# Revision of a Monoblock Metal-on-Metal Cup

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Revision of large-diameter, monoblock acetabular components for both hip resurfacing arthroplasty and metal-on-metal (MoM) total hip arthroplasty (THA) is correlated to a high amount of complications. For this reason, performing a limited revision by conversion to a dual mobility (DM) without acetabular component exchange has been proposed in order to limit these complications. Although DM bearing offers an easy solution avoiding the intraoperative and time- associated complications, concern about polyethylene wear and stability remains due to the difference regarding the design, the coverage angle and the clearance of the two implants. In order to evaluate the performance of this new solution with the new material to prevent the possibility of failure it is essential to conduct a review of the literature A qualitative systematic review of the literature has been conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. A comprehensive search of PubMed, EMBASE, Google Scholar, and Scopus for English and French articles between January 2000 and October 2019 was performed, with the primary objective of finding articles about dual mobility bearing coupling with large metal-on- metal cup in the case of hip revision procedure. Various combinations of the key words were used in the search strategy. Thirteen articles with DM bearing mated with MoM cup were analyzed. Of the 130 hip revisions selected, with a follow-up from 6 to 53 months, there were a total of 14 with complications (10.77%): four true dislocations (3.08%); six intra-prosthetic dislocations (IPD, 4.6%), two of which presented plastic deformation and polyethylene wear; four other complications (3.08%), included a cup osteolysis, a clicking noise, a superficial infection and a periprosthetic fracture. All the mentioned true dislocations occurred during the first month while IPDs appeared during the first two years from the index revision. In conclusion, according to the literature analyzed, we can stress that the concerns and doubts about mating a DM bearing with large MoM cup cannot be dissolved. It has been pointed out that a DM bearing is not designed for a MoM cup; it is not mechanically tested on MoM cups, which presents different clearance and coverage angles. Predictable complications may occur, such as IPD, polyethylene wear and true dislocation. These complications have been reported at an even higher rate than they were in the eighties, when the first generation of DM implants were of a lower quality of polyethylene and the characteristic of the design was less optimal than modern ones.

Keywords: revision ; MoM ; dual mobility ; hip ; total hip arthroplasty ; off label use

## Introduction

Hip resurfacing arthroplasty (HRA) and metal-on-metal (MoM) total hip arthroplasty implants have been advocated as an option for the treatment of degenerative hip disease for young and active patients [1]. Metal-on-metal (MoM) bearings have been used since early on in the age of modern total hip arthroplasty (THA) [2] although this solution has been gradually replaced by the low friction concept of Sir John Charnley [3] and by other hard bearing surfaces like ceramic/ceramic which were first introduced by Boutin in France in the early seventies [4]. In the nineties a second generation of MoM-THR, including resurfacings, was introduced with the intention of reducing wear [5] and improving stability and range of motion. Although early reports were encouraging [6], subsequent joint registry data [7] and clinical studies [8][9][10] have highlighted the increased revision rates of metal-on-metal (MoM) and hip resurfacing arthroplasties (HRA). Elevated metal ion levels, corrosion that can lead to osteolysis, and local adverse soft tissue reactions like adverse reaction to metal debris (ARMD), as well as fracture of the femoral neck, are well-documented complications that need early revision surgery [11][12]. Revision of a large-diameter monoblock acetabular component in failed MoM hips remains a challenging procedure for the orthopaedic surgeon, especially in the presence of well-fixed and well-positioned components. Some authors reported that cup revision in MoM can be technically difficult [13], it is often associated with loss of bone stock and could increase the risk of dislocation when small heads are used for revision surgery [14]. Therefore, it has been proposed to leave in place the acetabular component and to convert the implant into a dual mobility system [13][15][16][17][18][19][20][21][22][23][24][25][26]. Although dual mobility (DM) bearings offer an easy solution avoiding the intraoperative and time-associated complications related to the removal of a well-fixed and well-positioned acetabular shell, other considerations should be evaluated before this new solution is considered as reliable and reproducible. Concerns remain due to the differences in

the design between these two systems of hip arthroplasties as well as the biomechanical features of two different concepts between the Dual mobility cup and MoM implants. Therefore, it may be appropriated to evaluate the clinical performance of this new surgical solution in order to decide if there is a rationale in mating two different philosophies of design and material construction.

We conducted a qualitative systematic review with the primary objective of analyzing the incidence of all the complications connected with the procedure and particularly the dislocation rate of the hips as well as the intra prosthetic dislocation (IPD); the latter is a specific complication of dual mobility, in which the femoral head separates from the liner (small articulation) due to the wear failure of the retentive mechanism between the mobile polyethylene and femoral head [27], observed with significant incidence in the first generation of this DM implant.

## Conclusions

In conclusion, according to the literature analyzed, we can stress that the concerns and doubts about mating a DM bearing with a large MoM cup cannot be dismissed. It has been pointed out that a DM bearing is not designed for an MoM cup; it is not mechanically tested on MoM cups, which presents different clearance and coverage angles. Predictable complications may occur, such as IPD, polyethylene wear and true dislocation. These complications have been reported at a rate even higher than that which occurred in the eighties, when the first generation of DM implants were of a lower quality of polyethylene and the characteristic of the design was not as optimal as the modern ones. Future developments in this direction, together with in vitro studies, could be useful to carry out remarkable discussions on comparable results and acquire a better knowledge about this matter.

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