

Retrospective Study

Acetabular components with or without screws in total hip arthroplasty

Murad Pepe, Onur Kocadal, Tamer Erener, Kubilay Ceritoglu, Ertugrul Aksahin, Cem Nuri Aktekin

Murad Pepe, Onur Kocadal, Tamer Erener, Kubilay Ceritoglu, Cem Nuri Aktekin, Department of Orthopedics and Traumatology, Ankara Training and Research Hospital, 06340 Ankara, Turkey

Ertugrul Aksahin, Orthopedics and Traumatology, MedicalPark Hospital, 06680 Ankara, Turkey

Author contributions: Pepe M designed the research, planned the methods to generate hypothesis, conducted literature search and wrote the paper; Kocadal O designed the research and managed of the patients; Erener T designed the research, organized and reported data, contributed to the analysis; Ceritoglu K conducted literature search and explained the results; Aksahin E and Aktekin CN supervised the report.

Institutional review board statement: This study was reviewed and approved by the Ethics Committee of the Ankara Training and Research Hospital.

Informed consent statement: Patients were not required to give informed consent to the study because the retrospective anonymous clinical data were used that were obtained after each patient agreed to treatment by written consent. These consent forms are available in hospital archives patient's files. For full disclosure, the details are published on the home page of our hospital (<http://www.ankarahastanesi.gov.tr/>).

Conflict-of-interest statement: We have no financial relationships to disclose.

Data sharing statement: Technical appendix, statistical code, and dataset available from the corresponding author at dr_muradpepe@hotmail.com. Participants gave informed consent for data sharing.

Open-Access: This article is an open-access article which was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>

Manuscript source: Unsolicited manuscript

Correspondence to: Murad Pepe, MD, Department of Orthopedics and Traumatology, Ankara Training and Research Hospital, Ulucanlar Street, Altindag, 06340 Ankara, Turkey. dr_muradpepe@hotmail.com
Telephone: +90-545-8571807

Received: February 9, 2017

Peer-review started: February 15, 2017

First decision: March 27, 2017

Revised: April 10, 2017

Accepted: June 6, 2017

Article in press: June 7, 2017

Published online: September 18, 2017

Abstract

AIM

To compare the operation time, blood loss, and early outcomes of acetabular components with and without the screw.

METHODS

Thirty patients who underwent cementless acetabular component with or without screw and whose follow-up exceeded one year period in total hip arthroplasty were evaluated. A posterior approach was used in all surgical procedures by one experienced surgeon. Demographic data, operation time, intra- and postoperative blood loss volume, follow-up clinical score, cup migration, and osteolysis were recorded. The Kolmogorov-Smirnov test was performed for testing the normality of study data. Mann-Whitney *U* test was used to analyze the inter-group differences. A *P*-value of ≤ 0.05 was considered statistically significant.

RESULTS

Acetabular components were used in 16 (53.3%) patients with screw and 14 (46.7%) without screw. After one year of follow-up, an osteolytic lesion of 3 mm was found in only one patient in the screw group. No cup migration

was encountered. Intra-group mean Harris hip score significantly increased, but there was no significant inter-group difference. While the mean operation time of the screw group was 121.8 min (range; 95-140), it was 102.7 min (range; 80-120) in the no-screw group, and this difference was statistically significant ($P = 0.002$). The mean intraoperative/postoperative, and total blood loss were 556.6 mL (range: 350-800)/423.3 mL (range: 250-600), and 983.3 mL (range: 600-1350), respectively in the screw group; and 527 mL (range: 400-700)/456 mL (range: 230-600), and 983 mL (range: 630-1250), respectively in the no-screw group. The blood loss difference between the two groups was not significant. In the screw group, the operation time was 19.1 min longer than the no-screw group, and this difference was statistically significant.

CONCLUSION

Acetabular components with or without screw have similar results, but the use of screw increases the operation time significantly, while not changing the blood loss volume.

Key words: Hip arthroplasty; Acetabular fixation; With screw; Without screw; Operation time

© **The Author(s) 2017.** Published by Baishideng Publishing Group Inc. All rights reserved.

