

## Modular Versus Monoblock Cementless Acetabular Cups in Primary Total Hip Arthroplasty- A Review

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consistent good results. Literature review has shown a paucity of Level 1 studies in this regard and more Randomised controlled trials are to be called for. As of this day there is no evidence to demonstrate a clear advantage of use of one over the other.

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**Key words:** Modular; Monoblock; Cementless; Primary; Acetabulum

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### ABSTRACT

**AIM:** The evolution of cup designs have indeed contributed to better long term results in hip arthroplasty. This article aims to address the evolution of the modern day cups, pros and cons, literature review with regards to outcome and survivorship of monoblock and modular cementless cups in primary total hip arthroplasty.

**METHODS:** We conducted a systematic literature search on Pubmed, Medline and Cochrane database and enlisted Randomised Controlled trials (Level I/II evidence)/Retrospective comparative study, (level III evidence) and case series (Level IV evidence) of Modular and Monoblock cups over the past 15 years from Jan 1998 to May 2013. Details with reference to cup revision, aseptic loosening, osteolysis, migration, liner wear and survivorship were enlisted.

**RESULTS:** Modular acetabular cups have shown excellent long term results in majority of the studies. Issues of liner breakage and liner dissociation have largely been resolved by the evolution of third generation cups with improved locking mechanism. Concerns of aseptic loosening and retroacetabular osteolysis prevail especially in the second decade. Monoblock cups have shown excellent results in most of the studies largely in the midterm followup.

**CONCLUSION:** Both Modular and monoblock cups have shown

### INTRODUCTION

Despite improved cementing techniques, a major shift towards use of cementless acetabular cups has been noted. Loosening of the components has been a major cause of failure in the long-term survival of implants in hip arthroplasty. To enhance the biological fixation of these implants, most cementless acetabular components have various porous coatings of cobalt-chrome or titanium beads and the diffusion bonding of titanium<sup>[1]</sup>. Modular cups offer the advantage of use of offset/constrained liners, option of liner revision and ease to judge the depth of cup insertion. The downside of these first and some second generation modular cups was pelvic osteolysis seen around these cementless cup design which was attributed to the polyethylene wear debris resulting from the micromotion between the nonarticulating side of the polyethylene liner and the interior of the metallic shell (backside wear). Monoblock cups came into use to mainly address wear issues. The flip side was that there was no room for error in the final cup implantation, and also extensive revision surgery was needed for an isolated liner wear. With the advent of third generation modular cups showing drastic reduction in the wear debris generated, survivorship of modern day monoblock and modular cups are impressive.

### Review of designs

**Modular cups:** Porous coated cementless acetabular components, that promoted bony ingrowth were first introduced in response to loosening of cemented acetabular components. Contrary to belief, high incidence of failure was noted in the first generation modular cups. The most common reasons of failure were due to early wear of UHMWPE and liner dissociation issues<sup>[2]</sup>. Incongruity between liner and shell and primitive locking mechanisms were reasons cited for liner dissociation.

The second generation cups in the early 2000s made design changes in providing a more congruous surface preventing liner dissociation but problems of backside wear persisted.

The introduction of highly crosslinked polyethylene allowed for larger diameter femoral heads to be introduced to add stability. Although cross linking decreased wear, the mechanical properties also decreased. The concept of large diameter heads was introduced to increase range of motion without impingement and also reduce dislocation, but this required the use of a thinner liner. To provide dome support liner were made thicker at the centre and thinner at the periphery. This caused liner fractures.

Present third generation modular cups have improved liner locking mechanisms by receding them into the shell and also reduced incidence of liner fractures by containing the liner within the rim of the shell.

Periprosthetic osteolysis and aseptic loosening of implants are important factors accounting for long term survivorship of hip arthroplasty. Even with newer cementing techniques, long term studies have shown the revision rates for acetabular component to be approximately 10 to 15 percent and rates of loosening of the acetabular component of approximately 20 to 40 percent at fifteen to twenty years from the index procedure<sup>[3,4]</sup>.

