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CLINICAL STUDY

Dislocation Rate at Short-term Follow-up after Revision Total Hip Arthroplasty with a Dual Mobility Component

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ABSTRACT

Patients undergoing a revision total hip arthroplasty (THA) are at increased risk for dislocation. The literature suggests dual-mobility components may decrease the frequency of dislocation. We conducted a retrospective study of one type of dual mobility acetabular component implanted in 82 revision THA cases that were considered at increased risk for dislocation. Of the 82 hips, 58 had a mean follow-up of 12 months (3–28 months). The indication for revision was instability in 18 hips (31%), adverse metal-on-metal reaction in 13 hips (22%), reimplantation for infection in 11 hips (19%), and aseptic loosening of the acetabular component in 9 hips (16%). In the course of follow-up, 6 hips developed a deep infection requiring reoperation. There were no early hip dislocations.

Keywords: Dislocation, Dual mobility, Instability, Revision, Total hip arthroplasty.

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INTRODUCTION

Dislocation is one of the most common and vexing complications following total hip arthroplasty (THA). Unfortunately, patients undergoing revision THA are at an increased risk, with studies suggesting dislocation rates between 5 and 22.5%.[1,2] The risk of dislocation increases exponentially as the number of revision attempts increases.[3] The two options proposed to decrease dislocation include the use of large (36–40 mm) heads[4] and constrained components.[5,6] However, larger heads have been associated with increased volumetric wear and possible metal femoral head trunion degradation.[7] Constrained components are subject to mechanical overload leading to multiple failure mechanisms and loosening.[8] Dual mobility acetabular components are a relatively recent introduction meant to decrease the frequency of dislocation after revision arthroplasty, especially for recurrent dislocation.[9]

Dual mobility components were introduced in Europe over 25 years ago and only recently introduced to the US market.[10] Components have two articulating surfaces: A small femoral head snaps into a relatively large polyethylene head, which articulates against a polished inner acetabular shell.[10,11] Dual mobility components increase stability by increasing the head-to-neck ratio, increasing range of motion and jump distance.[12]

The main concerns regarding dual mobility components have been polyethylene wear and intraprosthetic dislocation.[10] Intraprosthetic dislocation occurs secondary to wear at the poly/femoral head interface, decreasing the ability of the polyethylene insert to retain the small head and allowing it to extricate.[13-16] While various rates have been documented, studies place the rate of intraprosthetic dislocation in current designs between 0 and 2.4%.[9,17-20] These concerns and a lack of long-term data have led many physicians in the United States to be conservative in their use of dual mobility components. Their use in revision arthroplasty, however, appears to be increasing, especially for procedures secondary to revision due to metal-on-metal wear and in chronic instability.[10]

At our institution, THA patients who are determined to be at increased risk for dislocation are revised using a modular dual mobility device (MDM X3™, Stryker, Mahwah, NJ, USA) (Fig. 1). This design utilizes a modular cobalt alloy liner that can be placed in a standard acetabular cup, allowing for screw fixation when desired.[9] Several studies have documented low rates of dislocation using various dual mobility designs in revision procedures[21,22] and in cases of recurrent instability,[23-25] but more data are needed to clarify if they are clinically effective and safe. Therefore, in this study we asked the following questions: (1) What is the frequency of dislocation when a dual mobility component is used in a variety of THA revisions? (2) What is the frequency of complications and reoperations with the use of dual mobility components in revision?

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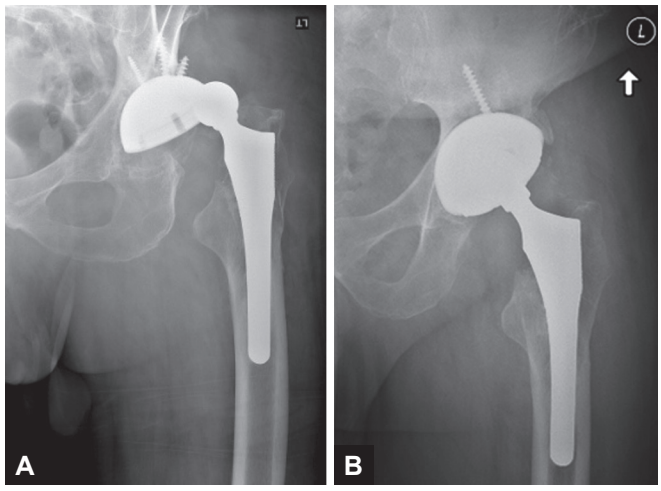
Fig. 1: The dual mobility components (MDM X3™, Stryker, Mahwah, NJ, USA) used in this study