Core tip: This is a retrospective study comparing the perioperative data and early outcomes of the screw and no-screw acetabular components in total hip arthroplasty. There is no study comparing the screw and no-screw components for perioperative data in the literature. Both components were characterized with similar clinical outcomes in the early term. But additional screws significantly increase the mean operative time.

Pepe M, Kocadal O, Erener T, Ceritoglu K, Aksahin E, Aktekin CN. Acetabular components with or without screws in total hip arthroplasty. *World J Orthop* 2017; 8(9): 705-709 Available from: URL: <http://www.wjgnet.com/2218-5836/full/v8/i9/705.htm> DOI: <http://dx.doi.org/10.5312/wjo.v8.i9.705>

INTRODUCTION

Uncemented porous coated acetabular components have been preferred over cemented ones in primary total hip arthroplasty (THA) in the last 25 years^[1]. Cementless acetabular cups can be implanted with or without screw^[2]. While some studies have reported that the additional screw improves stability, others have mentioned that the press-fit implanted no-screw components have produced similar results with the screw fixation systems^[3-6]. In addition, avoidance of screw reduces the risk of osteolysis of acetabular bone, neurovascular complications, and operational costs^[7-9]. Screws could be responsible for an increased wear due to

two phenomena. One is by contact with the insert, and the other one by corrosion between the screw and the cup. Screws can ensure stability in osteoporotic bones, acetabular defects, and when reliable implantation is not possible during surgery^[10]. Studies comparing acetabular components with and without screws are of limited number, and the majority of them have focused on component migration, osteolysis, and clinical outcome^[4,5,11]. According to our literature survey, no study has yet compared screw and no-screw fixation with respect to blood loss and operation time. In our study, we aimed to compare these two groups in terms of bleeding, surgery time, early clinical outcome, and cup migration.

MATERIALS AND METHODS

Patients who underwent THA with cementless porous coated acetabular component with or without screw for primary hip osteoarthritis and who had at least 12 mo of follow-up were included in this study. Patients with previous hip surgery, revision cases, cemented components, Crowe type 3 and 4 patients, less than 1 year follow-up, tumor or constrained prosthesis, and any bleeding diathesis were excluded from the study. The amount of intraoperative bleeding was determined by a resident by adding the total gauze weight to the difference between the irrigation and vacuum volumes^[12,13]. The postoperative blood loss was calculated by the volume of drainage. No pharmacological agent was used to affect the bleeding; monopolar cauterization was applied for hemostasis during surgery. The time from the beginning of the surgical incision to the closure of the subcutaneous tissue was recorded as the operation time. Harris hip scores (HHP) were recorded by a resident at preoperative period and at postoperative 1st, 3rd, 6th, and 12th months. On the first day after surgery, articular suction drain was removed and walking and strengthening exercises without full loading were started. Patients began to walk with full weight bearing at 6th week after surgery. Radiolucent lines, osteolytic lesions more than 3 mm in diameter^[14] and bone loss were recorded on radiographs of the patients at 3 acetabular regions described by Delee and Charnley^[15]. This study was approved by the ethical committee of our hospital.

Surgical technique

All patients underwent unilateral THA. Preoperatively, pelvis and standing posteroanterior hip radiographs were obtained. Posterior approach was performed in all surgical procedures by one experienced surgeon. A cementless proximal 1/3 porous plasma spray coated Bi-Metric femoral component was used in all patients. A cementless Exceed ABT taper fit acetabular cup with C2A ceramic liner and head was used in patients under 65 years old. A cementless Exceed ABT Ringloc X acetabular cup and E1 10° polyethylene liner and M2A CoCrMo head was used in patients over 65 years old (Biomet, Warsaw,

Table 1 Preoperative and intraoperative data of groups *n* (%)

