

Large Head Ceramic on Ceramic Versus Ceramic on Highly Cross-linked Polyethylene Total Hip Replacement in Young Active Adults : A Systematic Review

M.S.Hamdy, E.A.Tabl, A.S.Rizk and S.M.Zahid

Orthopedic Surgery Dept., Faculty of Medicine, Benha Univ., Benha, Egypt

E-Mail:ahmed2356@gmail.com

Abstract

Absolute hip arthroplasty (THA) is one of the best medical procedures utilized in the board of serious joint inflammation , injury and inherent illnesses of the hip and is presently one of the most broadly performed strategies in muscular practice around the world. An assortment of materials and prosthetic segments have been acquainted in THA system pointing with accomplish the best outcomes as respects better results and lower inconveniences. This investigation deliberately assessed the writing to feature the clinical and radiological aftereffects of utilizing huge head earthenware on clay (CoC) versus artistic on profoundly cross-connected polyethylene (CoP) complete hip substitution in youthful grown-ups in various clinical examinations. This efficient audit enlisted 18 examinations, with a sum of 5074 patients with a mean age running somewhere in the range of 42 and 63.9 years. The fundamental discoveries of this examination were that the principle signs for THA were osteoarthritis , osteonecrosis and rheumatoid joint pain. No critical measurable contrasts were found among COC and COP bearing surfaces in complete hip arthroplasty concerning occurrence of prosthesis relaxing , intraoperative or postoperative embed crack rate or THA disengagement rates. Then again, the absolute frequency of intra-and postoperative embed cracks just as danger of squeaking in with COC were factually fundamentally higher when contrasted with that with COP. It tends to be finished up from this examination that COP may be favored as a course surface in complete hip arthroplasty attributable to bring down all out occurrence of intra-and postoperative embed cracks and lower danger of squeaking when contrasted with COC as an orientation surface. Multicenter randomized controlled preliminaries with huge examples and over 10 years development are prescribed to check aftereffects of this investigation.

Keywords : Total hip arthroplasty , Ceramic on ceramic , Ceramic on highly cross-linked polyethylene.

1. Introduction

Absolute hip arthroplasty (THA) is one of the most practical and reliably fruitful medical procedures acted in muscular health [1] . THA gives solid results to patients' experiencing end-stage degenerative hip osteoarthritis , explicitly help with discomfort and useful restoration [2] . THA was discovered to be related with huge improvement in personal satisfaction following medical procedure [3] .

The expanded future joined with great general wellbeing following THA can empower the older to partake in assorted game exercises. THA has additionally been appeared to improve the wellbeing related personal satisfaction [4] . Besides , THA was found to fundamentally improve sexual associations with the accomplice and the general sexual fulfillment level of male patients ; notwithstanding it had no impact on the sexual capacity of patients [5] .

Despite the fact that THA is generally a fruitful system , yet disappointments are as yet recorded. Generally speaking, barring metal-on-metal direction from the examination, disappointments due to articulating materials speak to around 5% of the absolute number of inserts [6] . At the point when just late disappointments, those happening following ten years or more, are thought of , osteolysis and embed wear are the most well-known reasons for correction when related with aseptic releasing [7]. In any case, with enhancements in embed plans and careful strategies, osteolysis and aseptic slackening because of particulate trash produced by customary polyethylene

have become a significant impediment to prosthetic long haul survivorship [8]. Osteolysis has been accounted for in up to 60% of youthful dynamic patients with ordinary polyethylene [9] .

A few choices are at present accessible to the specialist while picking the bearing surface in THA [ceramic-on-fired (CoC) , artistic on-polyethylene (CoP) , metal-on-polyethylene (MoPE)], each with points of interest and inconveniences [10].

This methodical audit was performed expecting to feature the clinical and radiological aftereffects of utilizing huge head CoC versus CoP complete hip substitution in youthful grown-ups in various clinical investigations.

