Original Article
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Component Asymmetry in Bilateral Cementless Total Hip Arthroplasty

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Background: This study investigated the results of component asymmetry (CA) in bilateral cementless total hip arthroplasty (THA).
Methods: This study included 300 patients, who underwent bilateral cementless THA between April 2000 and December 2017. They were divided into the component symmetry (CS) and CA groups; CA group was sub-classified into acetabular component asymmetry (ACA) and femoral component asymmetry (FCA). Radiologic and clinical outcomes of the CA group were compared with those of the CS group.
Results: The incidence of CA was 25.7% (77/300 patients), including 55 patients with ACA, 34 patients with FCA, and 12 with both components asymmetric. The mean time interval between operations in the CA group was significantly longer than that in the CS group ($p < 0.001$). The mean differences in horizontal and vertical distances from teardrop to the center of rotation of the acetabular component between both hips in the ACA group were significantly larger than those in the CS group ($p = 0.033$ and $p < 0.001$, respectively). The mean femoral component alignment angle difference between both hips was significantly larger in the FCA group than in the CS group ($p < 0.001$). The mean Harris Hip Score at last follow-up of the CA group was similar to that of the CS group.
Conclusions: CA in patients undergoing bilateral cementless THA was not rare, especially with a longer time interval between operations. Regardless of CA, when stable fixation of the components was achieved, satisfactory radiologic and clinical outcomes were obtained.
Keywords: *Component asymmetry, Bilateral total hip arthroplasty, Cementless total hip arthroplasty*

Total hip arthroplasty (THA) is one of the most effective and definite treatments for hip osteoarthritis (OA) and many other hip joint pathologies, such as osteonecrosis of the femoral head (ONFH), rheumatoid arthritis (RA), and ankylosing spondylitis (AS).[1,2] In addition to OA, conditions such as ONFH, RA, and AS can affect both hips and may potentially require bilateral THA. The odds to undergo a second, contralateral THA range between 16% and 85%.[3,4] During the follow-up period, demand for THA of the contralateral hip continues to be approximately 15 times higher than that in the general population.[5]

Although bilateral coxarthrosis is frequently symmetric in appearance, the similarity in component size during bilateral THA should not be assumed. It is essential that the prosthesis matches the native bone geometry to avoid complications such as aseptic loosening, pain, and improper load distribution. For cementless THA, secondary biological integration of the porous-coated components depends on the quality of primary stability

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and improvements in the long-term fixation of cementless components via bone ingrowth.[6,7] The essential requirements for bone ingrowth include implants intimately contacting a viable host bone and adequate initial stability during the incorporation for consistent bone ingrowth. Therefore, proper sizing of each prosthetic component in bilateral cementless THA is necessary to maximize outcomes and reduce complication risk.

In patients with bilateral coxarthrosis undergoing bilateral cementless THA, component asymmetry (CA) between both hips was not rare despite their similarity. Studies have described this CA in bilateral cemented total knee arthroplasty,[8,9] but no studies have investigated this in bilateral cementless THA. This study aimed to quantify the incidence of acetabular and femoral CA and investigate the radiologic and clinical results of CA in bilateral cementless THA.

METHODS

Institutional Review Board approval was obtained prior to study commencement (No. 05-2018-057). Informed consent was waived.

Between April 2000 and December 2017, a total of 2,014 consecutive patients with coxarthrosis who had been surgically treated with primary THA at a single university hospital were evaluated. Of these, 351 patients underwent bilateral THA. After exclusion based on different disease type between both hips (1 patient), previous fractures of the acetabulum or femur (8), use of one or more cemented prostheses (9), and follow-up periods of < 2 years (33), 300 patients were enrolled in this study. Patients were divided into the component symmetry (CS) and CA groups; CA group was sub-divided into acetabular component asymmetry (ACA) and femoral component asymmetry (FCA).