	Screw group	No-screw group
No. of patients	16 (53.3)	14 (46.7)
Age (yr)	56.5 (36-82)	54.0 (35-68)
Sex		
Male	4 (25)	6 (42.9)
Female	12 (75)	8 (57.1)
Diagnosis		
Osteoarthritis/posttraumatic	12	9
Inflammatory	2	3
Osteonecrosis	2	2
Head size		
28	1	0
32	15	14

IN). Acetabular socket preparation was similar in both groups and the region was reamed concentrically. When the maximum medial depth was reached, the acetabular cup was implanted. After the surgeon implanted the component, he attempted to move the cup bar antero-posteriorly and supero-inferiorly for the stability control, and two additional screws were used if the stabilization was suspicious. Otherwise it was implanted without screws.

Statistical analysis

SPSS Mac OS X 20.0 (SPSS, Chicago, IL) program was used for statistical analysis. The Kolmogorov–Smirnov test was used to test the normality of study data. Mann-Whitney *U* test was used for the analysis of operation time, bleeding volumes, and clinical scores between the groups. The Wilcoxon test was used to analyze the changes in intra-group clinical scores before and after the operation. A *P*-value below 0.05 was considered statistically significant.

RESULTS

Ten (33.3%) patients were male and 20 (66.7%) were female. Acetabular cups were used with screw in 16 (53.3%) patients and without screw in 14 (46.7%) patients. Table 1 shows the demographic data of the patients. While the mean operation time was 121.8 min (range; 95-140), in the screw group, it was 102.7 min (range; 80-120) in the no-screw group, and this difference was statistically significant (*P* = 0.002) (Figure 1). The mean intraoperative bleeding volume was 556.6 mL (range; 350-800)/527 mL (range; 400-700), the postoperative drainage volume was 423.3 mL (range; 250-600)/456 mL (range; 230-600), and the mean total bleeding volume was 983.3 mL (range; 600-1350)/983 mL (range; 630-1250) in the screw/no-screw group, respectively. The bleeding amount was not statistically significant between the groups (*P* > 0.05). Harris hip scores significantly increased within the groups, but no significant difference was found between the groups (Figure 2). Hip dislocation occurred in two patients. One of them occurred in the screw group 15 d after surgery and was relocated by sedation in the operating

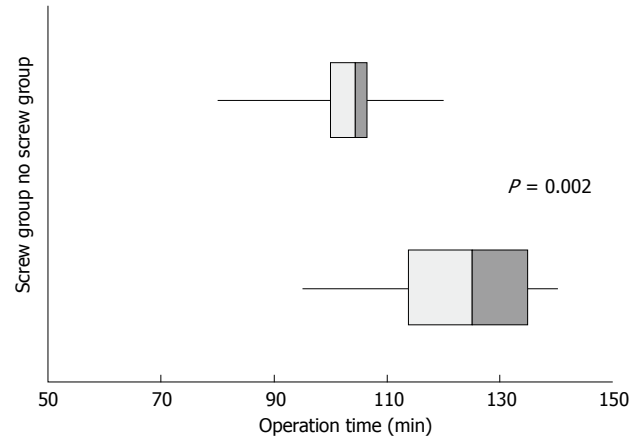


Figure 1 A bar diagram showing operation time and groups. Comparison of operation time between screw and no-screw groups with *P* values illustrated to show differences.

room; the other one was noticed in no-screw group at the early postoperative period and relocated on patient bed. No-screw group had a trochanteric fracture during femoral stem implantation. Plate fixation was performed and callus tissue formed at 6th month. None of the patients had acetabular component migration and revision surgery. One patient in screw group (6.2%) had osteolytic lesions around the screw (Table 1).

DISCUSSION

Transacetabular screw is used by surgeons to improve stability in total hip arthroplasty^[10,16]. It has been shown to improve initial stability in cadaveric studies^[10,17]. However, it is known that additional screws increase neurovascular complications^[8], although there is no consensus whether they increase osteolytic lesions^[11,18,19]. Some authors have attributed the increase in osteolytic lesions to a reaction to the debris escaping from the screw holes to the acetabular bone^[6,20]. In contrast, Schmalzried *et al.*^[19] reported in their retrospective study that pelvic osteolysis is associated with significantly greater head size and longer follow-up than screw use. In our study, only one case of osteolysis was identified, which was in the screw group. We attributed the low number of osteolysis cases to a short follow-up period.

