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# Isolated Polyethylene Exchange versus Acetabular Revision for Polyethylene Wear

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Isolated Polyethylene Exchange versus Acetabular Revision for Polyethylene Wear

Running title: Polyethylene alone versus Cup Revision

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Each author certifies that his or her institution has approved the human protocol for this investigation and that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.

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**1 ABSTRACT**

2 Polyethylene wear and osteolysis are not uncommon features seen when assessing  
3 advanced survivorship in THA. The dilemma faced by the orthopedic surgeon is whether  
4 to revise the cup and risk damage to the supporting columns and even pelvic  
5 discontinuity or to perform isolated polyethylene exchange and possibly encounter a high  
6 rate of postoperative recurrent instability and dislocation that will necessitate further  
7 surgery. Of 67 hips that underwent revision arthroplasty for polywear and osteolysis, 36  
8 had isolated polyethylene exchange, while 31 had full acetabular revision performed. The  
9 minimum follow-up was 2 years (mean, 2.8 years; range, 2 to 5 years). Three of the 36  
10 hips with a retained cup that were grafted through the cup holes failed due to acetabular  
11 loosening within 5 years postoperatively. One of the 31 hips with full revision required  
12 re-revision for aseptic cup loosening at 5 months postoperatively. Although we cannot  
13 recommend prophylactic revision of all cups for polywear and osteolysis, the patient may  
14 be warned of the possibility of a slightly higher failure rate when retaining the acetabular  
15 component. We do however advocate cup extraction in the following situations: damage  
16 to the locking mechanism, erosion of the femoral head through the liner and into the cup  
17 damaging the metal, and a malpositioned component that may jeopardize the stability of  
18 the revision.

19 Level of Evidence: Level II, Prognostic study See the Guidelines for Authors for a  
20 complete description of levels of evidence.

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21 **Introduction**

22 Total hip arthroplasty (THA) is one of the most successful procedures performed for  
23 various hip disorders, including degenerative joint disease, rheumatoid arthritis,  
24 osteonecrosis, and degenerative changes secondary to developmental dysplasia.<sup>6,9,23,24</sup>  
25 The result is a greater demand for THA with the number of operations expected to double  
26 in the next decade.<sup>10-12</sup> Although contemporary materials and enhanced bearing surfaces  
27 have improved the durability of THA, failure secondary to instability, malpositioning,  
28 infection, aseptic loosening, and polyethylene wear is inevitable.<sup>8,16</sup>

29 Polyethylene wear and osteolysis can be found frequently and pose the following  
30 dilemma to the surgeon; Exchange the Polyethylene alone or revise the acetabular cup  
31 instead, especially in the presence of a well-fixed acetabular component<sup>18,21</sup>. Some  
32 studies have advocated revising the acetabular component due to the high rate of  
33 postoperative instability and dislocation appreciated with isolated polyethylene exchange  
34 that can reach up to 30%.<sup>1,2</sup> Other investigators support retaining the acetabular shell due  
35 to the lower dislocation rates perceived in their series which they attributed to the use of  
36 the anterolateral and direct lateral approaches.<sup>19,22</sup>

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38 We hypothesized that polyethylene exchange with or without bone grafting has a  
39 satisfactory outcome for treating polywear and osteolysis as compared to complete  
40 acetabular revision.