**Monoblock cups:** Monoblock cups consist of a metallic shell with compressed molded liner within. Most of the shells are made of titanium and cobalt-chromium alloys. The external porous surface of these metal shells stimulates bone ingrowth into the shells, which ensures long-term biological fixation of the implant. Different techniques like plasma sprays, microporous surfaces and metallic fibre meshes are used to process the external surface of the shell to promote bony ingrowth. This has the advantage of eliminating debris from the interface between the metallic shell and the polyethylene liner (backside wear). The latest designs incorporate a tantalum or trabecular metal shell that is highly porous structure. Its overall geometry is similar to that of trabecular bone. The combination of the large porous surface of tantalum and its elasticity allows for a larger bone penetration volume, which results in a faster biologic ingrowth. The hemiellipsoid configuration helps to obtain rim fit in conjunction with highly crosslinked polyethylene. Options to use screws at the periphery of the cup exist to enhance stability whenever deemed necessary.

### PROS AND CONS OF MODULAR CUPS

- (1) Customization like variability of femoral head size to maximize PE thickness.
- (2) Availability of lipped liners to reduce the incidence of dislocation.
- (3) Use of adjunctive fixation like screws/pegs.
- (4) Easier revision options of liner replacement only in case of wear and dislocation.
- (5) Introduction of UHMWPE/XLPE/Vit E poly have led to dramatic reduction in the wear rates.

- (6) May be able to partially compensate for incorrect acetabular cup positioning Cons.

### Disadvantages

- (1) Backside wear-Minimised by highly polished inner metallic surfaces<sup>[5]</sup>.

- (2) Failure of locking mechanism particularly in highly crosslinked polyethylene<sup>[5]</sup>.

### Offset liners in modular cups

#### Advantages:

- (1) Offset, face-changing polyethylene liners theoretically increase head coverage, allow for larger heads at smaller cup diameters, and offer improved stability.

- (2) The surgeon can use the face-change to adjust the position of the liner within the shell to correct for a sub-optimally positioned cup.

Disadvantages – Impingement, Liner dissociation

### Constrained liners in modular cups<sup>[6,7]</sup>

#### To address recurrent instability due to:

- (1) Inadequate soft tissues.
- (2) Deficient abductor mechanism.
- (3) Neuromuscular disorders.

#### Relative indications:

- (1) Poor patient compliance.
- (2) Instability without a clear cause.

#### Disadvantages:

- (1) Increased interfacial stresses resulting in acetabular loosening.
- (2) Dissociation of the constrained component requiring open reduction.
- (3) Reduced range of movements.

### Advantages of Monoblock cups<sup>[8,9]</sup>

- (1) Reduction of stresses at the polyethylene weightbearing interface.
- (2) Elimination of modularity and backside wear.
- (3) Elimination of screw holes as access channels.

### Disadvantages<sup>[8,9]</sup>

- (1) Lack of modularity in liner necessitating precise cup placement.
- (2) Revision for isolated liner exchange for wear not possible.
- (3) Difficult to judge bottoming out of the cup.

## MATERIALS AND METHODS

We conducted a search on PubMed, Medline and Cochrane database by inclusion of words as cementless/acetabular cups/modular/monoblock/various names of available cups in different combinations to maximize our search. We enlisted Randomised Controlled trials (Level I/II evidence)/Retrospective comparative study, (level III evidence) and case series (Level IV evidence) Modular and Monoblock cups over the past 15 years from Jan 1998 to May 2013 in English literature. Since Level II and level III studies were of significantly large number only studies with more than 100 patients recruited and a minimum followup of 10 years were included.

### Inclusion criteria

**RCT/Prospective studies:** Modular cups: Level II/III/IV studies- More than 100 patients with minimum followup of 10 years with atleast 3 of 6 criterion being included (cup revision, aseptic

loosening, osteolysis, migration, liner wear, survivorship).