Cup migration can be evaluated not only by conventional radiography but also by radiostereometry^[20]. Studies comparing middle- and long-term cup migration have yielded no significant differences between the screw and no-screw groups^[11,20]. In our study, cup migration did not occur in either group at one-year follow up.

Thanner *et al.*^[4] reported a comparative study and found a mean HHP of 99 in the screw group and 98 in the no-screw group at the end of 2 years. In our study, at the end of one year, the mean HHP was 81.6 in the screw group and 84 in the no-screw group. Similar to the literature findings, our study did not reveal any significant differences between the two groups in terms of clinical outcomes and cup migration. Short-term follow-up and limited case series were the weak points

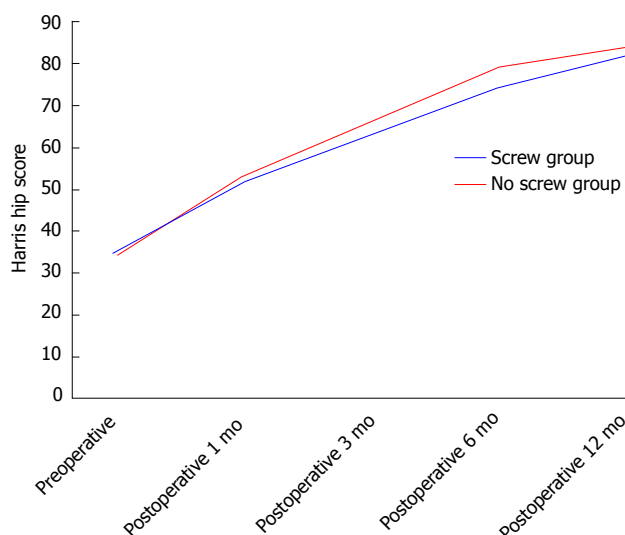


Figure 2 A line chart showing changes Harris hip score over time.

of our study.

The strength of our study is that it compared perioperative data. A review of the literature indicated that no study has yet compared the screw and no-screw groups with regard to volume of blood loss and operation time. Studies have reported that blood loss in THA ranges between 600 and 1800 mL^[21,22]. The mean blood loss in our study was 983.3 mL in the screw group and 983 mL in the no-screw group, with the difference being statistically non-significant. The mean volume of intraoperative bleeding was greater by 29.6 mL in the screw group. We attributed this difference to a bleeding from screw holes, but it was not statistically significant. An analysis of the postoperative drain volumes revealed that the mean volume was greater by 32.7 mL in the no-screw group, which contributed to a slight difference of 0.3 mL between the two groups in the total amount of bleeding.

Duchman *et al.*^[23] reported that an operative time greater than 120 min was associated with increased short-term morbidity and risk of complications in THA. We found a mean operative time of 121.8 min in the screw group but no complication such as wound infection was encountered. We compared the screw and no-screw groups for the operation time and found that the mean time was 19.1 min greater in the screw group, and this difference was statistically significant. We attribute this difference to preparation of holes, sterile unpacking, and screwing.

Similar to the literature data, our study showed no difference between clinical outcome and cup migration between the screw and no-screw groups in the short term, whereas not using a screw provided a significant advantage in terms of operation time.

COMMENTS

Background

Cementless acetabular components in total hip arthroplasty can be implanted

with or without screws. It is known that using screws increases neurovascular complications. However, its effects on osteolysis, component stability, and migration are still being debated. No study has compared the perioperative data of screw and no-screw components in the literature. In this study, the authors compared the acetabular components with and without screws in terms of bleeding, operation time, early clinical outcomes, and cup migration.

Research frontiers

The results of this study contribute to clarifying the effect of the screws used in the fixation of the acetabular component in total hip arthroplasty on the operation time, surgical bleeding, and early clinical outcomes.

