

Assessment of Short Term Clinical and Radiological Outcome of Fully Hydroxyapatite Coated Stem in Total Hip and Bipolar Arthroplasty: A Retrospective Study

P. Thiagarajan¹

ABSTRACT

Introduction: Pain in the hip joint is one of the important causes that disable locomotion. Pain in the hip joint may be due to various causes ranging from fracture neck of femur in the elderly to rheumatoid arthritis in the younger age. There are many ways and methods by which this crippling pain in the hip can be treated. This includes analgesics, using a walking stick or bilateral axillary crutches, arthrodesis, excision arthroplasty and hip arthroplasty. Hence, the aim of the present study was to assess the short term clinical and radiological outcome of full hydroxyapatite coated stems in total hip and bipolar arthroplasty.

Material and Methods: The present study was a retrospective study which was done among 44 hip arthroplasty both bipolar and total hip replacement with fully hydroxyapatite coated stem in 32 patients. Preoperatively, the patients were evaluated using the Harris hip score, except in acute neck of femur fracture patients. This score takes into account pain, function, absence of deformity and range of motions. All 32 hips were operated through posterior approach. In that 18 Left side and 14 right side.

Results: In the present study, 32 hips were evaluated both clinically and radiologically clinical evaluation was done with the help of Harris hip score and it was found that excellent score was achieved among 84.3%, good among 12.5%, fair among 0% and poor among 3.1% of the patients. According to radiological examination, based on the position of stem, center was achieved among 68.75% patients followed by varus among 18.75% and valgus among 12.5% of the patients.

Conclusion: About 84% of patients had radiologically silent hip with excellent clinical score. With HA coated stem, there is no clinically significant anterior thigh pain due good stem stability.

Keywords: Hydroxyapatite Coated Stem, Hip Arthroplasty, Clinical, Radiological, Outcome

function to the torso and upper body. The hip is a multiaxial ball and socket joint, uniting the femur with the pelvis. As a result of this configuration, the leg moves forwards and backwards, side to side, and rotates to the right and left.²

Pain in the hip joint is one of the important causes that disable locomotion. Pain in the hip joint may be due to various causes ranging from fracture neck of femur in the elderly to rheumatoid arthritis in the younger age. There are many ways and methods by which this crippling pain in the hip can be treated. This includes analgesics, using a walking stick or bilateral axillary crutches, arthrodesis, excision arthroplasty and hip arthroplasty.³

Hip replacement, or arthroplasty, is a surgical procedure in which the diseased parts of the hip joint are removed and replaced with new, artificial parts. These artificial parts are called the prosthesis. The goals of hip replacement surgery are to improve mobility by relieving pain and improve function of the hip joint. Hip arthroplasty could be either cemented or uncemented.⁴

The concept of fixing total hip prosthesis by bony ingrowth rather than by cement has evolved in an attempt to decrease the incidence of loosening. The attractiveness of biological fixation lies in its potential for direct attachment of the implant to bone without an interposed fibrous tissue layer. It has been shown that the interface between implant and ingrowing bone can remodel with time and can maintain stability. Uncemented femoral components are either porous coated or hydroxyapatite coated.⁵

During the last decade hydroxyapatite coating of hip replacements has been developed and experimental studies have established its basic efficacy. The dental experience with hydroxyapatite coated metal implants showed a substantial advantage with use of these implants compared with the use of uncoated implants of the same design and having the same metallurgical characteristics. The hydroxyapatite

INTRODUCTION

The earliest recorded attempt at hip replacement was performed by Gluck T in 1891. Gluck T used ivory to replace the femoral head. Artificial replacement of the femoral head with acrylic cement was introduced by JUDET in 1937. This was the first opening to the novel idea of replacing the hip joint in part or whole. This also withstood only a short period of time.¹

The hip joint functions as one of the most important joints in the human body. Designed for both mobility and stability, the hip allows the entire lower extremity to move in three planes of motion, while providing an important shock absorption

¹Assistant Professor, Department of Orthopaedics, Sree Balaji Medical College & Hospital, Chennai, Tamil Nadu, India

Corresponding author: P. Thiagarajan, Assistant Professor, Department of Orthopaedics, Sree Balaji Medical College & Hospital, Chennai, Tamil Nadu, India

How to cite this article: P. Thiagarajan. Assessment of short term clinical and radiological outcome of fully hydroxyapatite coated stem in total hip and bipolar arthroplasty: a retrospective study. International Journal of Contemporary Medical Research 2019;6(12):L1-L5.