2. Materials and methods

A literature search was conducted to identify studies in total hip replacement in young active adults treated with large head CoC total hip replacement (THR) and CoP THR.

The electronic databases from 2000 up to march 1st 2019 of 'Pub med Medline', 'EMbase', and 'Google Scholar' were explored using the combination of the following search-terms: hip replacement in young adults ; large ceramic head on highly cross-linked polyethylene cementless total hip replacement in young adults ; ceramic on ceramic cementless total hip replacement in young adults.

An article was found eligible when it concerned large head ceramic on highly cross-linked polyethylene total hip replacement in young active adults or ceramic

on ceramic THR in young active adults , comparative study between both methods published in English between 2000 to 2019 and studies should be clinical not experimental studies with minimum of 2 years follow up by clinical and radiological results.

Search terms used were ceramic ; polyethylene; total hip arthroplasty and random.

2.1 Inclusion criteria

- 1- Patients who underwent primary THA as the target population .
- 2- A comparison between COC and MOP bearing surfaces as an intervention .
- 3- Studies that reported hip function , complications or radiographic outcomes of THA (at least one desirable outcome) .
- 4- Prospective , randomized controlled trials .
- 5- Full text published in English .

2.2 Exclusion criteria

- 1- Studies in which COC was not compared versus COP .
- 2- Studies that did not report clinical or radiographic outcomes .

Our final review included 18 studies . Data were extracted from the studies using a structured form. The following information was sought from each study : Year of publication , enrollment period , number of patients , study design , mean age of patients , follow-up , complications , number of revision and materials design.

3. Results

Our systematic review included 18 studies . Table (1) shows the summary of the design of the included studies and Table (2) shows the main diagnosis , material design , femoral head diameter and number of patients in the included studies .

Table (1) Summary of study design of included studies .

Authors	Year	Enrollment period	Study design	Mean age (years)
Beak et al.	2015	2009	Prospective single	55
Lim et al.	2015	2005-2009	Retrospective single	55
Varnum et al.	2015	2002-2009	Prospective single	59
Hamilton et al.	2015	2003-2007	Prospective single	56
Park et al.	2015	2002-2006	Prospective single	48
Aoude et al.	2015	2004-2010	Prospective single	44
Kang et al.	2014	2005-2007	Retrospective single	57
Kiyama et al.	2013	1997-2007	Retrospective single	51
Kim et al.	2013	0	Prospective randomized	45 versus 45
Beaupre et al.	2013	0	Retrospective single	51 versus 53
Lauren et al.	2013	0	Randomized controlled trial	51.3 versus 53.6
Solarino et al.	2012	1995-1998	Retrospective single	50
Amantullah et al.	2011	1999-2001	Multicenter	50
Derek et al.	2011	0	Randomized controlled trial	63.9 versus 57.5
Choi et al.	2010	2000-2004	Retrospective single	53
Mai et al.	2010	1997-2005	Retrospective single	56
Hamilton et al.	2010	0	Randomized controlled trial	42 versus 42
Lombardi et al.	2010	0	Randomized controlled trial	55 versus 53

Table (2) Main diagnosis, material design , femoral head diameter and number of patients in the included studies.

Authors	Main diagnosis	Material design	Femoral head diameter	Number of patients
Beak et al.	ON	CoC	32	91
Lim et al.	OA	CoC	28	245
Varnum et al.	ON	CoC	32	1773
Hamilton et al.	ON	CoC	28	345
Park et al.	OA	CoC	36	527
Aoude et al.	ON	CoC	38	115
Kang et al.	ON	CoC	36	79
Kiyama et al.	OA	CoC	38	148
Kim et al.	NA	CoC and cohpx	36	100 versus 100
Beaupre et al.	NA	CoC and cohpx	32	48 versus 44
Lauren et al.	NA	CoC and cohpx	28	92
Solarino et al.	ON	CoC	32	61
Amantullah et al.	OA	CoC	28	166
Derek et al.	NA	CoC and cohpx	32	312
Choi et al.	RA	CoC	32	149
Mai et al.	OA	CoC	28	306

