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The effect of component position on clinical outcomes in resurfacing hip arthroplasty

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Objective: The aim of this study was to evaluate the relationship between component position and clinical results in resurfacing hip arthroplasty.

Methods: Resurfacing hip arthroplasty was performed on 41 hips of 38 patients (22 male, 16 female; mean age: 53.7 years; mean follow-up time: 20.1±5.8 months). The femoral and acetabular component orientation angles in the coronal plane were evaluated on anteroposterior radiographs. Harris and Oxford hip scores were used in the clinical evaluation.

Results: The mean angle between the collum and diaphysis was 139.5±8.8 degrees. In 22 hips, the femoral component angle between collum and diaphysis was less than 5 degrees valgus position when compared with the same anatomical femur angle. In the other 19 hips, the femoral component angle was greater than 5 degrees valgus position. The mean inclination angle of the acetabular component was 46.1±7 degrees. In 22 hips, the mean inclination angle of the acetabular components was 45 degrees or less. There was no significant difference in the clinical outcomes between patients with femoral component angles of greater than 5 degrees valgus position and those with angles of less than 5 degrees valgus position ($p>0.05$). There was also no significant difference between the clinical results of patients with an acetabular inclination of 45 degrees or less and those with an acetabular inclination exceeding 45 degrees ($p>0.05$).

Conclusion: The orientation of femoral and acetabular components in the coronal plane does not appear to have an effect on clinical outcomes in resurfacing hip arthroplasty.

Key words: Coxarthrosis; fixation angles of components; resurfacing hip arthroplasty.

Total hip arthroplasty is the most well-known option for the surgical treatment of coxarthrosis. With the introduction of new prosthetic designs, surface replacing prostheses have regained some popularity in recent years.[1]

In this study, our aim was to evaluate the relation between the position of the prosthetic components and early functional results in patients who underwent hip resurfacing arthroplasty.

Patients and methods

The study included 41 hip resurfacing arthroplasties of 38 patients (22 male, 16 female; mean age: 53.7 years; range: 23 to 78 years) performed between May 2006 and March 2008 at the Ministry of Health's Metin Sabanci Baltalimanı Bone Diseases Training and Research Hospital, Orthopedics and Traumatology Department.

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Table 1. The pre- and postoperative statistical results of the Harris and Oxford hip scores.

Paired samples t-test	Average	Standard deviation	T	df	p
Group 1: Preoperative and postoperative Harris hip scores	-62.711	11.899	-32.912	38	0.001
Group 2: Preoperative and postoperative Oxford hip scores	31.718	9.055	21.874	38	0.001

t: t-test value, df: Degrees of freedom, p: Probability value

Radiographic assessment was made using pre- and postoperative radiographs of both hips. The appropriate component sizes were chosen preoperatively with templates. Harris and Oxford hip scores were used for preoperative and final functional assessment.

Follow-ups were performed postoperatively at 1.5., 3., 6. and 12. month.

The inclination angle of the acetabular component and the neck-shaft angle of the femoral component were measured on the final anteroposterior and lateral radiographs. The angle of inclination (B angle) was measured as the intersection of the line connecting the teardrop figures and the line connecting the edges of the acetabular component (Fig. 1). A longitudinal line is drawn from the handle of the femoral component toward lateral femoral cortex. Then another line is drawn to intersect the cortex at every point, passing through the middle of the femoral shaft. The angle at the intersection of these two lines is the neck-shaft angle (A) (Fig 1.)

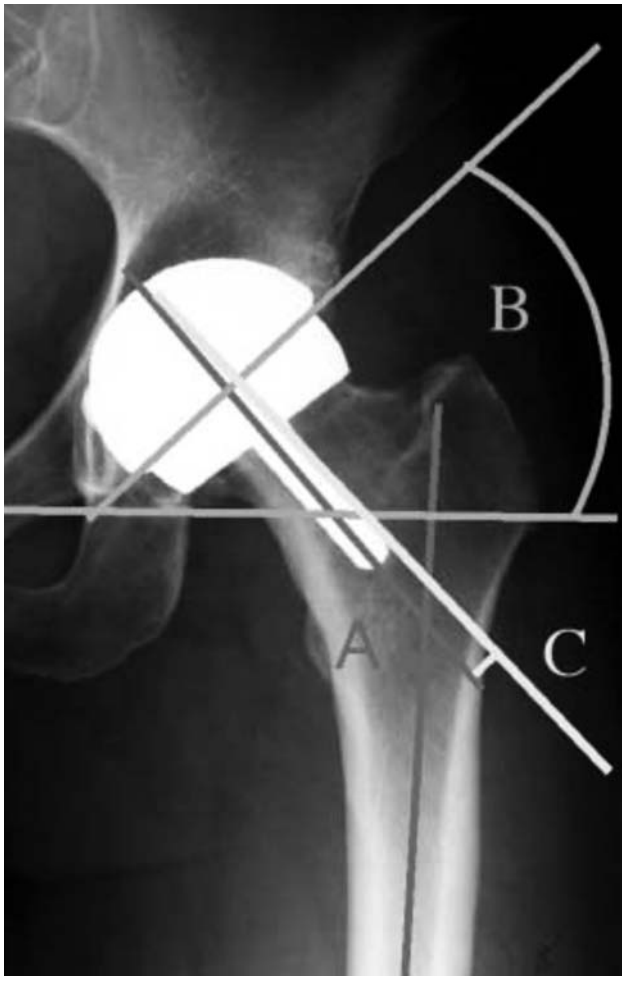

Fig. 1. Radiological measurement of the prosthesis' component angles.