DOI: <http://dx.doi.org/10.21276/ijcmr.2019.6.12.13>

coated femoral stems in humans were used by Furlong and Osborne, who began clinical trials in 1985 and by Geesink, who reported on a series in 1986.^{6,7}

Reports in dental literature have attested to the success of bulk calcium phosphate materials composed of pure hydroxyapatite and used as a bone substitute. Patients who had hydroxyapatite grafts were followed for a maximum of seven years and were evaluated clinically and radiographically along with computer assisted densitometry.^{8,9}

In our centre, both porous coated and hydroxyapatite coated uncemented hip replacements are done on a regular basis. In this study, the aim was to assess the short term clinical and radiological outcome of full hydroxyapatite coated stems in total hip and bipolar arthroplasty.

MATERIAL AND METHODS

The present study was a retrospective study which was done among 44 hip arthroplasty both bipolar and total hip replacement with fully hydroxyapatite coated stem in 42 patients between March 2007 and March 2011 in SRI Ramachandra Medical College, India. All surgeries were done by senior consultants. 9 patients were lost to follow up (of which 1 bilateral hip case), 2 patients (2 hips) died during the follow up period. The remaining 31 patients (32 hips) were followed up to assess the clinical and radiological outcome. A retrospective study of 32 hips was done with a mean follow up of 31.21 months i.e., 2 years 7 months (range, 18 to 54 months). About 21 patients (22 hips) were men and 10 patients (10 hips) were women.

Standard Collerless Corail Stem was used in this study. It is fully coated with 150um layer of hydroxyapatite. The stem is made with forged titanium. The neck angle is 135 degrees. It has a Tapered neck geometry and optimized Articul/eze® taper increase range of motion, Low-profile lateral shoulder design enables easy insertion in reduced incision techniques, including the anterior approach. Step geometry converts hoop stresses to compressive loads. straight stem with thin distal tip. Vertical/horizontal grooves provide rotational and axial stability. Standard and high offset collarless stem options enable femoral offset restoration and soft-tissue tensioning. High offset collarless option adds +7 mm of direct lateralization to restore hip biomechanics in a wider range of patients.

- DUROLAC CUP
- DUROLAC LINER
- MODULAR ENDO HEADS

Preoperative Clinical Assessment

Preoperatively, the patients were evaluated using the Harris hip score, except in acute neck of femur fracture patients. This score takes into account pain, function, absence of deformity and range of motions. The general condition of the patient including his physical and mental status, general medical condition and ability to withstand surgery is considered. Physical status should include both upper and lower extremities including opposite hip, knees, feet and spine. Any fixed deformities and limp length discrepancy was

noted. Trendelenberg test was used to access the abductor osseo-muscular mechanism.

Investigations such as the complete blood count, ASO, CRP, RA Factor, throat swabs, urine analysis, chest x-ray and multi-channel ECG was also done as a routine.

Preoperative radiographic assessment

- X ray Pelvis with both hips AP view
- X ray of affected hip AP and Lat view

Preoperative planning should include the use of plastic overlap templates supplied by the prosthesis manufacturers. Templating aids in selection of the type of implant which will provide the best fit, implant size and neck length required to restore equal limb length.

Surgical Procedure

Preparation of Patient

On the day of surgery, the theatre skin preparation was done using Chlorhexidine solution. Prophylactic antibiotic was given on the table (third generation cephalosporin).

Anaesthesia used, Positioning and Approach

Epidural / spinal anaesthesia was usually employed. The patient was then positioned in Right or Left lateral depending upon the side. In our study, all 32 hips were operated through posterior approach. In that 18 Left side and 14 right side. The procedure is as follows:

Posterior approach

Popularized by Moore and it is often called the southern approach. The patient is placed in the true lateral position with the affected limb uppermost. Make a 10 to 15 cm curved centered on the posterior aspect of the greater trochanter. The incision is begun 6 to 8 cm above and posterior to the posterior aspect of the greater trochanter. The part of the incision that runs from this point to the posterior aspect of the trochanter is in line with the fibers of the gluteus maximus. Curve the incision across the buttock, cutting over the posterior aspect of the trochanter and continue down along the shaft of femur. Incise the fascia lata on the lateral aspect of the femur to uncover the vastus laterals (Figure no. 1 and 2).