We performed preoperative templating in all patients. Bone mineral density of the proximal femur was performed preoperatively using dual-energy X-ray absorptiometry. The T-score of proximal femur at each operation side was measured preoperatively. All operations were performed by one experienced arthroplasty surgeon (KTS) using a posterolateral approach with patients in the lateral decubitus position. A single type of acetabular component (Trilogy; Zimmer, Warsaw, IN, USA), femoral component (Fiber Metal Taper, Zimmer), and highly cross-linked polyethylene liner (Longevity, Zimmer) were used. For acetabular component fixation, a 1–2 mm press-fit fixation technique with or without screw fixation was performed. After adequate preparation of the femur, the final component size was determined when a properly lateralized broach made contact with the cortical bone in the calcar region. The tapered stem, which provided a stable press-fit, was inserted. The acetabular component was used in 2 mm increments from 42 mm to 66 mm and the femoral component was used in 1 mm increment from 9 mm to 17 mm based on the diameter of the stem. Taking into consideration of the information obtained with preoperative templating or first operation, we attempted to insert the appropriate size of components in intimate contact with host bone during second operation. The operation time, component size, number of acetabular screws, and time interval between operations were recorded. Patients were followed up at 6 weeks, 3, 6, and 12 months, and annually thereafter from surgery. We obtained the Harris Hip Score (HHS) and plain radiographs at each visit.

Radiologic Evaluation

We obtained the preoperative anteroposterior (AP) radiographs of both hips with the femur rotated 15°–20° internally (Fig. 1A). An inter-teardrop line was drawn connecting the most inferior borders of both teardrops, which served as a baseline for all other measurements. By measuring the distance from this line to the apex of lesser trochanters of the femur, we determined the difference as a degree of indirect limb length discrepancy (LLD). Indirect LLD was expressed as a negative value when it was shorter than the contralateral side and a positive value when it was longer. The center of rotation (COR) of the hip was determined as the center of the acetabular component of preoperative templating. The vertical distance from inter-teardrop line to the COR (VDCOR) was measured.[10] The horizontal distance from teardrop to the COR (HDCOR) was measured as the distance between a vertical line bisecting the teardrop and the COR.[10] The calcar-to-canal ratio[11] was measured as the fraction of intramedullary canal isthmus over the calcar isthmus dimension. According to the calcar-to-canal ratio, the Dorr type[11] was determined preoperatively.

After second operation, standardized AP radiographs of both hips were used to measure the radiologic parameters (Fig. 1B). The mean inclination of both acetabular components was calculated. A circle contiguous to the external border of the acetabular component was used to find the COR. The VDCOR and HDCOR of acetabular components were measured.[10] The femoral component alignment angle (FAA)[12] was measured as the angle between the anatomical axis of the femur and the long axis of the femoral component. The difference of Dorr type between both femurs was evaluated.