Monoblock cups: Level II/III/IV studies- More than 100 patients with minimum followup of 10 years with atleast 3 of 6 criterion included (cup revision, aseptic loosening, osteolysis, migration, liner wear, survivorship).

### Exclusion criteria

Studies other than that in humans

Lab/Biomechanical studies

Our search yielded total of 124 publications. Titles and abstracts of all publications were screened for inclusion criteria, following which 41 publications were considered eligible. After applying our exclusion criteria, a total of 29 publications (18 Case series modular cups, 7 case series monoblock cups, 3 Comparative studies and 1 RCT) persisted.

## DISCUSSION

### Literature review on Survivorship of modular cups

Porous coated hemispherical cup designs have been largely used. Harris Galante (HG) I and II are one such types with sintered titanium fiber mesh at bone implant interface and holes for transacetabular screws. The capture mechanism in the type II design was modified from the HG I cup to increase the number and length of the locking tines. Clohisy and Harris *et al*<sup>[10]</sup> showed excellent results with 99% survivorship at 10 years followup. Garcia Rey *et al*<sup>[11]</sup> showed > 95% survivorship with both the HG type I and II designs at 10 year followup.

Engh *et al*<sup>[12]</sup> reported their 15 year survivorship of 4,289 primary total hip arthroplasties performed using hemispheric porous-coated cups. Initial fixation was achieved with spikes (255 AML TriSpike cups), by press-fitting with rim screws (427 Arthropor cups) or by press-fitting the component (83 Harris-Galante, 391 ACS Triloc+, 2,537 Duraloc, and 596 Pinnacle cups). Of 203 revised hips, only 18 cups were found to be loose at the time of revision. Using revision for any reason as an end point, 15-year survivorship was 82.9% +/- 5.6% for spiked components, 71.6% +/- 8.5% for press-fit cups with adjunctive rim screws, and 72.0% +/- 12.6% for press-fit components. They concluded that porous-coated acetabular components have demonstrated excellent long-term fixation.

Steff *et al*<sup>[13]</sup> produced their long term data on One hundred and twenty consecutive nonselected total hip arthroplasties in 108 patients with use of a cementless acetabular component (Harris Galante I cup). This series was evaluated at a minimum of twenty years of follow-up. Twenty-two hips (18.3%) were revised during the follow-up period, but only one hip (0.8%) was revised because of loosening of the acetabular component.

Literature with regards to the performance of threaded cups have been divided. Studies by Aldinger *et al*<sup>[14]</sup>, Grubl *et al*<sup>[15]</sup> and Clarius *et al*<sup>[16]</sup> have shown unsatisfactory results of the threaded acetabular cups. They reported high failure rates of these cups (upto 38%) due to aseptic loosening. Epinette *et al*<sup>[17]</sup> showed that their results with the threaded cups were comparable to other designs. Reikeras *et al*<sup>[18]</sup> in their series found the results of the threaded cups to be better compared to pressfit cups. Zweymuller *et al*<sup>[19]</sup> showed 99.3% survivorship with threaded cups at 10 year mean followup.

Eskelinen *et al*<sup>[20]</sup> reviewed mid to long term follow up of uncemented hips from the Finnish register. Among the acetabular cups used, Biomet Universal, the ABG II and the Harris-Galante II cups showed >90% survival rates at 10 years with aseptic loosening as endpoint; at 13 years the corresponding survival rates were 94%

for the Biomet Universal and 95% (95% CI 91-98) for the Harris-Galante II cups with aseptic loosening as endpoint. The PCA Pegged porous-coated uncemented cup showed a poor 13-year survival rate of 68% with aseptic loosening as endpoint. When endpoint was defined as any revision (including exchange of liner), the 10-year survival rates of all brands of cup except Harris-Galante II declined to under 80%.