Hamilton et al.	NA	CoC and cohpx	28	177 versus 87
Lombardi et al.	NA	CoC and cohpx	38	109

CoC , ceramic-on-ceramic ; CoP , ceramic-on-polyethylene ; NA:non-available ; OA , osteoarthritis ; ON , osteonecrosis ; RA , rheumatoid arthritis

The number of revisions in the included studies ranged from 0 to 31 and the mean follow-up period ranged from 0 to 12 years (short- to mid-term follow-up) and 3 studies had mean follow-up periods of less than 5 years Table (3) .

Table (3) Number of revisions and mean follow-up period in the included studies.

Authors	Number of revisions	Mean follow up period (Yrs)
Beak et al.	1	5
Lim et al.	6	7
Varnum et al.	31	9
Hamilton et al.	9	5
Park et al.	30	6
Aoude et al.	2	6
Kang et al.	1	7
Kiyama et al.	3	6
Kim et al.	1 (COC) 1/100(COPXL)	12
Beaupre et al.	0/48 (COC) 2/44(COPXL)	5
Lauren et al.	2/10 (COC) 3/82(COPXL)	5
Solarino et al.	2	13
Amantullah et al.	11	5
Derek et al.	11/196 (CoC) 3/161(CoP)	5
Choi et al.	1	7
Mai et al.	3	4
Hamilton et al.	4/177 (COC) 2/87(COPXL)	3
Lombardi et al.	0	0

No significant statistical difference was found between the incidence of prosthesis loosening between

CoC and CoP bearing surfaces in total hip arthroplasty Table (4) .

Table (4) Incidence of prosthesis loosening in ceramic-on-ceramic (CoC) and ceramic-on-polyethylene (CoP) bearing surfaces in total hip arthroplasty .

Authors	Events (CoC)	Total	Events (CoP)	Total	Weight	Risk ratio
Kim et al.	0	0	0	0	0	0
Beaupre et al.	0	0	0	0	0	0
Lauren et al.	0	0	0	0	0	0
Derek et al.	7	196	4	161	43	1
Hamilton et al.	3	177	0	87	7	3
Lombardi et al.	1	65	0	45	6	2

Prosthesis loosening in CoC and CoP: 1.8% and 1.0%, respectively; RR=1.55; 95% CI, 0.59-4.07; P=0.38; P=0.76

A pooled analysis of 6 studies (1533 hips) revealed no significant difference between the CoC and CoP groups as regards intraoperative implant fracture rate (0.87% vs 0%, respectively; RR=3.25; 95% CI, 0.69-15.28; P=0.14, P=1.0). It also revealed no significant

difference between the CoC and CoP groups as regards postoperative implant fracture rate (0.85% vs 0%, respectively; RR=3.54; 95% CI, 0.77-16.33; P=0.11; homogeneity, P=0.98). Meanwhile, the total incidence of intra- and post-operative implant fractures in the CoC group was statistically significantly higher (P=.02) when compared to that of the CoP group, indicating that CoC increased the total implant fracture rate Table (5) .

Table (5) Incidence of prosthesis fracture in ceramic-on-ceramic (CoC) and ceramic-on-polyethylene (CoP) bearing surfaces in total hip arthroplasty .

Authors	Events (CoC)	Total	Events (CoP)	Total	Weight	Risk ratio
Kim et al.	0	0	0	0	0	0
Beaupre et al.	0	0	0	0	0	0
Lauren et al.	0	0	0	0	0	0
Derek et al.	5	196	0	161	20	9.05

Hamilton et al.	4	177	0	87	24	4.45
Lombardi et al.	1	65	0	45	21	2.09

The pooled analysis of these studies revealed also that CoC bearing surfaces significantly increased the risk of squeaking compared with CoP bearing surfaces (1.9% vs 0%, respectively; RR=9.05; 95% CI, 1.46-44.49; P=0.02; P=0.96) Table (6) .