At the last follow-up, we assessed the distribution of

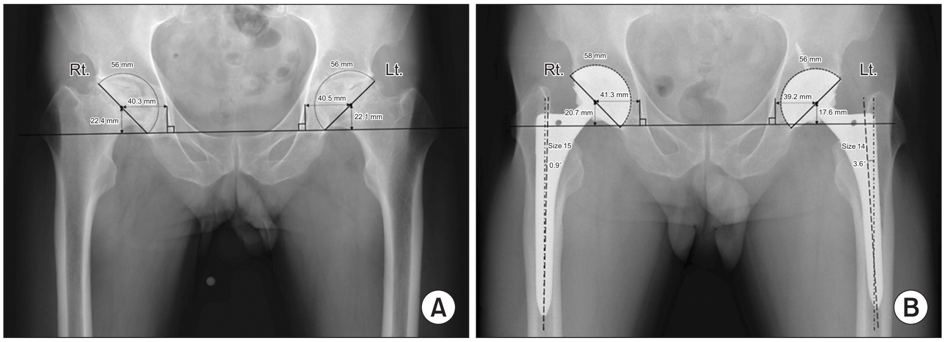

Fig. 1. (A) A 58-year-old male patient presented with bilateral osteonecrosis of the femoral heads. The preoperative differences in horizontal distance from teardrop to the center of rotation (HDCOR) and in vertical distances from the inter-teardrop line to the COR (VDCOR) between both hips were nearly the same. It was expected that components of the same size would be inserted into both hips in preoperative templating (56 mm size for acetabular components and size 15 for femoral components). (B) After second operation, the standardized anteroposterior radiograph of bilateral cementless total hip arthroplasty was achieved. First operation was performed on the left side. The time interval between operations was 2 weeks. The patient showed asymmetry of both components. An acertabular component of 56 mm in size and a size 14 femoral component were fixed on the left side and an acetabular component of 58 mm in size and a size 15 femoral component were fixed on the right side. There were differences in the HDCOR and VDCOR of the acetabular components between both hips (1.3 mm and 3.1 mm, respectively). The femoral component alignment angle of the left side (3.6°) was larger than that of the right side (0.9°), which was 1 size bigger than the left side. Rt: right, Lt: left.

any radiolucent line or osteolysis at the acetabular bone-prosthesis interface in the 3 zones described by DeLee and Charnley[13)] and at the femoral bone-prosthesis interface in the 7 zones described by Gruen et al.[14)] in the radiograph. Radiolucent lesions of ≥ 2 mm around the acetabular or femoral components, which were not present immediately after the operation, denoted osteolysis. Changes in the inclination of > 5° and vertical or horizontal migration of the acetabular component of ≥ 2 mm were defined as acetabular component loosening. The stability of femoral components was classified into stable bone ingrowth, stable fibrous ingrowth, and unstable prosthesis.[15)] The following findings were considered as femoral component loosening: a radiolucent line > 1 mm throughout the zones, changes in ≥ 3° of valgus and varus alignment, and stem subsidence ≥ 2 mm.[15)]

Two authors (SHW and SML) blinded to all clinical information and uninvolved in operation measured the postoperative radiologic parameters. To reduce measurement errors, each author measured and reviewed the parameters twice at 1 month interval.

Statistical Analysis

Summary data are expressed as means ± standard deviation for continuous variables and number and frequency (%) for categorical ones. Continuous variables with abnormal distribution were analyzed using the Mann-Whitney *U*-test. Independent *t*-tests were used to compare variables with a normal distribution. Categorical data were statistically analyzed by chi-square test or Fisher's exact test ($n < 40$ or $t < 1$). A linear regression model was used to analyze the relationship between CA and radiologic parameters. The interobserver and intraobserver reliabilities of the postoperative radiologic parameters were evaluated by the intraclass correlation coefficient (ICC). The values were interpreted according to Landis and Koch's criteria.[16)] Statistical analysis was performed using IBM SPSS ver. 20.0 (IBM Corp., Armonk, NY, USA). A p-value < 0.05 was considered statistically significant.

RESULTS

The patients were 20–87 years old (average, 55.7 years) (Table 1). There were 174 men (58.0%) and 126 women (42.0%). The preoperative diagnosis was ONFH in 232 patients (77.3%), OA in 50 (16.7%), RA in 14 (4.7%), and AS in 4 (1.3%). The mean follow-up period was 53.9 ± 37.1 months (range, 24–219 months). The sex, age, type of diagnosis, follow-up period, and operation side were not different between the CS and CA groups except the mean time interval between operations ($p < 0.001$). Among the total 300 patients, 223 patients were in the CS group. The overall incidence of CA was 25.7% (77/300), including 55 patients with ACA, 34 with FCA, and 12 with both components asymmetric (Table 2). Among the CA patients, the acetabular component size was smaller in the second operation in 58.2% (32/55) and bigger in 41.8% (23/55). Femoral component size was smaller in the second operation in 23.5% (8/34) and bigger in 76.5% (26/34).

