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ORIGINAL RESEARCH

A prospective comparative study of functional outcome of 28 mm versus 36 mm femoral head sizes in uncemented total hip arthroplasty

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ABSTRACT

Introduction: Total hip arthroplasty has been considered as the operation of the century as it revolutionised the management patients suffering from diseased hip joint.Total hip replacement have demonstrated improved function, reduced pain, and improved quality of lifefor patients, and are cost-effective Hence, the present study was conducted to evaluate functional outcome of 28 mm versus 36 mm femoral head sizes in uncemented total hip arthroplasty.**Materials and Methods:** The prospective study was carried outamong 80patients who underwent Primary Hip Arthroplasty through posterolateral approach, in the department of orthopaedics. The patients were divided into 2 groups with 40 patients in each group. In one group 28 mm and in other group 36 mm femoral head sizes were implanted during uncemented total hip arthroplasty procedure.The data was statistically analysed by SPSS-22. **Results:** Among 80 patients, 65% were male and 35% were female. After 24 weeks postoperatively, the flexion was 8.91 degrees, extension was 2.81 degrees, abduction was 5.23 degrees and adduction were 2.2 degrees more in patients who received 36 mm femoral head as compared to the patients who received 28 mm femoral head.The modified HHS was more in patients who received 36 mm femoral head as compared to the patients who received 28 mm femoral head reporting better functional outcome.Wear and tearwas seen in 6 patients of 28 mm and in 2 patients of 36 mm femoral head sizes in uncemented total hip arthroplasty. **Conclusion:** The present study concludes that uncemented total hip arthroplasty is one of the most effective surgical interventionsthat improves patient's quality of life by improving range of motion of hip joint post-operatively. The 36 mm femoral heads in total hip replacement revealed better improvement in the rangeof motion hence better functional outcome as compared to use of 28 mm heads in THA.

Keywords: Total hip arthroplasty; 28 mm femoral head; 36 mm femoral head

INTRODUCTION

Over the years, the use of large-diameter replacement femoralheads has become increasingly common in orthopedics. One of the main reasons for this trend is clearly the decreasedrisk of dislocation linked to increased jumping distance and range ofmotion. This decreased risk of instability is all the more important giventhe current desire to reduce the costs of total hip arthroplasty (THA) complications.[1]Total hip arthroplasty has been described as the operation of the century as it revolutionised the management of elderly patients suffering from arthritis.[2]

Several risk factors for a dislocating hip have been identified,such as implant orientation, surgical technique (both approachand surgical skills), sex, femoral neck fracture as indication,and neuromuscular disease. In recent times, the surgical approachand use of larger femoral heads have received more attention asa possible solution to this problem.[3]Furthermore, patient and surgical variables leading to increased risk of dislocation are neuromuscular and cognitive disorders, alcoholism, female gender, diagnosis of fracture, component malposition and patient noncompliance. In addition to optimizing the femoral and acetabular component positioning, maximizing the diameter of the femoral head has been touted as another important intra-operative tool available to the surgeon to decrease dislocation rates.[4]Total hip replacement have demonstrated improved function, reduced pain, and improved quality of lifefor

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patients, and are cost-effective.[5]Hence, the present studywas conducted to evaluatefunctional outcome of 28 mm versus 36 mm femoral head sizes in uncemented total hip arthroplasty.

MATERIALS AND METHODS

The currentcomparativeprospective cross-sectional study was carried outamong 80patients who underwent Primary Hip Arthroplasty through posterolateral approach, in the department of orthopaedics. The study was carried out for 5 years.

The ethical approval was obtained from the institutional ethics committee before the initiation of the present study and an informed, written consent was obtained from all the patients who were enrolled for the present study.

The inclusion criteria consisted of all patients who underwent primary total hip replacement in our institute with age ranged >18 years of either sex and <70 years. Patient with AVN grade 3 and with radiological changes of arthritis and patients willing for total hip replacement surgery and who gave consent were included in this study. Patients with failed THA, neuropathic joints, septic arthritis, neurological defects around hip (paralyzed abductors)and patients who were not fit for commencement of surgery because of any associated medical condition were excluded from the study.

The patients were divided into 2 groups with 40 patients in each group. In one group 28 mm and in other group 36 mm femoral head sizes were implanted during uncemented total hip arthroplasty procedure.

Patients who satisfied the inclusion criteria were examined clinically and radiologically as per protocol. Routine blood investigations, CRP, ESR, urine routinewere done for all the patients.

The surgery was conducted byjoint replacement surgeons in the hospital and patients were evaluated clinically and radiologically before surgery, after at 8 weeks, 12 and 24 weeks postoperatively. All cases were evaluatedfor the range of movements using goniometer, functional outcome by modified HHS and for dislocationswith clinical and radiological evaluation.