Table (6) Incidence of prosthesis squeaking sound in ceramic-on-ceramic (CoC) and ceramic-on-polyethylene (CoP) bearing surfaces in total hip arthroplasty .

Authors	Events (CoC)	Total	Events (CoP)	Total	Weight	Risk ratio
Kim et al.	0	0	0	0	0	0
Beaupre et al.	0	0	0	0	0	0
Lauren et al.	0	0	0	0	0	0
Derek et al.	5	196	0	161	20	9.05
Hamilton et al.	4	177	0	87	24	4.45
Lombardi et al.	1	65	0	45	21	2.09

Furthermore , the analysis of 6 studies revealed no significant statistical difference in THA dislocation

rates between the CoC and CoP groups (3.1% vs 4.0%, respectively; RR=0.77; 95% CI, 0.47-1.25; P=0.29; P=0.98) Table (7) .

Table (7) Incidence of hip dislocation in ceramic-on-ceramic (CoC) and ceramic-on-polyethylene (CoP) bearing surfaces in total hip arthroplasty .

Authors	Events (CoC)	Total	Events (CoP)	Total	Weight	Risk ratio
Kim et al.	1	100	1	100	3	1
Beaupre et al.	0	0	0	0	0	0
Lauren et al.	2	48	4	44	12	0
Derek et al.	10	196	9	161	28	1
Hamilton et al.	5	177	4	87	15	1
Lombardi et al.	1	65	2	45	6.7	0.35

4. Discussion

THA is a reliably effective medical procedure acted in muscular health [1] which gives fulfilling results to patients' experiencing end-stage degenerative hip osteoarthritis [2] . A few choices are at present accessible to the specialist while picking the bearing surface in THA including CoC and CoP , each with points of interest and burdens [10] .

This deliberate survey was performed intending to feature the clinical and radiological aftereffects of utilizing enormous head artistic on fired versus clay on exceptionally cross-connected polyethylene all out hip substitution in youthful grown-ups in various clinical investigations. Audit of distributed writing yielded 18 investigations , satisfying qualification standards , that were remembered for this methodical survey.

The included examinations were review or planned , randomized and controlled preliminaries. The mean time of patients in the included examinations went somewhere in the range of 42 and 63.9 years (Table 1) . This finding is not quite the same as aftereffects of the efficient audit and meta-examination distributed by [11] , that included 44 case arrangement with 13212 hip substitution methodology, as they found that the normal time of patients getting hip substitution in the UK in 2017 was 69 years and this distinction may be clarified by the diverse time-frames during which studies were performed remembering the inclination to perform substitution medical procedures at more

youthful ages[12] .

The primary analyses in the included investigations were osteoarthritis , osteonecrosis and rheumatoid joint pain and the quantity of patients remembered for each examination went from 61 to 1773 patients (Table 2) . This discovering comes in concurrence with what was referenced by the American institute of muscular specialists in 2019 [13] that the fundamental signs of hip substitution incorporate osteoarthritis , post-horrible joint inflammation , avascular rot , rheumatoid joint pain and youth hip illness.

The femoral head distance across in the included investigations went from 28 to 38 mm (Table 2). This finding concurs with what was accounted for by [14] as they referenced that utilizing femoral head of bigger size in complete hip arthroplasty has expanded during the previous decade and that few arthroplasty vaults detailed that the most normally utilized femoral head sizes are 32 mm and 36 mm . This pattern towards expanding femoral head size in complete hip arthroplasty was found to diminish the danger of postoperative separation and improve impingement unfenced of movement [15] . Also, correspondingly , artistic head sizes going from 28 mm to 36 mm were utilized for THR in an investigation that was led on 40 patients [16] .