Figs 2A and B: Anteroposterior pelvis radiographs show a 60-year-old male with a history of multiple dislocations: (A) Preoperative films shown, (B) Postoperative films after revision to a dual mobility component. This resolved his instability

MATERIALS AND METHODS

Demographic Data

We conducted an Institutional Review Board-approved single-center retrospective chart review of 82 patients who had undergone revision THA utilizing the dual mobility design between April 5, 2011, and October 28, 2013. Patients at increased risk for dislocation based on history, physical exam, radiographic findings, and surgeon experience were revised using the dual mobility construct.

All the revision procedures were performed by four fellowship trained arthroplasty surgeons. Three of the four surgeons used a standard posterior approach and performed a posterior soft tissue repair when possible. The fourth surgeon used a direct lateral approach. The posterior approach patients were protected with posterior precautions for 6 to 12 weeks following the procedure. Weight bearing status after the revision surgery was based on intraoperative findings and surgeon discretion. All patients initiated physical therapy on postoperative day 0 or 1, then continued physical therapy and/or home exercise program for a minimum of 6 weeks. Anteroposterior (AP) pelvis radiographs were routinely obtained in the postoperative recovery room. Routine follow-up occurred at 2, 6 weeks, 1 year, and annually (or biannually) thereafter. Anteroposterior pelvis and frog-leg lateral radiographs were performed at the 6 weeks and 1 year appointments. Additional X-rays were taken if deemed necessary.

Of the 82 revision hip procedures performed, 58 (56 patients) had a minimum follow-up of 3 months (3–28 months), with a mean follow-up time of 12.2 months. Several patients had been lost to follow-up or were between the 6 week and 1 year appointments. One patient died from a cardiac event on the day of surgery. There were 19 male (32.3%) and 36 female patients (67.2%). The mean patient age was 60.2 (34–83 years) with a median age of 59. The main reason for revision to the dual mobility component was instability (18, 31.0%) (Figs 2A and B), followed by adverse metal-on-metal reaction (13, 22.4%), infection (11, 19.0%), and aseptic loosening (9, 15.5%). Of the 58 procedures performed, 49 (84.5%) were done using the posterior approach, while 9 (15.5%) were completed using a direct lateral approach. The direct lateral was only used in cases where the initial procedures had been performed via the direct lateral approach.

Statistical Analysis

Statistical analysis of the data was then undertaken utilizing SAS version 9.2 and JMP Pro 11 software (SAS, Cary, NC, USA). A Fisher's exact test was used to evaluate the correlation between postoperative infection and the original reason for revision. In addition, the link between infection and patient sex was also evaluated using Fisher's exact test. Significance was based on a p-value <0.05.

RESULTS

There were no hip dislocations (0/58) in the course of follow-up. There was one case (1.7%) of early cup migration. This occurred in a patient that had required a superior augment during their revision procedure. The migration was radiographically evident at the patient's 2-week appointment when compared with the immediate postoperative images taken in recovery. However, the patient showed no clinical evidence of loosening or instability. All subsequent radiographs were unchanged from the 2-week film and the cup proved stable.