Polyethylene wear rates in these cups have been different in published studies. The wear patterns depends on the head size and also the bearing surface of the head. Anseth *et al*<sup>[21]</sup> reported a wear rate of 0.153 mm/year at an average follow-up of 17.2 years, with no statistical differences between Harris-Galante porous I and Harris-Galante porous II acetabular components. Shu Saito *et al*<sup>[22]</sup> have shows a linear polyethylene wear rate of 0.085 mm/year at an average follow-up of 22.5 years. Röhrl *et al*<sup>[23]</sup> reported the lower wear rate of 0.09 mm/year at an average follow-up of 12 years. In all cases, a modular 32-mm femoral head made of ceramic was used. Cruz-Pardos and Garcia- Cimbelo<sup>[24]</sup> reported the high wear rate of 0.17 mm/year at an average follow-up of 13 years.

Table 1 Modular cup series over past 15 years (Minimum 100 pts with mean 10 year followup).

### Literature review on Survivorship of monoblock cups

Poultides *et al*<sup>[25]</sup> described 258 primary total hip arthroplasties (212 patients) with a monoblock, acetabular component who were followed up for a mean period of 11.1 years (10-15). Average yearly wear rate was 0.08 mm/y. Acetabular radiolucencies were present in 6 hips (2.4%); all were nonprogressive and present in acetabular zone I. Acetabular osteolysis was present in 5 patients (1.9%); all cups were stable. Four acetabular components were revised, 3 because of recurrent instability. No acetabular components were revised for polyethylene wear or dissociation, acetabular osteolysis, loosening, or deep infection. They concluded that this design yielded excellent long term results.

Garavaglia *et al*<sup>[26]</sup> reported excellent results in their series of 561 THAs with a porous coated monoblock cup (Morscher cup) without screw fixation. None of the patients had required cup revision for aseptic loosening. At ten years, the cup survivorship was 98.8% (95% CI 97.4-99.5) with cup revision for any cause as an endpoint. No radiolucencies or osteolysis were seen around the cups. Mean total linear polyethylene wear was 0.9 mm.

Berli *et al*<sup>[27]</sup> reviewed reviewed 261 patients who received the first 280 Morscher Press-Fit Cups with a 15 year followup. They termed their results excellent or good in 96% of the hips. The 15-year overall survivorship was 95.3% and with the end point of aseptic loosening, the survivorship was 97.5%. They concluded that the wear was greater in cups with an inclination greater than 45 degrees and in metal on polyethylene compared with ceramic-polyethylene bearings.

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Table 2 Monoblock cup series over past 15 years (Minimum 100 pts with mean 10 year followup).