#### 41 **MATERIALS AND METHODS**

42 We retrospectively reviewed 62 patients (67) hips of which 36 (54%) had polyethylene  
43 exchange and 31 (46%) had complete acetabular revision from 2002 to 2004. Patients  
44 were identified through a search of our joint registry database to identify patients who  
45 underwent revision THA at our institution during the period spanning. The study  
46 population included 35 women (56.5%) and 27 men (43.5%) with an average age of 62.4  
47 years (range, 31-88 years) and body mass index (BMI) of 28.7 (range, 19-53). Primary  
48 THA was performed for degenerative osteoarthritis, dysplasia, avascular necrosis,  
49 rheumatoid arthritis, and posttraumatic arthritis. Revision surgery was performed at an  
50 average of 12.4 years (range, 2-23.8 years) after the index THA. Demographic data and  
51 time to revision were recorded from the medical records (Table1). We obtained the type  
52 of implant, liner elevation, and size of femoral head from the operative records. The type  
53 of cups used in the polyexchange group where 25 Universal cups (Biomet, Warsaw, IN),  
54 3 Howmedica Osteonics cups (Stryker, Mahwah, NJ), 3 Duraloc (Depuy, Warsaw, IN)  
55 cups, 3 Reflection cups (Smith & Nephew, Memphis, TN), and 2 Converge cups  
56 (Zimmer, Warsaw, IN) . Patients were followed for a minimum of 2 years (mean, 2.8  
57 years; range, 2-5 years). There where no patients lost to follow-up during these period.

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58 We had prior Institutional Review Board approval. The criteria for liner exchange versus  
59 revision of the acetabular component was based on a number of factors including fixation  
60 status of the component, presence of osteolysis, size and track record of the acetabular  
61 component in situ, and age or activity level of the patient. Acetabular component was  
62 revised when loose, or too small to allow adequate thickness of polyethylene, or if it had  
63 a bad track record, and presence of symptoms (pain). - - We included only patients with  
64 primary THA and both detectable polywear and any degree of osteolysis at time of  
65 presentation for revision and only patients with cementless components. We excluded  
66 patients who underwent revision THA for instability (n = 68), component loosening (n =  
67 230), and malpositioning in which polywear and osteolysis were not the only cause (n =  
68 18).

69 All patients underwent revision arthroplasty using direct lateral approach and under  
70 regional anesthesia. Bone graft was used in 15 out of 31 (48%) of patients undergoing  
71 revision of the acetabular component. In most of these patients the acetabulum could be  
72 reamed to accept a larger diameter acetabular component and obliterating osteolytic lesion.  
73 Of the 36 hips that underwent isolated polyethylene exchange, allogeneic bone graft was  
74 impacted through the cup holes in 32 hips. In the remaining four hips, either the size of  
75 osteolysis was not deemed to be large require bone grafting or an access point to  
76 introduce the graft could not be found.. Complete acetabular revision was performed in  
77 the remaining 31 hips for the following reasons in addition to wear and osteolysis, the

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78 locking mechanism was damaged in two cases, and the size of the cup precluded the  
79 alternative of cementing a polyethylene liner into these well fixed cups; the femoral head  
80 had eroded into the metal shell in eight cases; the orientation and position of the  
81 acetabular component was less than optimal for a stable construct in six cases, in which  
82 pre-operative evaluation showed no apparent malpositioning of the acetabulum, but intra-  
83 operatively the cup was in neutral position in 4 patients and retroverted in the other 2  
84 patients, although these patients did not complain of any preoperative instability;  
85 incompatibility of the old shell with newer generation polyethylene liners in five cases;  
86 the acetabular component was poorly attached after removing the screws in 10 cases.  
87 Allograft was inserted into the acetabulum in 12 of the 31 hips. Prophylactic antibiotics  
88 were administered to all patients within 1 hour of surgery. Femoral head sizes 28 mm, 32  
89 mm, were frequently used and on one hip 36 mm was used,, while only four patients  
90 received a 22-mm head. A high wall, 10°, and 20° elevated liners were inserted in the  
91 majority of cases with the exception of 10 patients who received a nonelevated liner.  
92 Autogenic blood was routinely transfused intraoperatively in all patients who had  
93 donated their own blood preoperatively, while allogeneic transfusion was deemed  
94 necessary in only two cases. Drains were not used in any patient.

95

96 Radiographic review of all the preoperative and follow-up radiographs was performed by  
97 two of the authors (CR, WJH), for any signs of loosening, osteolysis, and implant

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98 malposition. There were no differences among the two reviewers.. The survival time of  
99 the implant construct was taken from the time of revision. Postoperative complications  
100 including infection, wound drainage, and mechanical failure were documented.