Statistical analysis

The data was statistically analysed by statistical package for social sciences (SPSS-22). Mean and SD continuous variables

Descriptive statistics

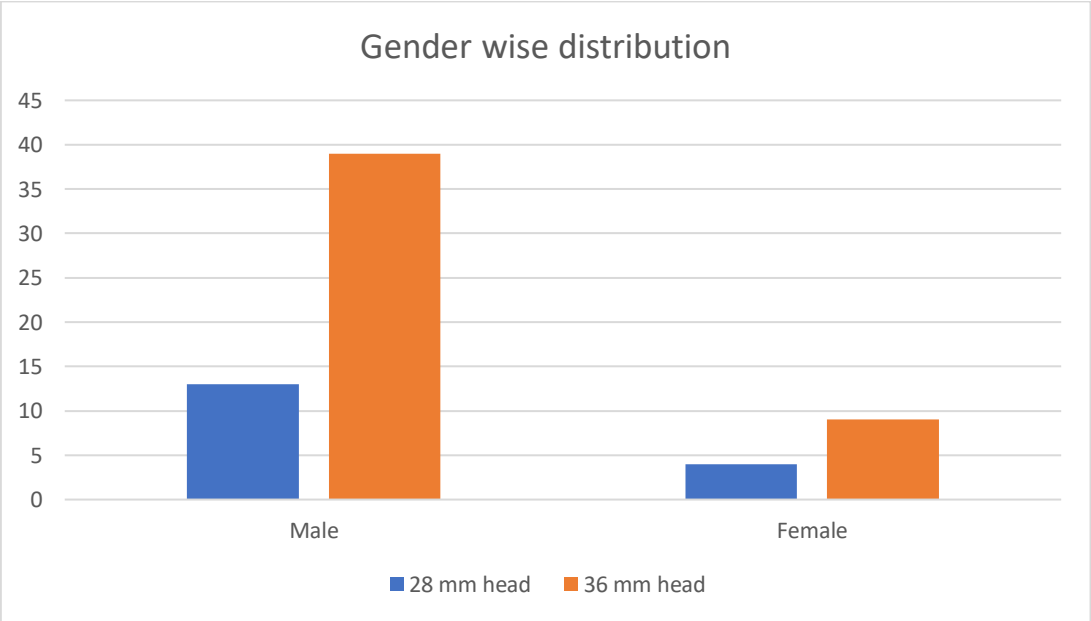
Chi-square test was used to compare the categorical variables between 28 mm and 36 mm head groups. Mann Whitney and independentStudent t test was used to compare the mean values of continuous variables between 28 mm and 36 mm head groups. The level of significance was set at $p<0.05$.

RESULTS

Table 1: Gender wise distribution of patients

Category	Total (n=80) %	28 mm head	36 mm head	P value
Male	52 (65%)	13	39	Non-significant
Female	28 (35%)	4	24	Non-significant

Among 80 patients, 65% were male and 35% were female (table 1, graph 1).



Graph 1: Gender wise distribution of patients

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Table 2: Evaluation of range of motion) of 28 mm versus 36 mm femoral head sizes in uncemented total hip arthroplasty at 8 and 16 weeks

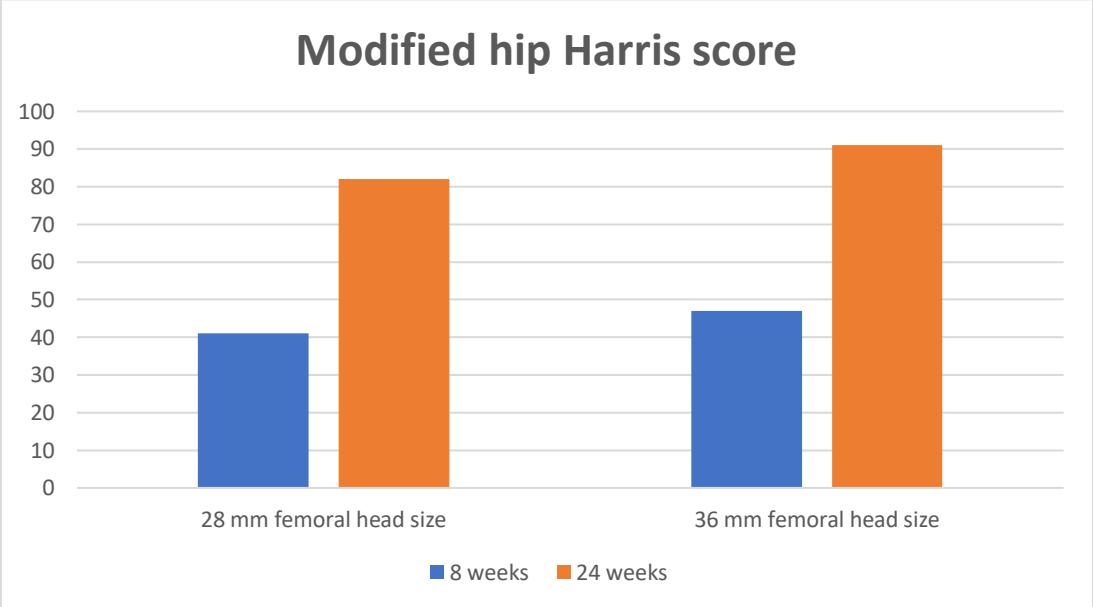
Time duration	8 weeks (mean±SD)			24 weeks(mean±SD)		
Parameters	**28 mm femoral head size**	**36 mm femoral head size**	**P value**	**28 mm femoral head size**	**36 mm femoral head size**	**P value**
Flexion	88.43±6.46	97.35±4.7	<0.001	93.47±5.52	102.38±4.58	<0.001
Extension	7.37±3.9	11.1±4.2	<0.001	8.49±2.4	11.3±4.8	<0.001
Abduction	29.89±3.25	35.43±2.9	<0.001	32.3±4.2	37.53±3.72	<0.001
Adduction	23.56±2.5	27.2±3.05	<0.001	24.9±3.3	27.1±1.9	<0.001