Table 1. Demographics of Patients with Bilateral Cementless Total Hip Arthroplasty

Variable	CS group (n = 223)	CA group (n = 77)	*p*-value
Sex			0.476
Male	132 (59.2)	42 (54.5)	
Female	91 (40.8)	35 (45.5)	
Age (yr)			0.589
Mean	55.2 ± 13.9	57.5 ± 11.5	
Range	20–87	28–87	
Diagnosis			0.363
ONFH	177 (79.4)	55 (71.4)	
Osteoarthritis	32 (14.3)	18 (23.4)	
Others*	14 (6.3)	4 (5.2)	
Follow-up period (mo)			0.266
Mean	55.8 ± 38.9	46.6 ± 33.1	
Range	24.0–219.0	24.0–153.3	
First operation side			0.239
Right	133 (59.6)	40 (51.9)	
Left	90 (40.4)	37 (48.1)	
Time interval between operations (mo)	10.2 ± 22.8	28.8 ± 44.0	< 0.001

Values are presented as number (%) or mean ± standard deviation.
CS: component symmetry, CA: component asymmetry, ONFH: osteonecrosis of the femoral head.
*Eighteen patients had rheumatoid arthritis of both hips (14 cases) and ankylosing spondylitis of both hips (4 cases).

Comparisons between CS and ACA Groups

The mean preoperative differences in HDCOR and VDCOR between both hips were not significant between the two groups (Table 3). The mean postoperative acetabular inclination showed no significant difference between the two groups. The mean postoperative difference in HDCOR of the acetabular component between both hips of the ACA group (2.49 ± 1.91 mm; range, 0.0–7.3 mm) was significantly larger than that of the CS group (1.72 ± 1.31 mm; range, 0.0–4.0 mm) ($p = 0.033$). The mean postoperative difference in VDCOR of the acetabular component between both hips of the ACA group (0.86 ± 1.95 mm; range, –5.0 to 6.0 mm) was significantly larger than that of the CS group (0.14 ± 0.77 mm; range, 0.0–7.0 mm) ($p < 0.001$).

There was no significant difference between the groups in the number of acetabular screws used during the operations and the difference between both sides. Radiolucent lines < 1 mm in width were observed around the acetabular component in 25.2% (70/278). We found various degrees of osteolysis around the acetabular component in 6.8% (19/278). In all cases, osteolysis was focal and without clinical relevance. Incidence of radiolucent lines and osteolysis showed no significant difference between the two groups. There was 1 case with posterior dislocation of the hip joint after slip down in the ACA group. The hip was stabilized and had no further re-dislocation after closed reduction. None of the acetabular components showed evidence of migration or loosening.

The mean time interval between operations was significantly longer in the ACA group (27.04 ± 44.41 months; range, 0.4–163.3 months) than in the CS group (10.2 ± 22.83 months; range, 0.3–195.3 months) ($p = 0.003$). The mean T-score at the first operation was not significantly different, but that at the second operation was significantly lower in the ACA group (–1.11 ± 1.06; range, –2.5 to 2.8) than in the CS group (–0.76 ± 1.01; range, –2.8 to 1.6) ($p = 0.008$). The mean HHS at last follow-up was similar between the groups.

Table 2. Incidence of Component Asymmetry in Bilateral Cementless Total Hip Arthroplasty

Variable	Value
Total patients with bilateral cementeless total hip arthroplasty	300 (100)
Component asymmetry in the second operation*	77 (25.7)
Acetabular component asymmetry	55 (18.3)
2 Size smaller	2 (0.6)
1 Size smaller	30 (10.0)
1 Size bigger	20 (6.7)
2 Size bigger	3 (1.0)
Femoral component asymmetry	34 (11.3)
1 Size smaller	8 (2.7)
1 Size bigger	23 (7.7)
2 Size bigger	3 (1.0)
Both components asymmetry	12 (4.7)

Values are presented as number (%).
*Component size difference compared to the first operation side.