Lengthen the fascial aspect of the femur to uncover the vastus laterals. Split the fibres of the gluteus maximus by blunt dissection. Retract the fibres of the split gluteus maximus and the deep fascia of the thigh. Underneath is the posterolateral aspect of the hip joint, still covered by the short external rotator muscles. Internally rotate the hip to put external rotator muscles on a stretch. Detach the muscles close to their femoral insertion and reflect them backward. The posterior aspect of the hip joint capsule is now fully exposed. The hip joint capsule is incised with a longitudinal or T-shaped incision. Dislocation of hip is achieved by internal rotation. Now removal of the femoral head and neck is done, and exposure of the acetabulum is obtained.

Post-operative care

The patient was nursed in absolute aseptic conditions in the postoperative ward with the limb protected by an abduction pillow placed between the legs. Drains were removed at the end of 48 hrs.

Rehabilitation protocol

Active ankle dorsiflexion and plantar flexion, quadriceps and gluteal exercises were started. Upper limb and breathing exercises were also done. Patients were allowed to sit in bed on first post-operative day. After drain removal patient was made to stand and walk. Patient was mobilized with protected weight bearing for first 3 weeks. Patient was mobilized with full weight bearing after 3 weeks. In case of intraoperative fissure, non-weight bearing walking for 6 weeks was followed. Sutures were removed on the 12th post-operative day.

After the surgery, clinical evaluation with Harris hip score [modified] and radiological evaluation with plain x-ray pelvis with both hips and proximal femur - AP view and x-ray of the operated hip - AP view was done for all patients at regular intervals.

Clinical Evaluation

Patients were evaluated clinically using the Harris Hip Score. Based on the points scored the grading is done as follows.

- Excellent: 100 – 90
- Good: 89 – 80
- Fair: 79 – 70
- Poor: < 60

Radiological Evaluation

Observations and measurements were made on the antero-posterior radiograph of the pelvis and on the antero-posterior and lateral radiograph of the hip.

RESULTS

In the present study, 32 hips were evaluated both clinically and radiologically clinical evaluation was done with the help of Harris hip score and it was found that excellent score was achieved among 84.3%, good among 12.5%, fair among 0% and poor among 3.1% of the patients (Table no. 1).

Excellent	84.3 %(27)
Good	12.5 %(4)
Fair	0%
Poor	3.1%(1)

Table-1: Shows the distribution of data based on clinical evaluation using Harris hip score

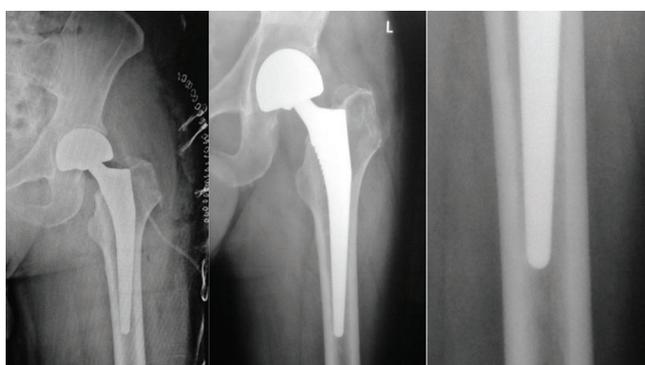


Figure-1: Shows post-op following left bipolar and follow-up after 22 months

According to radiological examination, based on the position of stem, center was achieved among 68.75% patients followed by varus among 18.75% and valgus among 12.5%

Varus	18.75% (6)
Center	68.75% (22)
Valgus	12.5% (4)

Table-2: Shows the distribution of data based on position of stem using radiological examination