Innovations and breakthroughs

Using screw did not affect clinical outcome and cup migration at the early postoperative period. Screw and no-screw groups showed similar results in respect to surgical bleeding. However, the use of the screw significantly increased the operation time.

Applications

This study showed that the implantation of the acetabular component without screw would have a significant advantage in the operation time.

Terminology

Osteolysis: Bone matrix resorption by osteoclast cells.

Peer-review

The sample size and the follow up is short of course but interesting.

REFERENCES

- 1 **Yamada H**, Yoshihara Y, Henmi O, Morita M, Shiromoto Y, Kawano T, Kanaji A, Ando K, Nakagawa M, Kosaki N, Fukaya E. Cementless total hip replacement: past, present, and future. *J Orthop Sci* 2009; **14**: 228-241 [PMID: 19337818 DOI: 10.1007/s00776-008-1317-4]
- 2 **Engh CA**, Hopper RH, Engh CA. Long-term porous-coated cup survivorship using spikes, screws, and press-fitting for initial fixation. *J Arthroplasty* 2004; **19**: 54-60 [PMID: 15457419]
- 3 **Roth A**, Winzer T, Sander K, Anders JO, Venbrocks RA. Press fit fixation of cementless cups: how much stability do we need indeed? *Arch Orthop Trauma Surg* 2006; **126**: 77-81 [PMID: 16501986 DOI: 10.1007/s00402-005-0001-9]
- 4 **Thanner J**, Kärrholm J, Herberts P, Malchau H. Hydroxyapatite and tricalcium phosphate-coated cups with and without screw fixation: a randomized study of 64 hips. *J Arthroplasty* 2000; **15**: 405-412 [PMID: 10884197 DOI: 10.1054/arth.2000.2963]
- 5 **Iorio R**, Puskas B, Healy WL, Tilzey JF, Specht LM, Thompson MS. Cementless acetabular fixation with and without screws: analysis of stability and migration. *J Arthroplasty* 2010; **25**: 309-313 [PMID: 19303251 DOI: 10.1016/j.arth.2009.01.023]
- 6 **Udomkiat P**, Dorr LD, Wan Z. Cementless hemispheric porous-coated sockets implanted with press-fit technique without screws: average ten-year follow-up. *J Bone Joint Surg Am* 2002; **84-A**: 1195-1200 [PMID: 12107321 DOI: 10.2106/00004623-200207000-00016]
- 7 **Valle AG**, Zoppi A, Peterson MG, Salvati EA. Clinical and radiographic results associated with a modern, cementless modular cup design in total hip arthroplasty. *J Bone Joint Surg Am* 2004; **86-A**: 1998-2004 [PMID: 15342763 DOI: 10.2106/00004623-200409000-00019]
- 8 **Wasielowski RC**, Cooperstein LA, Kruger MP, Rubash HE. Acetabular anatomy and the transacetabular fixation of screws in total hip arthroplasty. *J Bone Joint Surg Am* 1990; **72**: 501-508 [PMID: 2324135 DOI: 10.2106/00004623-199072040-00005]
- 9 **Healy WL**, Iorio R, Lemos MJ, Patch DA, Pfeifer BA, Smiley PM, Wilk RM. Single Price/Case Price Purchasing in orthopaedic surgery: experience at the Lahey Clinic. *J Bone Joint Surg Am* 2000; **82**: 607-612 [PMID: 10819271 DOI: 10.2106/00004623-200008000-00019]