Comparisons between CS and FCA Groups

There was no significant difference between the two groups with regard to the mean difference in calcar-to-canal ratio between both hips and mean indirect LLD in preoperative radiographs (Table 4). The difference in Dorr type on both femurs between the two groups was statistically significant (p < 0.001). A change in the Dorr type was observed in 6 patients (17.6%), all of which was from type A to B in the FCA group. There were two cases of crack in the femoral neck during true femoral component fixation in the CS group. Both patients were treated with calcar wiring during the operation. It did not influence radiologic and clinical outcomes. There was no case of calcar fracture or crack in the FCA group. The mean postoperative difference in FAA between both hips was significantly larger in the FCA group (1.8°2 ± 2.17°; range, 0°–11.3°) than in the CS group (0.69° ± 0.61°; range, 0°–2.9°) (p < 0.001). When compared according to component size between both hips in the FCA group, the mean FAA of the smaller component (1.8° ± 2.64°; range, –4.2° to 12.5°) was significantly larger than that of the bigger component (0.94° ± 1.2°; range, –2.9° to 3.1°) (p = 0.009). Femoral components showed excellent or good fixation postoperatively and stable bony fixation at the last follow-up, except for 1 case in the CS group with periprosthetic fracture treated through femoral stem revision, open reduction, and internal fixation. Radiolucent lines < 1 mm around the femoral component were observed in 23.3% (60/257), with no significant difference between the two groups. There was no osteolysis and loosening around the femoral component. There was no patient showing thigh pain or lateral cortical hypertrophy due to varus malalignment or component loosening.

The mean time interval between operations was significantly longer in the FCA group (26.93 ± 36.55 months; range, 0.3–147.2 months) than in the CS group (10.2 ± 22.83 months; range, 0.3–195.3 months) (p = 0.001). The mean T-score at the first operation showed no significant difference, but that at the second operation was significantly lower in the FCA group (–1.36 ± 0.81; range, –2.3 to 1.1) than in the CS group (–0.76 ± 1.01; range, –2.8 to 1.6) (p = 0.001). The mean HHS at the last follow-up was similar between the groups.

Linear Logistic Regression Analysis and ICC Values

The difference in HDCOR and VDCOR of the acetabular component between both hips showed a significantly positive correlation with ACA (β = 0.158, p < 0.001 and β = 0.251, p < 0.001, respectively) (Table 5). The difference in FAA between both hips showed a significantly positive correlation with FCA (β = 0.146, p < 0.001). The interobserver and intraobserver reliabilities of postoperative radiologic parameters showed a high ICC value (> 0.81), indicating excellent interobserver and intraobserver reliabilities (Table 6).

DISCUSSION

Although numerous studies have described acetabular and proximal femur geometry and morphology related to THA,[17,18] none addressed the incidence or potential need for different-sized components in patients undergoing bilateral cementless THA. To our knowledge, this is the first study describing a difference in component size among patients undergoing bilateral cementless THA.

Unlike cemented THA, in which a geometric mismatch between the component and host bone is required for a sufficient cement mantle, cementless THA aims for a close fit between the implant and endosteal surface.[19] Optimal fixation involves a tight peripheral press-fit with complete seating of the acetabular component to maximize the surface area available for ingrowth and stress transfer between the implant and bone.[20] Restoration of the hip center is one of the primary goals of acetabular reconstruction. If inadequate bone is available, a medial

Table 3. Radiologic and Clinical Data of the Component Symmetry Group and Acetabular Component Asymmetry Group