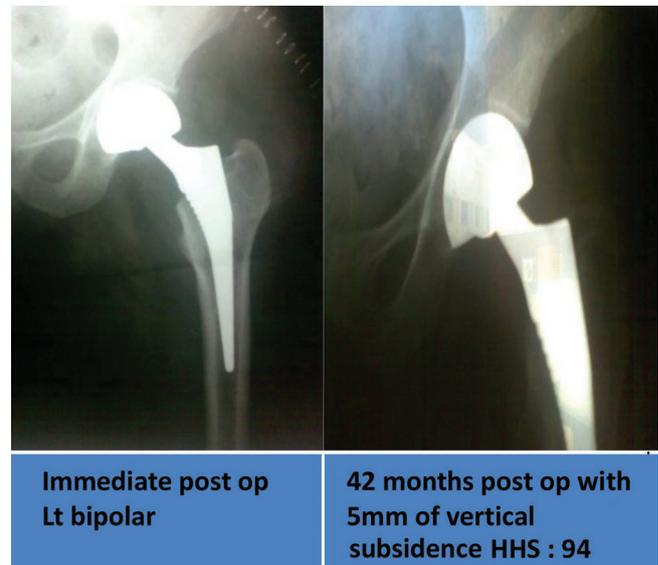


Figure-2: Shows post-op following left bipolar and follow-up after 42 months



Figure-3: Shows post-op following left bipolar and follow-up after 32 months



Figure-4: Shows the fracture neck of left femur hip pre-operatively and post-operatively follow-up of 52 months

Endosteal bone apposition	12.5%(4)
Bone – reactive lines	6.25%(3)
Periosteal bone reaction	Nil
Pedestal formation	Nil
Calcar resorption	Nil
Osteoporosis	Nil
Heterotopic bone formation	Nil

Table-3: Shows the distribution of data based on bone reactions noted in 32 cases of hip arthroplasty

of the patients (Table no. 2).

The bone reaction was seen in majority (12.5%) of the endosteal bone apposition followed by bone-reactive lines (6.25%). All the other reactions were not found in this study. Majority of the patients belonged to silent hip category i.e. 84.37% followed by 15.62% of the bone reactions (Table no. 3).

In the current study, majority of the complications (31%) were due to calcar fissure (12.5%) and vertical subsidence (9.37%) followed by limb-length discrepancy (6.25%) and (3.12%) post-operative hip dislocation (Graph no. 1 and 2).

DISCUSSION

In the present era, hip arthroplasty is no longer a surgery for the elderly alone. The threshold for hip arthroplasty has changed. Young patients with hip pathology are now offered this modality of treatment. Due to immense research on this subject in operative technique, technology and biomaterial, it is now very much possible to safely perform this surgery in the younger age group patients depending upon the patient's activity, occupation and other social obligations.

The clinical evaluation based on Harris Hip Score (HHS Modified) in this study yielded excellent results in 84.3%, good results in 12.5% and poor results in 3.1%. The mean post-operative Harris Hip Score was 91.6%. In a study conducted by Jean- Pierre Vidalain reported that the twenty year follow-up results of total hip replacements with cementless Corail stem. At last follow-up 80% of his patients had Good results as per Harris hip score. The mean post-operative Harris Hip Score was 85.1% in his study. This was comparable to our study with a mean post-operative score of 91.6%.¹⁰

In this study, there were no patients with clinically significant anterior thigh pain. Complete absence of anterior thigh pain with hydroxyapatite coated cementless stems has been reported by R.G.T. Geesink et al in their three month review of uncemented hydroxyapatite coated total hip replacements. There were no significant changes in clinical outcomes with varus/valgus stems in our study.¹¹

Vertical subsidence was seen in 3 hips in our study. All 3 hips had good clinical outcome. In a study done by Sudhahar et al reported that the early results of femoral stem subsidence of corail stems in total hip replacements. It was found that there was a subsidence rate of 61.5% (24 hips) ranging from 1mm to 15mm. In the 24 hips, subsidence was only in 2 hips with unfavourable clinical outcome and required revision. Although subsidence following hydroxyapatite coated

cementless stem is a common occurrence, it did not directly correlate with the clinical outcome.¹²

In our series, 81.25% of the hips had a totally silent hip at latest follow-up and are classified in Sedel's Group A. 15.625% and 3.125% of hips fell under group B and D respectively. This was comparable to study by Jean Pierre Vidalain who also had majority of his hydroxyapatite coated stems under Sedel's Group A with complete radiological "silence".^{10,13,14}

In the present study, there was one case of post-operative dislocation. Patient had dementia and his activity was restricted to indoors. On 20th post-operative day, patient tried to lie prone and dislocated his hip. Closed reduction was attempted, but was unsuccessful. Hence, open reduction was done and patient was placed in an abduction splint. Patient was discharged with the abduction splint. Patient reviewed 3 months later with a dislocated hip. The x-ray revealed a high riding femur. Since patient's compliance was an issue, excision arthroplasty was done in this case. Intra-operatively femoral stem had good osteointegration and an osteotomy was done to exit the prosthesis.^{15,16}

