CA 25–50°

Group C: CA >50°

#### Outcome Measures

Functional Scores

Harris Hip Score (HHS)

WOMAC score

Lifestyle Assessment

Squatting

Cross-legged sitting

#### Complications

Dislocation

Impingement

Limp

#### Statistical Analysis

ANOVA for continuous variables

Chi-square test for categorical variables

$p < 0.05$  considered significant

#### RESULTS

Demographics

Mean age:  $54.2 \pm 12.1$  years  
 AVN most common indication (52%)

Table 1: Functional Outcomes by Combined Anteversion

Group	HHS	WOMAC
<25°	78.3	32.5
25-50°	89.6	18.2
>50°	82.1	24.7

Patients in Group B (25-50°) showed significantly higher HHS compared to other groups ( $p < 0.001$ ). [table 1, figure 1 & 2]

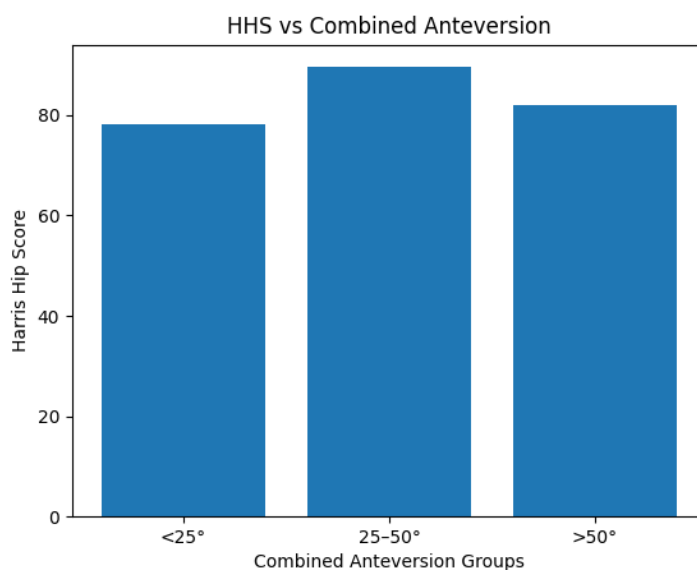


Figure 1: HHS vs Combined Anteversion

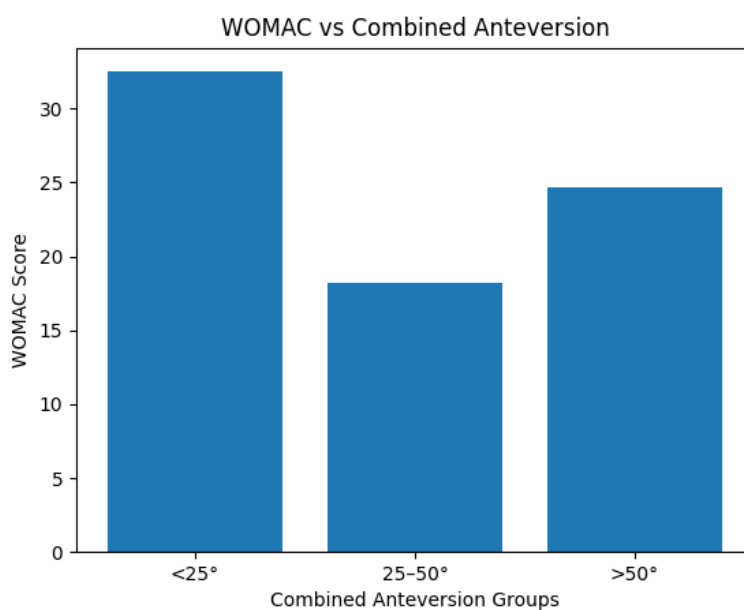


Figure 2: WOMAC vs Combined Anteversion

Lifestyle Outcomes [Figure 3]  
 Squatting ability highest in Group B

Cross-leg sitting significantly better in Group B

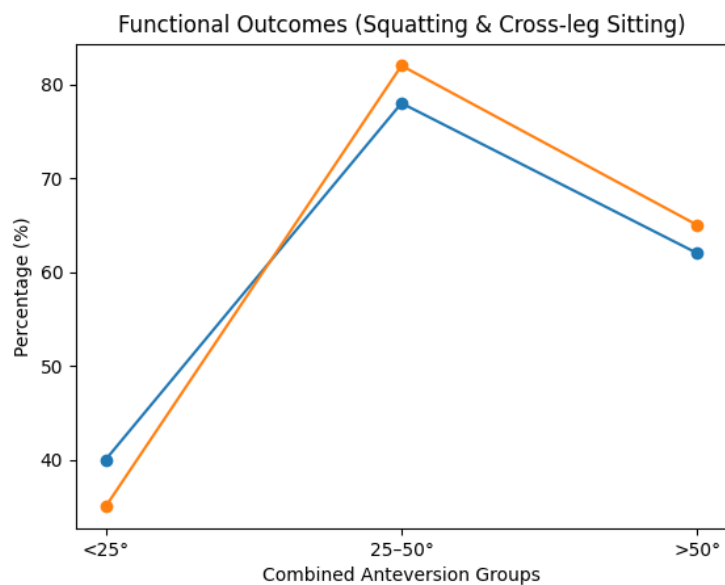


Figure 3: Lifestyle Outcomes

### Complications

Dislocation occurred predominantly in Group A and Group C, consistent with previous literature highlighting the importance of optimal component positioning [14,16,17,20].

### DISCUSSION

This study demonstrates that combined anteversion significantly influences functional outcomes following THR. Patients within the 25–50° range showed superior outcomes, consistent with previously described combined anteversion concepts [3,5].

However, our findings suggest that the optimal range for Indian patients may extend slightly beyond traditional values, supporting the concept of a functional safe zone rather than a fixed radiological target [19].

The role of spinopelvic dynamics further complicates the concept of a universal safe zone, as pelvic tilt can alter functional anteversion during daily activities [10,11,15].

Additionally, the persistence of dislocations within traditional safe zones highlights the limitations of relying solely on static measurements [9,14,16].

Our study uniquely incorporates lifestyle-based functional outcomes, demonstrating that slightly higher anteversion may facilitate activities such as squatting without compromising stability.

### Limitations

Short follow-up duration  
Moderate sample size  
Radiographic measurement variability

### Conclusion

Optimal combined anteversion for Indian patients undergoing THR appears to lie between 30°–55°, offering improved functional outcomes and reduced complications.

This study supports a shift toward patient-specific and function-oriented implant positioning rather than reliance on traditional universal safe zones.

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