EAS Journal of Orthopaedic and Physiotherapy
Abbreviated Key Title: EAS J Orthop Physiother
ISSN 2663-0974 (Print) | ISSN 2663-8320 (Online)
Published By East African Scholars Publisher, Kenya

OPEN ACCESS

Volume-7 | Issue-4 | Jul-Aug, 2025 | DOI: https://doi.org/10.36349/easjop.2025.v07i04.015

Original Research Article

Femoral Offset and Hip Function in Total Hip Prosthesis

El Amraoui I[1]*, Antar A[1], Laaraichi A[1], Aguenaoue O[1], Fekhaoui M.R[1], Mekkaoui M.J[1], Bouffetal M[1], Bassir R.A[1], Kharmaze M[1], Lamrani M.O[1], ELAMRAOUI Ibrahim[2]

[1]Orthopedic and Trauma Surgery Department, Rabat University Hospital, RABAT, Morocco
[2]Resident Physician in Orthopedic and Trauma Surgery, Faculty of Medicine and Pharmacy of Rabat, Morocco

Article History
Received: 22.06.2025
Accepted: 25.08.2025
Published: 28.08.2025

Journal homepage:
https://www.easpublisher.com

Quick Response Code

Abstract: The femoral offset is the most important prognostic element in hip arthroplasty. Its restoration is crucial. Any change in the native value of the offset affects the quality of clinical function of the hip. The aim of our study was to evaluate the clinical function of the hip based on the value of the femoral offset after arthroplasty. This is a retrospective study conducted between 2010 and 2013, involving 27 patients who underwent total hip arthroplasty. Patients who had previous surgical procedures on the same hip or on the contralateral hip were excluded. Measurements were taken from standard hip radiographs in approximately 15° internal rotation, with magnification at 100%. Clinical results were assessed using the WOMAC score, which averaged 15.2 points, and the Merle d'Aubigné-Postel score, with an average of 15 points. Two other tests were also evaluated in our study, the step and hop tests were used. The best functional results were obtained in patients who had a lateralization of the femoral stem with an increased offset.

Keywords: Femoral offset, Total hip arthroplasty (THA), Hip function, WOMAC score, Radiographic evaluation.

INTRODUCTION

The hip offset is a defined variable that reflects the balance between body weight and the resistance force provided by the hip abductors. It is the distance from the perpendicular segment raised from the center of rotation of the hip to the line of action of the abductor muscles. The implantation of total hip prostheses in younger subjects requires adherence to a certain number of biomechanical rules in order to ensure the longevity of the implants. Thus, restoring the femoral offset helps to improve joint movement range and especially to optimize the effectiveness of the gluteal muscles. The aim of our work is to analyze the relationship between the value of the femoral offset and the clinical functioning of the hip.

METHODS

This is a retrospective study conducted in the trauma-orthopedics department of the CHU of Rabat over a period of 3.5 years from January 2021 to June 2024. It includes 20 patients who underwent total hip arthroplasty, both cemented and uncemented. Patients with a history of surgery on either hip were excluded from this study. Epidemiological, clinical, and radiological parameters were studied before and after the implantation of the total hip prosthesis. Measurements of the femoral offset were taken from standard hip X-rays in approximately 15° internal rotation, with an enlargement of 100%.

RESULTS

The average age was 46 years (18-75), with a sex ratio of 1.45 (16 men to 11 women). The indication for arthroplasty was mainly primary coxarthrosis (Figure 1), with 1 case of neglected hip dislocation (Figure 2, Table 1). All these arthroplasties were implanted via the posterior-external approach of MOORE, the capsule was incised along the posterior edge of the gluteus medius and the greater trochanter, without reattachment of the pelvic-trochanteric muscles. The diameter of the prosthetic femoral head averaged 50 mm (ranging from 42 mm to 58 mm), and stability tests were validated by the absence of hip dislocation in internal rotation of more than 30° at 90° of flexion (Figure 3). On standard pelvic radiographs, the postoperative femoral offset ranged from 36.2 mm to 52.3 mm, with an average of 44.25 mm (Figure 4, Table 2). The difference between the prosthetic offset and the contralateral femoral offset (on a healthy hip) was 5.1 mm (ranging from -7.50 to +15.2). It was increased in 20 cases (91%) compared to the

***Corresponding Author:** El Amraoui I
Orthopedic and Trauma Surgery Department, Rabat University Hospital, RABAT, Morocco

contralateral offset. Clinical outcomes were assessed using the Merle d'Aubigné-Postel score with an average of 17 points, and the WOMAC score which averaged 15.2 points