101 The means of the patient's age, BMI, and survivorship of the index joint were calculated  
102 and compared using t-test, while Chi-square test was used to compare the gender and  
103 ASA distribution of both patients. The probability value for each test demonstrated the  
104 strength of evidence.

105 All analyses were performed using SPSS, version 13, software (SPSS, Inc., Chicago, IL)..

## 106 **RESULTS**

107 Three of the 36 acetabular components retained were bone grafted through the cup holes  
108 and loosened at 20, 31, and 53 months after the index revision. These 3 patients had  
109 extensive superior and medial osteolysis, and their cup was a Universal cup (Biomet.,  
110 Warsaw, IN ) with ongrowth surface. The implantation times of the three cups were  
111 25.5, 16.8, and 17.5 years respectively. Two hips were reconstructed using allograft and  
112 an upsized Trident porous-coated cup (Stryker, Mahwah, NJ), while the third required a  
113 tantalum trabecular metal-coated cup (Zimmer, Warsaw, IN) with trabecular mesh  
114 augments for proper fixation and support.

115 Among the 31 hips with complete acetabular revision one cup loosened and the patient  
116 underwent another revision at 5 months after index revision surgery. The patient had

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117 received allograft during the index revision but was reconstructed during the second  
118 operation using only an upsized tantalum trabecular metal-coated cup (Zimmer, Warsaw,  
119 IN).

## 120 **DISCUSSION**

121 Polyethylene exchange with bone grafting for polywear and osteolysis renders itself as a  
122 relatively simple and benign operation compared to revising a well-fixed acetabular  
123 component.<sup>5,17,22</sup> The dilemma faced by surgeons treating patients with osteolysis and  
124 well fixed acetabular components therefore is when to choose polyethylene exchange  
125 alone versus revising the acetabular component.. The high incidence of dislocation,  
126 reaching up to 30%, reported after isolated polyethylene exchange has prompted some  
127 surgeons to choose revision of acetabular component in most cases<sup>1-3</sup> Other investigators  
128 have advocated the opposite and recommended more conservative measures such as bone  
129 grafting through the cup holes to preserve bone stock and halt the progression of  
130 osteolysis.<sup>7,14,22</sup> These studies consisted of a relatively heterogeneous population that  
131 included patients who presented with instability and recurrent dislocation that biases the  
132 surgical intervention and postoperative results. Given that there is still no general  
133 consensus or specific guideline indicating whether a well-fixed acetabular shell should be  
134 revised or retained, we set out to answer this question with a more homogenous  
135 population of patients who presented with only polywear and osteolysis as their primary  
136 indication for surgery.

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137 Some caveats must be kept in mind when scrutinizing our results. The data collection was  
138 retrospective in nature and therefore its validity may have been marred by the available  
139 information. Another point that arises is the stringency of our inclusion criteria in which  
140 patients with instability or dislocation or gross loosening of their components with  
141 concomitant polywear and lysis were excluded from our cohort. This was done to  
142 eradicate possible biases that may have influenced the surgeon's decision making in favor  
143 of any particular intervention. One shortfall of our study is that the two cohorts were not  
144 matched and it is plausible that factors such as BMI, activity level, age, and degree of  
145 osteolysis may have influenced the outcome. Unfortunately because of the relatively  
146 small sample size we were not able to perform meaningful statistical analyses to evaluate  
147 the influence of each factor. In addition the reason for low incidence of dislocation (none  
148 in this cohort) after isolated polyethylene exchange in our patients may relate to the type  
149 of surgical approach, direct lateral in this case. Thus the findings of this study may not be  
150 directly applicable to patients undergoing similar procedures using posterior approach  
151 which is associated with a higher incidence of instability<sup>13</sup>.