### Comparative studies and Randomised Controlled trials of monoblock versus Modular cups

Yong *et al*<sup>[28]</sup> compared 41 hips treated with a nonmodular, porous-

**Table 1** Modular cup studies Minimum Follow up 10 yrs with 100 cases at enrollment (Level of Evidence II/III/IV).

| Study/Year                                    | Cup   | Number Recruited/No at followup | Mean follow up (years) | Cups revised               | Aseptic loosening | Isolated Liner exchange | Wear mm/yr            | Osteolysis                       | Migration             | Survivorship(%) Comments  |
|---|---|---------------------------------|------------------------|----------------------------|-------------------|-------------------------|-----------------------|----------------------------------|-----------------------|---|
| Traptsios <i>et al</i> <sup>[37]</sup> 2009   | HA threaded cup                                   | 204/198                         | 10.2                   | -                          | 0                 | -                       | -                     | 0                                | 0                     | 97.05   |
| Gaffey <i>et al</i> <sup>[34]</sup> 2004      | HG 1  | 120/72                          | 13-15                  | 3                          | 0                 | -                       | 0.15                  | 5                                | 0                     | 81% Wear rate higher than the Chamley cemented cups.                                |
| Teo <i>et al</i> <sup>[35]</sup> 2012         | Reflection  | 363                             | 11.6                   | 4                          | 2                 | 13                      | -                     | 8.8%                             | -                     | 99.4  |
| Bidar <i>et al</i> <sup>[36]</sup> 2012       | ABG 1   | 111/75                          | 13                     | 12                         | 0                 | -                       | 0.17                  | 32 (42.5%)                       | 0                     | 83.2% High frequency of osteolysis.   |
| Clohisy and Harris <i>et al</i> 1999          | HG 1  | 237/196                         | 10                     | 8 (4%)                     | 0                 | 0                       | -                     | 9 (5%)                           | 0                     | 99% Excellent fixation and clinical results.  |
| Bourne <i>et al</i> <sup>[37]</sup> 2001      | Hex lock  | 307/283                         | 10-13                  | 31 (10%)                   | 0                 | -                       | 0.35                  | -                                | -                     | Suboptimal acetabular component.  |
| Zweymuller <i>et al</i> 2007                  | Threaded double cone cup                          | 376/232                         | 10.3                   | 2                          | 3                 | 0                       | 0.13                  | 1                                | -                     | 99.3%   |
| Reikeras <i>et al</i> 2006                    | HA threaded cup<br>HA hemispherical<br>Coated cup | 128<br>195                      | 13                     | Threaded 9<br>Press fit 48 | -<br>13           | -                       | 0.5-9                 | 2<br>3                           | 3<br>5                | Threaded 0.91 at 16 years<br>Press fit 0.74 at 15 years<br>Threaded cups better     |
| Engh <i>et al</i> 2004                        | Spike<br>Rimscrew<br>Pressfit                     | 455<br>427<br>3607              | 15                     | 17<br>7<br>40              | 11<br>3<br>1      | 23<br>44<br>72          | -                     | 9<br>8<br>8                      | -                     | 82.9 spike<br>71.6 Rimscrew<br>72% pressfit<br>Porous cups show Excellent fixation. |
| Epinette <i>et al</i> 2003                    | Threaded HA Arc2f                                 | 418/304                         | 10                     | 4                          | 2 (48%)           | -                       | -                     | 4 Mild<br>4 Moderate<br>0 Severe | 0                     | 98.24<br>Comparable results to<br>Other designs.                                    |
| Weber <i>et al</i> <sup>[38]</sup> 2000       | Porous HA Optifix cup                             | 198/127                         | 10.6                   | 3                          | 3                 | 2                       | -                     | 14 (11%)                         | -                     | -   |
| Clarius <i>et al</i> 2010                     | Meccring<br>Threaded cups                         | 221/84                          | 17                     | 91 (41%)                   | 84 (38%)          | 0                       | -                     | -                                | Unrevised hips 5 (7%) | 51%<br>Threaded cups<br>Unsatisfactory in long term.                                |
| Alkinger <i>et al</i> 2004                    | Threaded cups<br>Meccring<br>Weill                | 221<br>127                      | 12.4                   | 76<br>56<br>20             | 69<br>51<br>18    | -                       | -                     | 23 Meccring<br>9 Weill           | 55                    | 63.8 Meccring at 14 yrs<br>76.2 Weill at 14 yrs<br>Threaded cups<br>Unsatisfactory  |
| Demmelmeier <i>et al</i> <sup>[39]</sup> 2010 | Wagner  | 118/102                         | 12                     | 2                          | 2                 | -                       | -                     | 0                                | -                     | 93.1% Very good long term results.<br>96.9 HG I                                     |
| Garcia Rey <i>et al</i> 2008                  | HG I, HG II                                       | 176                             | 10                     | 5 HG I<br>2 HG II          | 4 HG I<br>2 HG II | 4 HG I                  | .13 HG I<br>.11 HG II | 5 HG I<br>12 HG II               | -                     | 98.3 HG II<br>Stable fixation   |
| Sanz Reig <i>J et al</i> <sup>[40]</sup> 2011 | Perfecta  | 168                             | 14                     | 16                         | 3                 | 3                       | 0.21                  | 10                               | -                     | 91% Most problems due to cup  |
| Grubl <i>et al</i> 2002                       | Threaded cup                                      | 208/133                         | 10.7                   | 7                          | 5                 | 2                       | 0.1                   | 0                                | 1                     | 0.93<br>Threaded cup prone to aseptic loosening                                     |
| Hamilton <i>et al</i> [41] 2007               | Arthropor<br>ACS Triloc+<br>HG II                 | 433<br>394<br>83                | 15                     | 168                        | 20                | -                       | -                     | -                                | -                     | 74.9% Arthropor<br>70.1 ACS Triloc+<br>89.3% HG II                                  |