Table 1: Indications for total hip prosthesis

Etiologies	Number of cases	Percentage
Primary coxarthrosis	18	66,6%
Osteonecrosis of the femoral head	5	33,3%
neglected hip fracture-dislocation	1	3,7%
Secondary coxarthrosis due to ankylosing spondylitis	1	3,7%
Revision of MOORE prosthesis	2	7,4%

Table 2: Value of the femoral offset

	Operated side offset	Healthy side offset
Average preoperative	38,5 mm	39,6 mm
Value Average postoperative	44,25 mm	39,6mm
Extremes	36,2 et 52,3 mm	36,75 et 59,45mm

Figure 1: Radiological image of primary coxarthrosis

Figure 2: Radiological image of a neglected hip dislocation

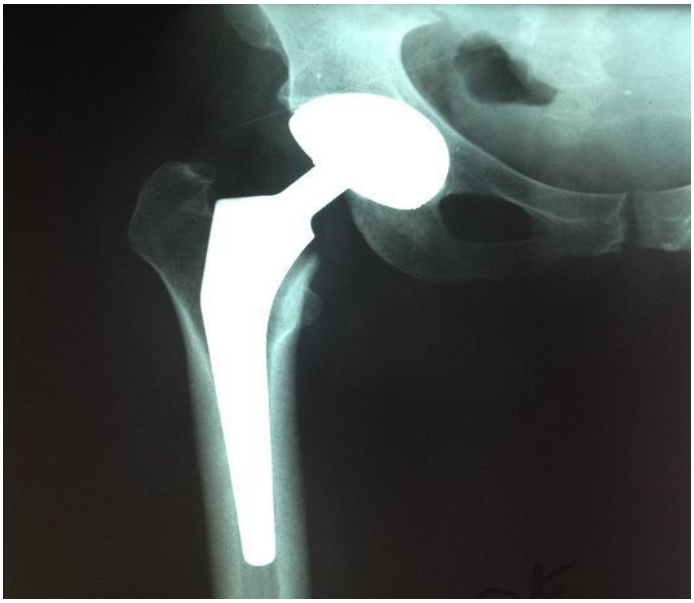

Figure 3: Post-operative radiological control

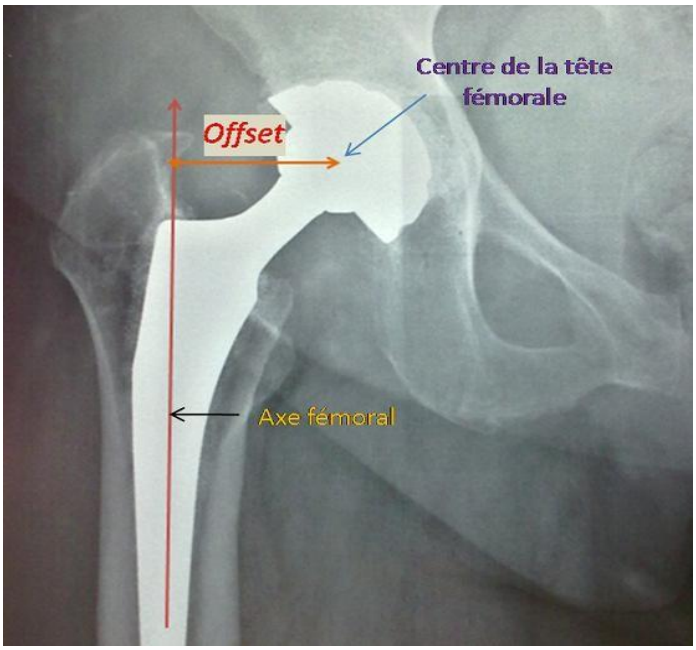

Figure 4: Measurement of the femoral offset

Two other functional tests were also used, namely the hop test (repetitive jumps on one leg) and step test (stepping onto a 50 cm high step). The evaluation was on a subjective scale to quantify the feasibility of the exercise: very easy, easy, difficult, and impossible. Seven patients from our series (31.8%) had difficulty and/or inability to perform the hop test, compared to eight (36.3%) regarding the step test (Figure 5). The analysis of the offset value in this patient group showed a significant decrease compared to the healthy side (Table 3). The analysis of all the results of our patients showed that the best functional results were obtained in patients.ayant eu une latéralisation de la tige fémoral avec un offset augmenté. Après un recul moyen de 19,5 mois (de 3 à 36 mois), Aucun cas de descellement n'a été objectivé à ce jour.