Incidence of intra-operative fissure in this study was 12.5% (4 hips). The 4 cases of intra-operative fissure were managed with cerclage wiring. Weight bearing was delayed to 6 weeks. All 4 hips had good clinical outcome. In a study conducted by R.G.T. Geesink et al reported 7 cases of intra-operative fissure in their follow-up of 118 hydroxyapatite coated total hip replacements. It was found that intra-operative fissure could be avoided with less aggressive broaching. Also, Intra-operative fissures (12.5%) are not related to the stem design, but can be avoided with careful and less aggressive broaching of the femoral canal. It has not affected the clinical and radiological outcome.^{11,17,18}

CONCLUSION

HA coated stems give excellent (84.3%) and good (12.5%) results in short term follow-up. About 84% of patients had radiologically silent hip with excellent clinical score. With HA coated stem, there is no clinically significant anterior thigh pain due good stem stability, in a short term analysis. No evidence of heterotopic ossification with this stem was reported from this study.

REFERENCES

1. Campbell's Operative Orthopaedics, International Edition: Tenth Edition.
2. Charnley J. Arthroplasty of the hip. A new operation. Lancet 1961; 1129-32.
3. Engh's: Criteria for loosening of uncemented femoral component; Clinic Orthop 1990 – 257.
4. Hamblen, D.L.; Ectopic Ossification in complications of total hip replacement. Edited by R.S.M.Ling. London, Churchill Livingstone, 1984.
5. Harris WH. Traumatic arthritis of the hip after dislocation and acetabular fractures: Treatment by mold arthroplasty and end-result study using a new method of result evaluation. J Bone Joint Surg 1969; 51-A: 737-55.

6. Harris WH, Barrack RJ.; Developments in diagnosis of painful THR. *Orthop. Rev.* 1993; 439-447.
7. Hing KA, Best SM, Tanner KE, Bonfield W, Revell PA. Biomechanical assessment of bone ingrowth in porous hydroxyapatite. *J Mater Sci Mater Med* 1997; 8: 731-36.
8. Jasani V Richards P, C Wynn-Jones. Pain related to the psoas muscle after total hip replacement. *JBJS* 2002; 84:991-993.
9. Ritter M.A., and Gioe. The effect of indomethacin on para-articular ectopic ossification following total hip arthroplasty. *Clin Orthop* 1982; 167: 113-117.
10. Jean-Pierre Vidalalin. Twenty year results of the cementless corail stem. *International Orthopaedics* 2011; 35:189-194.
11. Geesink RG, de Groot K, Klein CP. Chemical implant fixation using hydroxyl-apatite coatings. *Clin Orthop Relat Res* 1987; 225: 147-150.
12. Sudhahar T.A, Morapudi, Branes. Evaluation of subsidence between collarless and called corail femoral cementless total hip replacement, *J Orthopaedics* 2009; 6:3-6.
13. Mai DD, Mac Donald SJ, Bourne RB: Compartment Syndrome of right anterior thigh after primary total hip replacement. *Can J. Surg.* 2000; 43: 226-227.
14. Mallory TH; Halley D; Posterior buttock pain following THR: A case report *Clin. Orthop.* 1973; 90: 104-106.
15. Manley MT, D'Antonio JA. Capello WN, Edidin AA. Osteolysis: a disease of access to fixation interfaces. *Clin Orthop Relat Res* 2002; 405: 129-137.
16. Ravikumar J. Kasetti, A. A. Shetty, C. Rand. Heterotopic ossification after uncemented hydroxyapatite-coated primary total hip arthroplasty. *Journal of Arthroplasty* 2001;16: 1038-1042.
17. Rudolph G.T. Geesink. Six year results of hydroxyapatite coated total hip replacement *J. Bone Joint Surg* 1995; 77: 534 -47.
18. William J. Maloney, Robert J. Krushell, Murali Jasty, William H. Harris. Incidence of Heterotopic Ossification after Total Hip Replacement. *J. Bone and Joint Surg* 1991; 191-193.

Source of Support: Nil; **Conflict of Interest:** None

Submitted: 28-10-2019; **Accepted:** 22-11-2019; **Published:** 17-12-2019