Regarding postoperative complications, there were six hips (10.3%) that developed periprosthetic joint infection

requiring reoperation. However, there was no significant correlation (p = 0.692) between the reason for revision and subsequent infection. Two represented previously infected patients (18.2% incidence), two metal-on-metal revisions (15.4% incidence), and two revisions for instability (11.1% incidence). There was also no correlation between sex and infection rate (male, 2, 10.5%; female, 4, 10.3%; p = 0.347). Cultures from the infections grew out methicillin-susceptible *Staphylococcus aureus* (2), methicillin-resistant *Staphylococcus aureus* (1), coagulase-negative *Staphylococcus* (2), and one dually infected with *Proteus mirabilis* and *Acinetobacter* species. Two patients (3.4%) had deep vein thromboses, one of which developed in a peripherally inserted central catheter line while the patient was being treated for infection. Additionally, two patients (3.4%) suffered fractures of the greater trochanter after ground level falls and both were treated conservatively.

DISCUSSION

Dislocation remains a serious concern in patients undergoing revision THA. Management of instability has taken several forms including the use of large femoral heads and constrained liners, but dual mobility designs are growing in popularity. Several studies have demonstrated excellent short-term outcomes using dual mobility components in revision procedures.[21-25] However, given the documented risk of intraprosthetic dislocation and the exponential risk inherited by each new revision, it is imperative that the safety and efficacy of dual mobility components be confirmed. We therefore asked the following questions: (1) What is the frequency of dislocation when a dual mobility component is used in a variety of THA revisions? (2) What is the frequency of complications and reoperations with the use of dual mobility components in revision?

This study has several limitations. First, this is a retrospective study and does not provide the level of evidence that could be obtained via a randomized control experiment. Second, the procedures were not uniform throughout the study as the operations were performed by four different surgeons with slight variations in surgical technique. Third, the study was limited to a small number of patients. However, the 58 hips that met inclusion criteria in this study is comparable to other similar studies involving 33,[22] 56,[26] and 54 hips.[23] Lastly, follow-up was limited to the short-term and thus cannot elucidate the effectiveness of the construct over an extended period of time. Studies have shown, however, that the incidence of dislocation after THA is highest in the immediate postoperative period and in the months following,[27,28] and thus the short-term follow-up was sufficient for our evaluation.

The use of the dual mobility articulation resulted in no dislocations in the short-term follow-up of this study. This zero rate of dislocation remained true even for those patients with a history of multiple dislocations prior to revision surgery. This is remarkable in light of the multiple studies demonstrating the difficulty associated with revision surgery for chronic instability. A study by Woo and Morrey[29] showed instability persisted in 31% of patients who were revised due to instability. Carter et al[30] found 21.2% of patients had further dislocations after revision for instability. Other studies have similarly exhibited increased instability after revision for infection, with dislocation rates between 11 and 15%.[31,32] Our dislocation rate (0%) is similar to other studies published in the literature regarding the use of dual mobility cups in revision arthroplasty procedures. The published rate of dislocations when using a dual mobility type acetabular component ranges from 0 to 3.7%.[23-25,33-35] This is significantly lower than the accepted 5 to 22% rate of dislocation following revision hip arthroplasty when not using dual mobility type acetabular components.[1,36]

Our most common complication following revision with the dual mobility component was infection. We had six hips (10.3%) undergo reoperation for periprosthetic joint infections. This is consistent with a study published by Jafari et al[37] in which they reviewed over 1,300 revision hip procedures and found infection was the most common cause of failure, comprising 30.2% of failure causes. Interestingly, our infections were equally disbursed among the various reasons for revision (metal-on-metal, infection, instability) and did not show a strong correlation with those being revised secondary to infection. The high rate of infection manifest was likely a result of the complexity of these revision patients and their associated comorbidities.

CONCLUSION

This study highlights the early postoperative benefits of using a dual mobility component for revision hip arthroplasty. Our data suggest that the dual mobility construct is an effective means of resolving chronic instability and lowering the rate of postoperative dislocation after revision hip arthroplasty. Dual mobility components will continue to be utilized at this institution in patients at risk for instability. The short-term data are very promising; however, future studies need to focus on understanding the long-term efficacy and durability of these components.

REFERENCES

1. Bozic KJ, Kurtz SM, Lau E, Ong K, Vail TP, Berry DJ. The epidemiology of revision total hip arthroplasty in the United States. J Bone Joint Surg Am 2009 Jan;91(1):128-133.