Table 3: Comparative analysis of the offset based on hop and step tests

	Most offset value	**WOMAC Score**	**Score of Merle d'Aubigné-Postel**
Groupe A	40,75 mm	24,2	13
Groupe B	47,75 mm	6,2	17
Group A: Patients who are difficult or difficult to do the hop or step test. Group B: Patients who can do the hop and the step test			

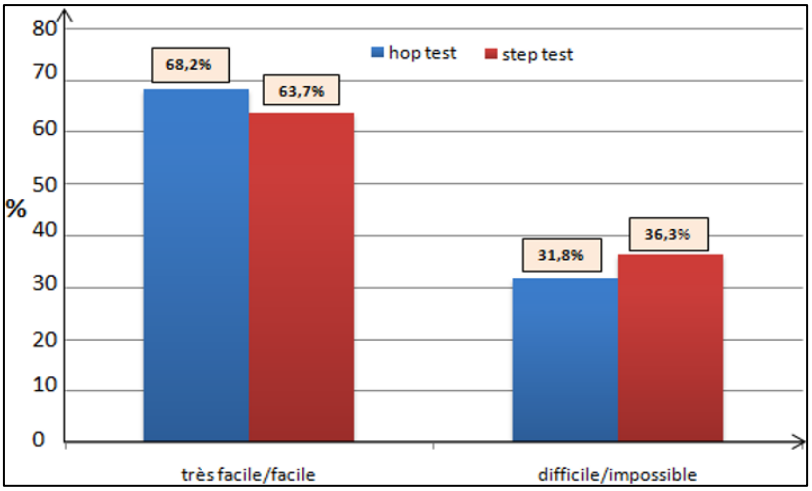

Figure 5: Results of the hop and step test

DISCUSSION

There is a very good correlation between the offset and the leverage of the hip abductor muscles as well as with their strength. Any modification of the offset affects the angle of attack of the gluteus medius and thus the force required to balance the pelvis. The literature review reveals that there is not enough scientific work in this regard. Regarding the approximate value of femoral offset, Massin et al. observed an average femoral offset value of 41.0 ± 6.2 mm (ranging from 20.5 to 59 mm) from a series of 200 femurs, while Noble et al. identified an average value of 43 ± 6.8 mm (ranging from 23.6 to 61 mm) from 200 femurs. These measurements can be made either on a standard hip X-ray or on reconstruction images from a computed tomography scan of the hip. Rubin et al. conducted radiographic and tomographic measurements on 32 femurs from cadavers and compared these with their anatomical measurements. They found that standard X-rays (frontal and lateral) provided approximate values for characterizing the geometry of the proximal femur. This team found an average difference of 2.4 ± 1.4 mm between radiographic values and anatomical values, whereas CT provided an accuracy of an average value of 0.8 ± 0.7 mm, considered better than radiographic accuracy. However, the routine performance of a CT scan for arthroplasty represents an unacceptable additional cost in practice, while Debarge *et al.,* Unnanuntana *et al.,* and Suh *et al.,* consider that 2D planning allows predicting the size of the femoral pivot and the offset in nearly 70% of cases.

In our series, the postoperative measurements of the offset were based on standard radiographs due to the difficulty of performing a systematic CT scan for all our patients, while taking into account image enlargement, the size of the femoral head, and respecting the position of the lower limbs in internal rotation at the time of taking the picture. The reproduction of the femoral offset remains a crucial criterion in hip arthroplasty; it would reduce the risk of dislocation [10] and polyethylene wear [11], whereas its increase favors the strength of the abducting muscles [12], improves joint ranges [1], decreases limping and the use of canes [13]. However, this comes at the cost of a higher risk of loosening related to increased stress on the stem according to Cannestra *et al.,* [14] and Olofsson *et al.,* [15], hence the importance of impeccable sealing quality, or alternatively opting for cementless fixation which appears to be less sensitive to the increase in constraints according to Danesh-Clough *et al.,* [16]. On the other hand, on the femoral side, reducing the offset could prove beneficial by promoting axial compressive forces on the femoral component. Lateralization with increased offset (starting from 4 mm) is considered the best method by many authors to retighten the soft tissues by moderately lengthening the operated limb [10].

CONCLUSION

Total hip arthroplasty remains a current and debated topic, and patients are increasingly asking for a functional and anatomical hip. The restoration of a normal offset is became a requirement in order to have an anatomical and functional hip.

Conflicts of Interest: None.

Contributions of the authors

All authors contributed to the conduct of this research work and have read and approved the final version of the manuscript.