152 We have reported a similar acetabular failure rate after revision THA for isolated  
153 polyethylene exchange compared to complete acetabular revision for polyethylene wear  
154 and osteolysis in uncemented cups. Although bone grafting was implemented in  
155 accordance with the recommendations in the literature to halt osteolysis,<sup>7</sup> acetabular cup  
156 loosening may have resulted possibly due to inadequate retroacetabular bone stock. On

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157 the other hand, the acetabular failure rates of early-generation porous-coated implants  
158 have been reported to range between 5 to 24% at 10 to 15 years follow-up.<sup>4</sup> Therefore,  
159 the acetabular components in the polyethylene exchange group may have failed due to  
160 their advanced implantation age, which approached 20 years after index surgery.

161 A recent investigation by Lie et al<sup>15</sup> found a higher cup revision rate in patients who  
162 underwent isolated polyethylene exchange compared to previous studies. However, the  
163 incidence of postoperative dislocation and cup loosening was similar to the group that  
164 had acetabular revision in their series. Furthermore, some of their patients may have  
165 undergone polyethylene exchange or cup revision for instability, malpositioning, and  
166 loosening without the associated polywear and osteolysis factor.<sup>15</sup> The question still  
167 remains to be answered by further studies.

168 To extract the acetabular components in every case of polywear and osteolysis implies  
169 relying on the retroacetabular bone stock quality. Maloney et al<sup>17</sup> first started by treating  
170 retroacetabular osteolysis with revision of the well-fixed cup and bone grafting. They  
171 observed large medial wall defects, extensive damage to the anterior and posterior  
172 columns, and in some cases pelvic discontinuity. To fill this void, cages and allograft  
173 which have lower survivorship and poor outcome become a necessity.<sup>20</sup> If there is any  
174 osteolysis present at the time of surgery, the addition of bone graft through the acetabular  
175 holes may increase the overall quality of the defect. Therefore, when the eventual need

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176 for revision surgery arises due to acetabular loosening, the patient may be revised with  
177 less aggressive implants.

178 Although we cannot recommend prophylactic revision of all cups for polywear and  
179 osteolysis, the patient may be warned of the possibility of a slightly higher failure rate  
180 when retaining the acetabular component. We do however advocate cup extraction in the  
181 following situations: damage to the locking mechanism, erosion of the femoral head  
182 through the liner and into the cup damaging the metal, and a malpositioned component  
183 that may jeopardize the stability of the revision.

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## References

1. Blom AW, Astle L, Loveridge J, Learmonth ID. Revision of an acetabular liner has a high risk of dislocation. *J Bone Joint Surg Br.* 2005;87(12):1636-1638.
2. Boucher HR, Lynch C, Young AM, Engh CA, Jr., Engh C, Sr. Dislocation after polyethylene liner exchange in total hip arthroplasty. *J Arthroplasty.* 2003;18(5):654-657.
3. Earll MD, Fehring TK, Griffin WL, Mason JB, McCoy T, Odum S. Success rate of modular component exchange for the treatment of an unstable total hip arthroplasty. *J Arthroplasty.* 2002;17(7):864-869.
4. Eskelinen A, Remes V, Helenius I, Pulkkinen P, Nevalainen J, Paavolainen P. Uncemented total hip arthroplasty for primary osteoarthritis in young patients: a mid-to long-term follow-up study from the Finnish Arthroplasty Register. *Acta Orthop.* 2006;77(1):57-70.
5. Griffin WL, Fehring TK, Mason JB, McCoy TH, Odum S, Terefenko CS. Early morbidity of modular exchange for polyethylene wear and osteolysis. *J Arthroplasty.* 2004;19(7 Suppl 2):61-66.
6. Hendrich C, Engelmaier F, Mehling I, Sauer U, Kirschner S, Martell JM. Cementless acetabular reconstruction and structural bone-grafting in dysplastic hips. Surgical technique. *J Bone Joint Surg Am.* 2007;89 Suppl 2 Pt.1:54-67.
7. Hozack WJ, Mesa JJ, Carey C, Rothman RH. Relationship between polyethylene wear, pelvic osteolysis, and clinical symptomatology in patients with cementless acetabular components. A framework for decision making. *J Arthroplasty.* 1996;11(7):769-772.
8. Kavanagh BF, Ilstrup DM, Fitzgerald RH, Jr. Revision total hip arthroplasty. *J Bone Joint Surg Am.* 1985;67(4):517-526.
9. Koulouvaris P, Stafylas K, Xenakis T. Cementless modular centroid reconstruction cup in young adults with congenital dysplasia of the hip. *J Arthroplasty.* 2008;23(1):79-85.