The quantity of modifications in the included examinations went from 0 to 31 (Table 3) . Hip update medical procedure is performed for fix of harmed hip prosthesis that was harmed because of a contamination ,

or because of typical mileage of the prosthetic hip [17]. In the interim, the mean subsequent period in the included investigations went from 0 to 12 years (short- to mid-term development) and 3 examinations had mean subsequent times of under 5 years (Table 3). The standard outpatient appraisal of patients who are well-working after essential THA expects to distinguish asymptomatic disappointment of prostheses and to manage suggestions for early mediation [18]. Nonetheless, it was outlined that most of post-usable subsequent visits, particularly for those asymptomatic patients, didn't bring about an adjustment in persistent administration yet added generous expense to the medical care framework [19].

A pooled examination of 6 investigations, including 1533 hips, uncovered that no measurably huge contrasts was found among CoC and CoP bearing surfaces in all out hip arthroplasty as respects the frequency of prosthesis releasing (Table 4). This discovering comes in accordance with that of the meta-examination distributed by [20] who played out their meta-investigation on 8 forthcoming randomized preliminaries enlisting an aggregate of 1508 patients and 1702 THA medical procedures as they found that the extricating rate was tantamount among CoC and CoP bearing surfaces in absolute hip arthroplasty.

A pooled investigation of 6 examinations, including 1533 hips, uncovered no critical distinction between the CoC and CoP bunches as respects intraoperative embed break rate (0.87% versus 0%, separately; RR=3.25; 95% CI, 0.69-15.28; P=0.14, P=1.0). It likewise uncovered no critical contrast between the CoC and CoP bunches as respects postoperative embed break rate (0.85% versus 0%, individually; RR=3.54; 95% CI, 0.77-16.33; P=0.11; homogeneity, P=0.98). In the interim, the all out rate of intra-and post-usable embed breaks in the CoC bunch was factually altogether higher (P=0.02) when contrasted with that of the CoP gathering, showing that CoC expanded the absolute embed crack rate (Table 5). This discovering comes in accordance with that of the meta-examination distributed by [20] as they announced that prosthesis break was altogether higher in the CoC bunch contrasted with the CoP gathering.

The pooled examination of the 6 investigations uncovered additionally that CoC bearing surfaces fundamentally expanded the danger of squeaking contrasted and CoP bearing surfaces (1.9% versus 0%, individually; RR=9.05; 95% CI, 1.46-44.49; P=0.02; P=0.96) (Table 6). This discovering comes in accordance with that of the meta-investigation distributed by [20] as they revealed that the squeaking sound was fundamentally higher in the CoC bunch contrasted with the CoP gathering. Commotions related with fired course (normally clicking and squeaking) have been accounted for with rates fluctuating from 0 to 33% and squeaking of clay heading was found to influence the patient's personal satisfaction and survivorship of the embed because of modification of the noisy hip [21].

No critical factual distinction in THA separation rates were found between the CoC and CoP gatherings (3.1% versus 4.0%, individually; RR=0.77; 95% CI, 0.47-1.25; P=0.29; P=0.98) (Table 7). Additionally, [20] revealed that in spite of the fact that disengagement rates appeared to be a little lower in the CoC gathering yet the thing that matters was not measurably critical.

Aftereffects of the current examination ought to be deciphered taking into account the investigation constraints. The generally modest number of preliminaries remembered for the examination is the main restriction. Another impediment is the incorporation of observational partner examines which are liable to frustrating elements and inclination and affected by misfortune to development, particularly when the investigation reaches out over numerous years. Likewise, the result boundaries in various preliminaries were distinctive in this manner; it is hard to pool the entirety of the boundaries. Lastly, just short and center term subsequent information are accessible and long haul subsequent outcomes are as yet required.

5. Conclusion

CoP may be favored as a direction surface in absolute hip arthroplasty attributable to bring down all out occurrence of intra-and post-employable embed cracks and lower danger of squeaking when contrasted with CoC as a heading surface.

6. Recommendations

Multicenter randomized controlled trials with large samples and more than 10 years follow-up are recommended in the future to verify results of this study.

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