Variable	CS group (n = 223)	ACA group (n = 55)	*p*-value
Radiologic data			
Preoperative data			
Difference in HDCOR between both hips (mm)	1.66 ± 0.61	1.46 ± 0.81	0.704
Difference in VDCOR between both hips (mm)	0.19 ± 0.60	0.55 ± 1.09	0.104
Postoperative data			
Mean inclination of both acetabular components (°)	44.12 ± 2.65	44.58 ± 3.39	0.248
Difference in HDCOR of the acetabular component between both hips (mm)	1.72 ± 1.31	2.49 ± 1.91	0.033
Difference in VDCOR of the acetabular component between both hips (mm)	0.14 ± 0.77	0.86 ± 1.95	< 0.001
Acetabular screw at the first operation	1.04 ± 0.38	1.13 ± 0.34	0.125
Acetabular screw at the second operation	1.08 ± 0.40	1.02 ± 0.30	0.378
Difference in the number of screws between both hips	0.04 ± 0.44	0.11 ± 0.42	0.674
Follow-up data			
Radiolucent line around the acetabular component	56 (25.1)	14 (25.4)	0.958
Osteolysis around the acetabular component	15 (6.7)	4 (7.2)	0.540
Location of osteolysis			0.592
Zone 1	5 (2.2)	1 (1.8)	
Zone 2	12 (5.4)	3 (5.5)	
Zone 3	8 (3.6)	1 (1.8)	
Prosthetic dislocation	0	1 (1.8)	0.198
Migration or loosening of the acetabular component	0	0	
Clinical data			
Operation time (min)	86.28 ± 14.26	86.81 ± 15.54	0.917
Time interval between operations (mo)	10.2 ± 22.83	27.04 ± 44.41	0.003
Bone mineral density (T-score)			
At the first operation	–0.72 ± 0.99	–0.84 ± 0.96	0.294
At the second operation	–0.76 ± 1.01	–1.11 ± 1.06	0.008
Harris Hip Score			
Preoperative	38.37 ± 10.24	37.36 ± 9.28	0.460
Last Follow-up	98.5 ± 2.23	98.1 ± 2.74	0.144

Values are presented as mean ± standard deviation or number (%).
CS: component symmetry, ACA: Acetabular component asymmetry, HDCOR: horizontal distance from teardrop to the center of rotation, VDCOR: vertical distance from inter-teardrop line to the center of rotation.

or high hip center might be needed for achieving enough coverage of acetabular component. Several studies have reported a range of 3–6 mm of medialization of the acetabular component.[21,22] Sariali et al.[23] reported that COR of the hip was restored with a mean accuracy of 0.73 ± 3.5 mm vertically. In this study, we measured the HDCOR and VDCOR of the acetabular component to compare the extent of acetabular reaming between both hips. Although

Table 4. Radiologic and Clinical Data of the CS Group and FCA Group

Variable	CS group (n = 223)	FCA group (n = 34)	*p*-value
Radiologic data			
Preoperative data			
Difference in calcar-to-canal ratio between both hips	0.01 ± 0.02	0.01 ± 0.02	0.279
Indirect LLD (mm)	–3.73 ± 2.63	–3.95 ± 2.29	0.601
Difference in Dorr type between both hips			
No change	223	28	< 0.001
Type A to B	0	6 (17.6)	
Type B to C	0	0	
Postoperative data			
Calcar or femoral neck fracture	2 (0.8)	0	
Difference in FAA between both hips (°)	0.69 ± 0.61	1.82 ± 2.17	< 0.001
Follow-up data			
Stability of femoral component			
Stable bony ingrowth	222 (99.5)	34 (100.0)	
Stable fibrous ingrowth	0	0	
Unstable prosthesis	1 (0.6)	0	
Periprosthetic fracture	1 (0.5)	0	
Radiolucent line around femoral component	54 (18.0)	6 (17.6)	0.399
Osteolysis around femoral component	0	0	
Clinical data			
Operation time (min)	86.28 ± 14.26	86.06 ± 18.00	0.978
Time interval between operations (mo)	10.20 ± 22.83	26.93 ± 36.55	0.001
Bone mineral density (T-score)			
At the first operation	–0.72 ± 0.99	–0.81 ± 0.92	0.316
At the second operation	–0.76 ± 1.01	–1.36 ± 0.81	0.001
Harris Hip Score			
Preoperative	38.37 ± 10.24	37.84 ± 6.05	0.584
Last follow-up	98.50 ± 2.23	98.52 ± 2.58	0.541

Values are presented as mean ± standard deviation or number (%).
CS: component symmetry, FCA: femoral component asymmetry, LLD: limb length discrepancy, FAA: femoral component alignment angle.

we could not find a constant change in component size when acetabular reaming was deeper or higher compared to the contralateral side, the larger the difference in the extent of acetabular reaming between both hips, the higher the correlation with ACA was. ACA could occur if the extent or method of acetabular reaming differed according to the difference in disease progression between both hips, even if both hips had the same disease. However, ACA did not influence the radiologic and clinical outcomes.