REFERENCES

1. McGrory BJ, Morrey BF, Cahalan TD, Kai-Nan AN, Cabanela ME. Effect of femoral offset on range of motion and abductor muscle strength after total hip arthroplasty. J Bone Joint Surg (Br). 1995; 77(6) :865-89. PubMed | Google Scholar
2. Lecerf G, Fessy MH, Philippot R et al. Le déport fémoral (offset) : concept anatomique, définitions, mesure, rôle dans la planification et la réalisation d'une arthroplastie de hanche. Revue de chirurgie orthopédique et traumatologique. 2009; 95(3) :248-257. PubMed | Google Scholar

3. Durand JC, Limozin R, Semay JM, Fessy MH. Usure du polyéthylène à dix ans dans l'arthroplastie totale de hanche : Influence de l'offset fémoral. Rev Chir Orthop. 2003; 89(Suppl 2) :90. PubMed | Google Scholar
4. Massin P, Geais L, Astoin E, Simondi M, Lavaste F. The anatomic basis for the concept of lateralized femoral stem: A frontal plan radiographic study of the proximal femur. J Arthroplasty. 2000; 15(1) :93-101. PubMedGOOGLE SCHOLAR
5. Noble PC, Alexander JW, Lindhal LJ, Yew DT, Granberry WM, Tullos HS. The anatomic basis of the femoral component design. Clin Orthop. 1988; (235) :148-62. PubMed | Google Scholar
6. Rubin PJ, Leyvraz PF, Aubaniac JM, Argenson JN, Esteve P, Deroguin B. The morphology of the proximal femur a three- dimensional radiographic analysis. J Bone Joint Surg (Br). 1992; 74 (1) :28-32. PubMed | Google Scholar
7. Debarge R, Lustig S, Neyret P, Ait Si Selmi T. Confrontation de la planification radiographique préopératoire et des données postopératoires lors de la mise en place des prothèses totales de hanche non cimentées. Rev Chir Orthop. 2008; 94(4) :368-75. PubMed | Google Scholar
8. Unnanuntana A, Wagner D, Goodman SB. The accuracy of preoperative templating in cementless total hip arthroplasty. J Arthoplasty. 2009; 24 (2) :180-6. PubMed | Google Scholar
9. Suh KT, Cheon SJ, Kim DW. Comparison of preoperative templating with postoperative assessment in cementless total hip arthroplasty. Acta Orthop Scand. 2004; 75(1) :40-4. PubMed | Google Scholar
10. Girard J, Vendittoli PA, Roy AG, Lavigne M. Analyse de l'influence de l'offset femoral sur la function Clinique lors d'une étude prospective randomisée comparant les arthroplasties totales de hanche aux resurfacages. Ruvue de chirurgie orthopédique et réparatrice de l'appareil moteur. 2008 ; 94(4):376-381. PubMed | Google Scholar
11. Ebied A, Hoad-Reddick DA, Raut V. Medium-term results of the Charnley low-offset femoral stem. J Bone Joint Surg (Br). 2005; 87(7) :916-20. PubMed | Google Scholar
12. Yamaguchi T, Naito M, Asayama I, Ishiko T. Total hip arthroplasty: the relationship between posterolateral reconstruction, abductor muscle strength, and femoral offset. J Orthop Surg. 2004; 12(2) :164-7. PubMed | Google Scholar
13. Bourne RB, Rorabeck CH. Soft tissue balancing: The hip. J Arthroplasty. 2002; 17(Suppl 1) :17-22. PubMed | Google Scholar
14. Cannestra VP, Berger RA, Quigley LR, Jacobs JJ, Rosenberg AG, Galante JO. Hybrid total hip arthroplasty with a precoated offset stem: Four to nine-year results. J Bone Joint Surg (Am). 2000; 82(9) :1291-9. PubMed | Google Scholar
15. Olofsson K, Digas G, Kärrholm J. Influence of design variations on early migration of a cemented stem in THA. Clin Orthop Relat Res. 2006 Jul;448:67-72. PubMed | Google Scholar
16. Danesh-Clough T, Bourne RB, Rorabeck CH, McCalden R. The mid-term results of a dual offset uncemented stem for total hip arthroplasty. J Arthroplasty. 2007; 22(2) :195-203. PubMed | Google Scholar

Citation: El Amraoui I, Antar A, Laaraichi A, Aguenaoue O, Fekhaoui M.R, Mekkaoui M.J, Bouffetal M, Bassir R.A, Kharmaze M, Lamrani M.O, ELAMRAOUI Ibrahim (2025). Femoral Offset and Hip Function in Total Hip Prosthesis. *EAS J Orthop Physiother, 7*(4): 110-114.