2. Khatod M, Barber T, Paxton E, Namba R, Fithian D. An analysis of the risk of hip dislocation with a contemporary total joint registry. Clin Orthop Relat Res 2006 Jun;447:19-23.
3. Kosashvili Y, Backstein D, Safir O, Lakstein D, Gross AE. Dislocation and infection after revision total hip arthroplasty. J Arthroplasty 2011 Dec;26(8):1170-1175.
4. Burroughs BR, Hallstrom B, Golladay GJ, Hoeffel D, Harris WH. Range of motion and stability in total hip arthroplasty with 28-, 32-, 38-, and 44-mm femoral head sizes. J Arthroplasty 2005 Jan;20(1):11-19.
5. Anderson MJ, Murray WR, Skinner HB. Constrained acetabular components. J Arthroplasty 1994 Feb;9(1):17-23.
6. Lachiewicz PF, Kelley SS. The use of constrained components in total hip arthroplasty. J Am Acad Orthop Surg 2002 Jul-Aug;10(4):233-238.
7. Lachiewicz PF, Heckman DS, Soileau ES, Mangla J, Martell JM. Femoral head size and wear of highly cross-linked polyethylene at 5 to 8 years. Clin Orthop Relat Res 2009 Dec;467(12): 3290-3296.
8. Yun AG, Padgett D, Pellicci P, Dorr LD. Constrained acetabular liners: mechanisms of failure. J Arthroplasty 2005 Jun;20(4): 536-541.
9. Plummer DR, Haughom BD, Della Valle CJ. Dual mobility in total hip arthroplasty. Orthop Clin North Am 2014 Jan;45(1):1-8.
10. Lachiewicz PF, Watters TS. The use of dual-mobility components in total hip arthroplasty. J Am Acad Orthop Surg 2012 Aug;20(8):481-486.
11. Stulberg SD. Dual mobility for chronic hip instability: a solution option. Orthopedics 2010 Sep 7;33(9):637.
12. Nevelos J, Johnson A, Heffernan C, Macintyre J, Markel DC, Mont MA. What factors affect posterior dislocation distance in THA? Clin Orthop Relat Res 2013 Feb;471(2):519-526.
13. Philippot R, Camilleri JP, Boyer B, Adam P, Farizon F. The use of a dual-articulation acetabular cup system to prevent dislocation after primary total hip arthroplasty: analysis of 384 cases at a mean follow-up of 15 years. Int Orthop (SICOT) 2009 Aug;33(4):927-932.
14. Philippot R, Farizon F, Camilleri JP, Boyer B, Derhi G, Bonnan J, Fessy MH, Lecuire F. Survival of cementless dual mobility socket with a mean 17 years follow-up. Rev Chir Orthop Reparatrice Appar Mot 2008 Dec;94(8):e23-e27.
15. Stigbrand H, Ullmark G. Component dissociation after closed reduction of dual mobility sockets – a report of three cases. HIP Int 2011 Mar-Apr;21(2):263-266.
16. Langlois J, El Hage S, Hamadouche M. Intraprosthetic dislocation: a potentially serious complication of dual mobility acetabular cups. Skeletal Radiol 2014 Jul;43(7):1013-1016.
17. Hamadouche M, Arnould H, Bouxin B. Is a cementless dual mobility socket in primary THA a reasonable option? Clin Orthop Relat Res 2012 Nov;470(11):3048-3053.
18. Massin P, Besnier L. Acetabular revision of total hip arthroplasty using a press-fit dual mobility cup. Orthop Traumat Surg Res 2010 Feb;96(1):9-13.
19. Combes A, Migaud H, Girard J, Duhamel A, Fessy MH. Low rate of dislocation of dual-mobility cups in primary total hip arthroplasty. Clin Orthop Relat Res 2013 Dec;471(12):3891-3900.
20. Vielpeau C, Lebel B, Ardouin L, Burdin G, Lautridou C. The dual mobility socket concept: experience with 668 cases. Int Orthop 2011 Feb;35(2):225-230.