The flexion was 9.04 degrees, extension was 3.73 degrees, abduction was 5.54 degrees, adduction was 3.7 degreeswas more in patients who received 36 mm femoral head as compared to the patients who received 28 mm femoral head at 8 weeks postoperatively.

After 24 weeks postoperatively, the flexion was 8.91 degrees, extension was 2.81 degrees, abduction was 5.23 degrees and adduction were2.2 degrees more in patients who received 36 mm femoral head as compared to the patients who received 28 mm femoral head.

Table 3: Evaluation of functional outcome (modified hip Harris score) and dislocation of 28 mm versus 36 mm femoral head sizes in uncemented total hip arthroplasty at 8 and 24 weeks

Time duration	8 weeks (mean±SD)			24 weeks(mean±SD)		
Parameters	**28 mm femoral head size**	**36 mm femoral head size**	**P value**	**28 mm femoral head size**	**36 mm femoral head size**	**P value**
Modified hip Harris score	41.0 ±1.2	47.1±3.02	<0.001	82±4.06	91±3.2	<0.001
Dislocation (number of cases)	0	0	-	6	0	<0.001



Graph 1: Evaluation of functional outcome (modified hip Harris score) of 28 mm versus 36 mm femoral head sizes in uncemented total hip arthroplasty at 8 and 24 weeks

The modified HHS was more in patients who received 36 mm femoral head as compared to the patients who received 28 mm femoral head reporting better functional outcome (table 3, graph 2).

No dislocation was reportedamong patients who received 36 mm femoral head sizeimplant and 6 cases of dislocation was reported among cases of 28 mm femoral head size due to fall of patient.

As femoral head size increases, the polyethylene liner thins to accommodate it and with larger head size, the jumping distance increases. This biomechanical form basis for the increased stability of larger femoral heads in THA

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Jump distance (JD): distance of translation of femoral head center required for head to dislocate from cup. Prosthetic hips with less JD are likelier to dislocate more easily than those with more JD.

Table 4: Complications of 28 mm versus 36 mm femoral head sizes in uncemented total hip arthroplasty

Complication	28mm	26mm
Wear and tear	6	2

Wear and tearwas seen in 6 patients of 28 mm and in 2 patients of 36 mm femoral head sizes in uncemented total hip arthroplasty.

DISCUSSION

Total hip arthroplasty (THA) has revolutionized the treatment of hip arthritis.[6]The present study reported better range of motion and functional outcome with a 32-mm headas compare to 28 mm femoral head size in uncemented total hip arthroplasty.Similar to our study, in a study Matsushita I et al,[7] postoperative activities of daily living (ADL) were comparedin patients who underwent THA using a head diameter of 26 mm or 32 mm. Comparison was performed between 25 joints of 24 patients who underwent THA with a 26-mm femoral head (26-mm group) and 24 joints of 20 patients with a 32-mm head (32-mm group). The postoperative range of flexion and abduction was significantly larger in the 32-mm group than in the 26-mm group. With respect to the mode of performing selected ADL such as putting on and removing pants, socks, and cutting toenails, many patients adopted the compensatory position of lumbar flexion with hip flexion plus knee extension in the 26-mm group, while a majority of the patients from the 32-mm group employed the mode of hip flexion with knee flexion. Patients with the 32-mm head showed better postoperative ADL of the ipsilateral side compared with the 26-mm head.