- 005000-00001]
- 10 **Hsu JT**, Chang CH, Huang HL, Zobitz ME, Chen WP, Lai KA, An KN. The number of screws, bone quality, and friction coefficient affect acetabular cup stability. *Med Eng Phys* 2007; **29**: 1089-1095 [PMID: 17194616 DOI: 10.1016/j.medengphy.2006.11.005]
 - 11 **Ni SH**, Guo L, Jiang TL, Zhao J, Zhao YG. Press-fit cementless acetabular fixation with and without screws. *Int Orthop* 2014; **38**: 7-12 [PMID: 23982638 DOI: 10.1007/s00264-013-2075-2]
 - 12 **Nadler SB**, Hidalgo JH, Bloch T. Prediction of blood volume in normal human adults. *Surgery* 1962; **51**: 224-232 [PMID: 21936146]
 - 13 **Li J**, Zhao J, He C, Tong W, Zou Y, Xu W. Comparison of Blood Loss After Total Hip Arthroplasty Between Ankylosing Spondylitis and Osteoarthritis. *J Arthroplasty* 2016; **31**: 1504-1509 [PMID: 27006146 DOI: 10.1016/j.arth.2015.12.049]
 - 14 **Claus AM**, Sychterz CJ, Hopper RH, Engh CA. Pattern of osteolysis around two different cementless metal-backed cups: retrospective, radiographic analysis at minimum 10-year follow-up. *J Arthroplasty* 2001; **16**: 177-182 [PMID: 11742472 DOI: 10.1054/arth.2001.28365]
 - 15 **DeLee JG**, Charnley J. Radiological demarcation of cemented sockets in total hip replacement. *Clin Orthop Relat Res* 1976; **121**: 20-32 [PMID: 991504]
 - 16 **Lachiewicz PF**, Suh PB, Gilbert JA. In vitro initial fixation of porous-coated acetabular total hip components. A biomechanical comparative study. *J Arthroplasty* 1989; **4**: 201-205 [PMID: 2795026 DOI: 10.1016/S0883-5403(89)80015-4]
 - 17 **Perona PG**, Lawrence J, Paprosky WG, Patwardhan AG, Sartori M. Acetabular micromotion as a measure of initial implant stability in primary hip arthroplasty. An in vitro comparison of different methods of initial acetabular component fixation. *J Arthroplasty* 1992; **7**: 537-547 [PMID: 1479374 DOI: 10.1016/S0883-5403(06)80076-8]
 - 18 **Schmalzried TP**, Akizuki KH, Fedenko AN, Mirra J. The role of access of joint fluid to bone in periarticular osteolysis. A report of four cases. *J Bone Joint Surg Am* 1997; **79**: 447-452 [PMID: 9070538 DOI: 10.2106/00004623-199703000-00021]
 - 19 **Schmalzried TP**, Brown IC, Amstutz HC, Engh CA, Harris WH. The role of acetabular component screw holes and/or screws in the development of pelvic osteolysis. *Proc Inst Mech Eng H* 1999; **213**: 147-153 [PMID: 10333686 DOI: 10.1243/0954411991534861]
 - 20 **Röhrl SM**, Nivbrant B, Ström H, Nilsson KG. Effect of augmented cup fixation on stability, wear, and osteolysis: a 5-year follow-up of total hip arthroplasty with RSA. *J Arthroplasty* 2004; **19**: 962-971 [PMID: 15586331]
 - 21 **Smith LK**, Williams DH, Langkamer VG. Post-operative blood salvage with autologous retransfusion in primary total hip replacement. *J Bone Joint Surg Br* 2007; **89**: 1092-1097 [PMID: 17785752 DOI: 10.1302/0301-620X.89B8.18736]
 - 22 **Hochreiter J**, Hejkrlik W, Emmanuel K, Hitzl W, Ortmaier R. Blood loss and transfusion rate in short stem hip arthroplasty. A comparative study. *Int Orthop* 2016; Epub ahead of print [PMID: 27942850 DOI: 10.1007/s00264-016-3365-2]
 - 23 **Duchman KR**, Pugely AJ, Martin CT, Gao Y, Bedard NA, Callaghan JJ. Operative Time Affects Short-Term Complications in Total Joint Arthroplasty. *J Arthroplasty* 2017; **32**: 1285-1291 [PMID: 28040399 DOI: 10.1016/j.arth.2016.12.003]

P- Reviewer: Prudhon JL **S- Editor:** Kong JX **L- Editor:** A
E- Editor: Lu YJ