21. Schneider L, Philippot R, Boyer B, Farizon F. Revision total hip arthroplasty using a reconstruction cage device and a cemented dual mobility cup. Orthop Traumat Surg Res 2011 Dec;97(8):807-813.
22. Civinini R, Carulli C, Matassi F, Nistri L, Innocenti M. A dual-mobility cup reduces risk of dislocation in isolated acetabular revisions. Clin Orthop Relat Res 2012 Dec;470(12):3542-3548.
23. Guyen O, Pibarot V, Vaz G, Chevillotte C, Béjui-Hugues J. Use of a dual mobility socket to manage total hip arthroplasty instability. Clin Orthop Relat Res 2009 Feb;467(2):465-472.
24. Leiber-Wackenheim F, Brunschweiler B, Ehlinger M, Gabrion A, Mertl P. Treatment of recurrent THR dislocation using of a cementless dual-mobility cup: a 59 cases series with a mean 8 years' follow-up. Orthop Traumatol Surg Res 2011 Feb;97(1):8-13.
25. Hailer NP, Weiss RJ, Stark A, Kärrholm J. Dual-mobility cups for revision due to instability are associated with a low rate of re-revisions due to dislocation. Acta Orthop 2012 Dec;83(6):566-571.
26. Tarasevicius S, Busevicius M, Robertsson O, Wingstrand H. Dual mobility cup reduces dislocation rate after arthroplasty for femoral neck fracture. BMC Musculoskelet Disord 2010 Aug 6;11(1):175.
27. Phillips CB, Barrett JA, Losina E, Mahomed NN, Lingard EA, Guadagnoli E, Baron JA, Harris WH, Poss R, Katz JN. Incidence rates of dislocation, pulmonary embolism, and deep infection during the first six months after elective total hip replacement. J Bone Joint Surg Am 2003 Jan;85-A(1):20-26.
28. Berry D. Effect of femoral head diameter and operative approach on risk of dislocation after primary total hip arthroplasty. J Bone Joint Surg Am 2005 Nov;87(11):2456-2463.
29. Woo RY, Morrey BF. Dislocations after total hip arthroplasty. J Bone Joint Surg Am 1982 Dec;64(9):1295-1306.
30. Carter AH, Sheehan EC, Mortazavi SM, Purtill JJ, Sharkey PF, Parvizi J. Revision for recurrent instability. J Arthroplasty 2011 Sep;26(6 Suppl):46-52.
31. Charlton WP, Hozack WJ, Teloken MA, Rao R, Bissett GA. Complications associated with reimplantation after girdlestone arthroplasty. Clin Orthop Relat Res 2003 Feb;(407):119-126.
32. Hartman CW, Garvin KL. Dislocation of the hip after reimplantation for infection. Clin Orthop Relat Res 2006 Jun;447:24-27.
33. Langlais FL, Ropars M, Gaucher F, Musset T, Chaix O. Dual mobility cemented cups have low dislocation rates in THA revisions. Clin Orthop Relat Res 2008 Feb;466(2):389-395.
34. Philippot R, Adam P, Reckhaus M, Delangle F, Verdot F, Curvale G, Farizon F. Prevention of dislocation in total hip revision surgery using a dual mobility design. Orthop Traumatol Surg Res 2009 Oct;95(6):407-413.
35. Hamadouche M, Biau DJ, Huten D, Musset T, Gaucher F. The use of a cemented dual mobility socket to treat recurrent dislocation. Clin Orthop Relat Res 2010 Dec;468(12):3248-3254.
36. Kurtz S, Ong K, Lau E, Mowat F, Halpern M. Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. J Bone Joint Surg Am 2007 Apr;89(4):780-785.
37. Jafari SM, Coyle C, Mortazavi SM, Sharkey PF, Parvizi J. Revision hip arthroplasty: infection is the most common cause of failure. Clin Orthop Relat Res 2010 Aug;468(8): 2046-2051.