For cementless femoral component, appropriate alignment and fit are required to achieve initial fixation.[24)] Inappropriate femoral component size can cause early mi-

Table 5. Regression Analysis of the Component Asymmetry and Postoperative Radiologic Parameters

Parameter	Component asymmetry	
	β ± SE	*p*-value
Difference in HDCOR of the acetabular component between both hips (mm)	0.158 ± 0.042	< 0.001
Difference in VDCOR of the acetabular component between both hips (mm)	0.251 ± 0.052	< 0.001
Difference in FAA between both hips (°)	0.146 ± 0.024	< 0.001

SE: standard error, HDCOR: horizontal distance from teardrop to the center of rotation, VDCOR: vertical distance from inter-teardrop line to the center of rotation, FAA: femoral component alignment angle.

Table 6. Interobserver and Intraobserver Reliabilities of Postoperative Radiologic Parameters

Parameter	Interobserver reliability (95% CI)	Intraobserver reliability (95% CI)
Mean inclination of both acetabular components (°)	0.92 (0.90–0.94)	0.91 (0.88–0.93)
Difference in HDCOR of the acetabular component between both hips (mm)	0.95 (0.94–0.97)	0.96 (0.94–0.97)
Difference in VDCOR of the acetabular component between both hips (mm)	0.96 (0.95–0.97)	0.96 (0.94–0.97)
Difference in FAA between both hips (°)	0.93 (0.90–0.95)	0.96 (0.95–0.97)

CI: confidence interval, HDCOR: horizontal distance from teardrop to the center of rotation, VDCOR: vertical distance from inter-teardrop line to the center of rotation, FAA: femoral component alignment angle.

gration or osteointegration problems.[24,25] Previous studies reported varus alignment of the femoral component was likely related to component undersize.[26,27] Similarly, a smaller femoral component was fixed when the FAA increased compared to the contralateral side in this study. The larger the difference in FAA between both hips, the higher the correlation with FCA was. However, FCA did not influence radiologic and clinical outcomes.

In this study, the mean time interval between operations was significantly longer in the CA group than that in the CS group. The mean T-score of the CA group at the second operation was significantly lower than that of the CS group. Although it is difficult to clarify the cause of longer time interval between operations in the ACA group, ACA could occur when the extent of acetabular reaming varies between both hips due to changes in bone strength of acetabulum during the time interval between operations. Several studies have found that cortical bone loss of proximal femur increases with age.[28] The size of femoral component may change in a second operation due to morphologic change and weakening of proximal femur during the time interval between operations. Compared with the CS group, which had no difference in the Dorr type between both femurs, in the FCA group, a change in the Dorr type was observed in 6 patients (17.6%), all of which occurred in the direction of weakening of proximal femur. The mean time interval between operations of these patients was 64.76 ± 28.19 months (range, 30–99.7 months). Similarly, in the FCA group, the size of the femoral component increased in the second operation in 78.6% of the patients.

This study has several limitations. First, this is a single-center retrospective cohort study. However, we accounted for all preoperative and postoperative radiologic and clinical outcomes in our consecutive patients. Second, the follow-up period was relatively short. We consider that a longer follow-up is needed for evaluating long-term complications. Third, only two-dimensional radiologic parameters were evaluated. Eckhoff et al.[29] reported asymmetry between both hips, especially in three-dimensional morphologies such as version of the femur. It is possible that FCA occurred due to the existing three-dimensional asymmetry. These limitations are obvious obstacles to the generalization of our results, and further multicenter prospective studies are needed for verification.

The incidence of CA was not rare in patients who underwent bilateral cementless THA, especially in those with a longer time interval between operations. The differences in the extent of acetabular reaming and FAA between both hips could induce CA. Regardless of CA, when stable fixation of the components was achieved, satisfactory radiologic and clinical outcomes were obtained. Awareness of the incidence of CA and the practice of independent sizing of each hip during bilateral cementless THA are important to facilitate successful bilateral cementless THA.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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