**Table 2** Monoblock cup studies (Level II/III/IV Evidence) minimum 100 pts with minimum mean followup of 10 years.

| Study/Year                               | Cup                     | Number Recruited/No at followup   | Mean follow up (years) | Cups revised | Aseptic loosening | Isolated Liner exchange | Wear mm/yr                           | Osteolysis | Migration | Survivorship(%) Comments                                |
|--|-------------------------|---|------------------------|--------------|-------------------|-------------------------|--------------------------------------|------------|-----------|---|
| Poullides <i>et al</i> 2012              | Titanium elliptical cup | 258   | 11.1                   | 4            | 0                 | 0                       | 0.08                                 | 5          | 0         | Excellent long term survival.                           |
| Garavaglia <i>et al</i> 2011             | Morscher cup            | 561/335   | 10                     | 5            | 0                 | 0                       | 0.9                                  | 0          | NA        | 98.8%   |
| Udomkiat <i>et al</i> 2002               | APR cup Sulzer          | 132/110   | 10.2                   | 5            | 1                 | 18                      | 0.16                                 | 4          | 0         | 95.3%   |
| Berli B J <i>et al</i> 2007              | Morscher cup            | 280/101   | 14.7                   | 13           | 7                 | -                       | .1 Metal on Poly .05 Ceramic on Poly | 2          | 8         | 95.3% Excellent long term results                       |
| Gwynne <sup>[43]</sup> <i>et al</i> 2009 | Morscher cup            | 125   | 11                     | 1            | 0                 | -                       | 0.11                                 | 4          | 0         | 96.8%   |
| Ali MS <sup>[43]</sup> <i>et al</i> 2003 | Mathys                  | 127/114   | 10                     | 3            | 2                 | -                       | -                                    | 0          | 0         | 97.9%   |
| Ihle <sup>[44]</sup> <i>et al</i> 2008   | Mathys                  | 93/67 (included as the study has the longest followup among Monoblock cups. | 20                     | 14           | 5                 | -                       | -                                    | 7          | NA        | 83% Reliable long term fixation of the titanium RM cup. |

**Table 3** Studies comparing monoblock and modular cups.

| Study/Year                         | Cup                                   | Number Recruited/No at followup | Mean follow up (years)    | Cups revised | Aseptic loosening | Isolated Liner exchange | Wear mm/yr                  | Osteolysis                                      | Migration  | Survivorship(%) Comments  |
|------------------------------------|---------------------------------------|---------------------------------|---------------------------|--------------|-------------------|-------------------------|-----------------------------|---|--|---|
| Gonzalez 2004 Paired study         | Trilogy Implex                        | 65 Trilogy 64 Implex            | 5.65                      | -            | -                 | -                       | Monoblock 0.07 Modular 0.08 | Trilogy 1 Implex 1                              | Monoblock 0 Modular 1.5%                         | No difference in the two cups                                       |
| Baad Hansen 2011 RCT               | Trabecular Metal Trilogy cup (Zimmer) | 60                              | 2 years                   | -            | 0                 | -                       | -                           | Monoblock -0.08 to -0.26 Modular -0.13 to -0.33 | Less rotation along transverse axis in Monoblock | Promising short term results with monoblock cups                    |
| Weiss 2012 Prospective case series | TM cup Trilogy                        | 211 TM 1300 Trilogy             | 5                         | 8 40         | -                 | -                       | -                           | -   | -  | 95 Modular 97 Monoblock   |
| Young 2002 Paired study            | One piece Modular vs Duraloc cup      | 41 One piece cup 41 Duraloc     | 5.3 Monoblock 5.5 Modular | -            | -                 | -                       | 0.11 Monoblock 0.16 Modular | 2% Monoblock 22% Modular                        | -  | No difference in revision risk Lower wear rates of non modular cups |