**AU: Please do not delete query boxes or remove line numbers; ensure you address each query in the query box.**

10. Kurtz S, Lau E, Halpern M, Ong K. Trend shows growing orthopedic surgery case load. Will surgeons be able to keep up? *Mater Manag Health Care*. 2006;15(7):61-62.
11. 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;89(4):780-785.
12. Kurtz SM, Ong KL, Schmier J, Mowat F, Saleh K, Dybvik E, Karrholm J, Garellick G, Havelin LI, Furnes O, Malchau H, Lau E. Future clinical and economic impact of revision total hip and knee arthroplasty. *J Bone Joint Surg Am*. 2007;89 Suppl 3:144-151.
13. Kwon MS, Kuskowski M, Mulhall KJ, Macaulay W, Brown TE, Saleh KJ. Does surgical approach affect total hip arthroplasty dislocation rates? *Clin Orthop Relat Res*. 2006;447:34-38.
14. Lachiewicz PF, Soileau E, Ellis J. Modular revision for recurrent dislocation of primary or revision total hip arthroplasty. *J Arthroplasty*. 2004;19(4):424-429.
15. Lie SA, Hallan G, Furnes O, Havelin LI, Engesaeter LB. Isolated acetabular liner exchange compared with complete acetabular component revision in revision of primary uncemented acetabular components: a study of 1649 revisions from the Norwegian Arthroplasty Register. *J Bone Joint Surg Br*. 2007;89(5):591-594.
16. Lie SA, Havelin LI, Furnes ON, Engesaeter LB, Vollset SE. Failure rates for 4762 revision total hip arthroplasties in the Norwegian Arthroplasty Register. *J Bone Joint Surg Br*. 2004;86(4):504-509.
17. Maloney WJ, Herzwurm P, Paprosky W, Rubash HE, Engh CA. Treatment of pelvic osteolysis associated with a stable acetabular component inserted without cement as part of a total hip replacement. *J Bone Joint Surg Am*. 1997;79(11):1628-1634.
18. Maloney WJ, Woolson ST. Increasing incidence of femoral osteolysis in association with uncemented Harris-Galante total hip arthroplasty. A follow-up report. *J Arthroplasty*. 1996;11(2):130-134.
19. O'Brien JJ, Burnett RS, McCalden RW, MacDonald SJ, Bourne RB, Rorabeck CH. Isolated liner exchange in revision total hip arthroplasty: clinical results using the direct lateral surgical approach. *J Arthroplasty*. 2004;19(4):414-423.

**AU: Please do not delete query boxes or remove line numbers; ensure you address each query in the query box.**



20. Paprosky W, Sporer S, O'Rourke MR. The treatment of pelvic discontinuity with acetabular cages. *Clin Orthop Relat Res.* 2006;453:183-187.
21. Schmalzried TP, Guttman D, Grecula M, Amstutz HC. The relationship between the design, position, and articular wear of acetabular components inserted without cement and the development of pelvic osteolysis. *J Bone Joint Surg Am.* 1994;76(5):677-688.
22. Wade FA, Rapuri VR, Parvizi J, Hozack WJ. Isolated acetabular polyethylene exchange through the anterolateral approach. *J Arthroplasty.* 2004;19(4):498-500.
23. Wroblewski BM, Siney PD, Fleming PA. Charnley low-frictional torque arthroplasty in young rheumatoid and juvenile rheumatoid arthritis: 292 hips followed for an average of 15 years. *Acta Orthop.* 2007;78(2):206-210.
24. Zhang H, Cheng JQ, Shen B, Yang XN, Shi R, Pei FX. Cementless total hip arthroplasty in chinese patients with osteonecrosis of the femoral head. *J Arthroplasty.* 2008;23(1):102-111.

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