Similarly, in the prospective study conducted by Parthasarathy A et al,[8]30 patients undergoing primary THA with 28 mm and 36 mm femoral head sizes for degenerative arthritis aged between 20-70 years, in Sanjay Gandhi institute of trauma and orthopaedics, Bangalore and all patients were followed up at 6, 12 and 24 weeks postoperatively and assessed for range of motion and functional status using modified Harris hip score (HHS). The flexion was 9.31 degrees, extension was 4.0 degrees, adduction was 3.35 degrees, abduction was 4.31 degrees, internal rotation was 6.13 degrees, external rotation was 9.06 degrees and modified HHS was more in patients who received 36 mm femoral head as compared to the patients who received 28 mm femoral head at the end of follow up and it was found that the use of 36 mm femoral head providedbetter improvement in the range of motion, functional outcome, and better patient and surgeon satisfaction than 28 mm femoral head in THA.[8]Range of hip movement after THA is determined by patientspecific,surgical and prosthesis-specific factors. Examplesare obesity, preoperative hip stiffness, surgical approach,extent of soft-tissue release and repair, implant positioningand implant characteristics. Impingement can occur between theliner and the neck, i.e., implant-to-implant impingement,or between the patient's own bone and soft tissues, forexample between the trochanter major and joint capsuleor the trochanter and osteophytes. Head size is only one ofthe implant characteristics affecting range of movement.[9]

Zijlstra WP et al[3] studied the effect of femoral head size and surgical approach on risk of revision for dislocation after total hip arthroplasty byanalyzing data on 166,231 primaryTHAs and 3,754 subsequent revision THAs performed over a period of 8 years registered in the Dutch Arthroplasty Register. For all approaches,32-mm heads reduced the risk of revision for dislocation comparedto 22- to 28-mm heads (HR = 1 and 1.6, respectively), whilethe risk of revision for other causes remained unchanged. 36-mmheads increasingly reduced the risk of revision for dislocation butonly with the posterolateral approach (HR = 0.6), while the riskof revision for other reasons was unchanged. With the anteriorapproach, 36-mm heads increased the risk of revision for otherreasons (HR = 1.5).For the posterolateralapproach, 36-mm heads can safely further reduce the risk ofrevision for dislocation.In the present study, primary hip arthroplasty was performed through posterolateral approach.

No dislocation was reported among patients who received 36 mm femoral head size implant and 6 cases of dislocation was reported among cases of 28 mm femoral head size due to fall of patient.Magee THet al[4] followed 527 total hip arthroplasties in 469 patients after primary total hip arthroplasty with femoral head sizes ranging from 28 to 44 mm to study the effect of femoral head diameter on risk of dislocation after primary total hip arthroplasty. The operative approach was the posterior approach in all patients. The patients were followed at defined intervals and asked about dislocation. There was a mean follow up of 60 months with a range of 12 to 138 months. In total hip arthroplasty, utilizing the posterior approach, no statistically significant association between the risk of dislocation and femoral head size was reported.The degree of lateral transition of the femoral head centrerelative to the centre of the acetabular componentrequired to dislocate defines the jumping distance. Withlarger head size, the jumping distance increases. However,jumping distance also depends on acetabular componentinclination and anteversion and head offset, whichis the distance from the centre of the movement associatedwith bigger femoral heads should theoretically lower therisk of dislocation.[10]In a

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study by Singh SP et al,[11] dislocation rate decreased significantly as the size of the head increased in primary THA. Use of 36 mm diameter head in primary THA also resulted in slightly greater improvement in the range of movements as compared to 28 mm diameter (although statistically not significant).

Large femoral heads can provide greater impingement-free hip range of motion (ROM), reduce the risk of dislocation by increasing the jump distance (JD), and are more anatomical as their size is closer to native femoral head. However, larger heads may have an increased risk of wear, resulting in loosening and failure, and mechanically assisted crevice corrosion at head-neck taper junction.[6,10]

The strength of our study includes participants selected from the same hospital with same surgical team, single surgical approach and same post-surgical care instructions.

Hip replacement remains one of the most effective surgical interventions. This procedure has enabled millions of patients with severe hip pain and functional limitation to regain a high quality of life. Further advancements have been made in implant material and design, surgical technique, and perioperative management.[12]

CONCLUSION

The present study concludes that uncemented total hip arthroplastyisone of the most effective surgical interventionsthat improves patients quality of life by improving range of motion of hip joint post-operatively and with improvement functional outcome. The 36 mm femoral heads in total hip replacement revealed better improvement in the rangeof motion hence better functional outcome as compared to use of 28 mm heads in THA.

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