coated acetabular component with a matched group of 41 hips treated with a modular acetabular component at mean 5.3 year followup with regards to effect of acetabular modularity on polyethylene wear and osteolysis. The nonmodular acetabular components demonstrated a lower, but not a significantly lower, mean true wear rate than did the modular components (0.11 compared with 0.16 mm/y,  $p=0.22$ ) and also a significantly lower rate of osteolysis (2% compared with 22%,  $p=0.01$ ). They attributed the lower and more consistent true wear rates of the nonmodular components to the fact that they have greater liner-shell conformity, greater liner thickness, and less liner-shell micromotion than modular components.

Weiss *et al*<sup>[29]</sup> reviewed 210 primary total hip arthroplasty (THA) procedures in the Swedish Hip Arthroplasty Register that used uncemented monoblock cups during the period 1999-2010 with 1,130 modular cups performed at the same time. The cumulative 5-year survival with any revision as the endpoint was 95% for monoblock cups and 97% for modular cups ( $p=0.6$ ). They inferred that there was no statistically significant difference in revision risk between the cup designs.

Baad Hansen *et al*<sup>[30]</sup> conducted a RCT on 60 patients who underwent THA for noninflammatory arthritis (30 tantalum monoblock vs 30 Trology modular cup) with 2 year follow up. Radiostereometric analysis (RSA) showed no statistically significant difference between the cup types with regard to translation. However, less rotation along the transverse axis was seen in the trabecular metal cups than in the modular cups. The degree of periprosthetic bone loss was similar between the cup types in any of the regions of interest at 2 years of follow-up. They concluded that short term results regarding the fixation of monoblock cups to the acetabular host bone are favourable.

Gonzalez DV *et al*<sup>[31]</sup> conducted a matched pair study comparing wear and periprosthetic osteolysis in Sixty-three patients (65 hips) with a modular cup (Trilogy) and 64 patients (65 hips) with a monoblock cup (Implex) with an average followup of 5.65 years. The average total wear in the Trilogy group was 0.47 mm for the Implex cup and 0.43 mm One patient in each group presented with periacetabular osteolysis. The authors concluded that there was no difference in the wear rate and prevalence of periprosthetic osteolysis between the 2 groups.

Halma *et al*<sup>[32]</sup> conducted a systematic search in the Medline, Embase, and Cochrane electronic databases to collect controlled trials comparing monoblock with modular uncemented acetabular components in primary THA and listed 7 studies that met inclusion criteria. Evidence analysis showed no difference in polyethylene wear rate, acetabular osteolysis, frequency of cup migration, and aseptic loosening between monoblock and modular acetabular components.

Table 3 Comparitive studies between modular and monoblock cups.

## CONCLUSION

Both Modular and monoblock cementless cups have distinct features to support their use. While modular cups offer the advantage of an array of choices with respect to liners and their positioning and the ease of revision for wear, monoblock cups are said to have shown less osteolysis and polyethylene wear compared to their modular counterparts. The use of monoblock cups have seen a rise in the recent past. Newer generation modular cups liner have significantly reduced dissociation and rim fracture and highly cross linked polyethylene has proven to decrease wear. The short term and medium term results of monoblock cups have been impressive and

long term results are awaited. Although few studies have shown that they have an advantage over modular cups in term of osteolysis and wear larger RCT's and database studies have failed to demonstrate a clear advantage. As of this date both forms have shown good results and multicentric trials are called for to demonstrate the clear advantage of the use of one over the other.

## CONFLICT OF INTERESTS

There are no conflicts of interest with regard to the present study.

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