The neck-shaft angle (A angle) was measured as the angle between the axis of the femoral component handle and the anatomical axis of the femur (Fig. 1).

The femoral component position in the coronal plane was assessed on anteroposterior radiographs with reference to a femoral neck-shaft angle of 130 degrees. Based on this assessment, femoral components at an A angle exceeding 130 degrees were considered to be in a valgus position and those with a smaller A angle to be in a varus position.

Hips were assigned to two groups based on the valgus angle of the femoral component: (1) hips with a femoral component in a valgus position of more than 5 degrees (19 hips), and (2) those in a femoral valgus position of less than 5 degrees (22 hips). Hip scores of the two groups were then compared to evaluate the relation between component position and clinical outcome.

Statistical analysis was done using SPSS 15 software (SPSS Inc., Chicago, IL, USA). The t-test was used for biostatistical analysis. A p value less than 0.05 was considered significant.

Results

The average preoperative Harris hip score was 29±11.6 (range: 10 to 56) and average preoperative Oxford hip score was 46±8.7 (range: 25 to 60). At the final follow-up, average Harris hip score was 92±4.4 (range: 76 to 97) and the mean Oxford hip score was 14±2.9 (range: 12 to 25). The increase in the average Harris hip score and the decrease in the average Oxford hip score were statistically significant ($p<0.05$) (Table 1).

The mean neck-shaft angle for the femoral component was 139.5±8.8 (range: 120 to 155) degrees. For the femoral component a neck-shaft angle of more than 130° was assumed to be in the valgus position and less than 130° in the varus position.[2] The femoral component was in the varus position in 4 hips, neutral in 3 hips and in the valgus position in 34 hips.

There was no significant difference between the clinical outcomes of the patients with a femoral component in a valgus position of more than 5 degrees and those in a valgus position of less than 5 degrees ($p>0.05$). The average inclination angle of the acetabular component was 46.1±7 (range: 36 to 60) degrees. Acetabular component inclination angle was 45 degrees and below in 22 hips and over 45 degrees in 19 hips. There was no significant difference between the clinical results of patients with an acetabular inclination of 45 degrees or below and those with an acetabular inclination exceeding 45 degrees ($p>0.05$).

Discussion

While there is no consensus on the optimal fixation angle of the femoral component, a slight valgus orientation is generally recommended. Ganapathi et al. asserted that inefficiency is more common when the femoral component is in the varus position (less than 130 degrees), and indentation at the femoral neck may occur in excessive valgus position.[2] According to Beaulé et al., a femoral component in excessive valgus may cause indentation at the femoral neck and reduce blood flow at the femoral head. In order to preserve the blood supply, an excessive dissection of the femoral neck should be avoided.[3]

In our series, we made no extensive dissection of the proximal femur and had no femoral neck fracture complication in our follow-ups.

Beaulé et al. stated that inserting femoral component at a valgus position reduces the offset[3,4] While the clinical relevance is not yet evident,[5] the reduced offset may predispose impingement. It is recommended to evaluate the offset compatibility on preoperative radiographs.[3] Amstutz suggested inserting the femoral component at a neck-shaft angle of 140 degrees.[6]

Falez et al.[7] asserted that inappropriate alignment may cause proximal indentation or femoral neck fractures. In cadaveric studies, proximal indentations of 4 mm were shown to create a weakness sufficient to create a femoral neck fracture. Moreover, 10 degrees of varus position increased anterosuperior and posterosuperior stress distribution of the femoral neck by up to 15 to 21%. Indentations of less than 3 mm or femoral varus of less than 10 degrees were not associated with femoral neck fractures. The presence of avascular necrosis in the histopathological examination of those cases with fractures complicates understanding of the fracture mechanism. Damage in the extraosseous vessels may cause a 50% reduction in blood flow to the femoral head. Moreover, avascular necrosis can be seen as a consequence.[7]

Radcliffe et al. discovered that loading on the femoral neck from the femoral components at the valgus position has the appearance of a normal femur. When the fixation angle of the femoral component is set from the varus to the valgus position, the loading decreases on the inferior femoral neck as it increases on the superior femoral neck.[8]

As proposed by Silva, it is recommended that the femoral components be fixed at 5 degrees valgus position according to measured neck-shaft angles.[9]

We found a mean femoral component neck-shaft angle of 139.5 degrees. Furthermore, the femoral component was at varus position in 4 patients, neutral in 3 and at valgus position in the remaining.

Morlock et al. stated that the first hundred of all the patients subject to surface replacement prosthesis with revision problems are assumed to be a learning curve, since the revision problems have emerged within these patients. They also reported that problems associated with the acetabular component emerge due to poor cap adhesion and angulation problems.[10] As seen in the literature, the average inclination angle of the acetabular component is 45 degrees more than the generally accepted value.[1,11] We found a mean acetabular component inclination angle of 46.1 degrees. Kim et al. stated that the most common cause of revision surgeries is the deficiency of acetabular components, which is a result of the learning curve.[12]

In conclusion, in accordance with our experience from our series, we recommended that the acetabular components be fixed at an inclination angle close to 45 degrees. However, we did not find a significant relationship between the fixation angles of hip resurfacing implants and hip scores. We believe the relationship between the insertion angle of the acetabular component and functional outcomes in hip resurfacing implants should be evaluated in a larger series with longer follow-up periods.

Conflicts of Interest: No conflicts declared.

References

1. Giannini S, Moroni A, Romagnoli M, Cadossi M. Hip resurfacing: mid-term results of the last-generation metal-on-metal devices. J Orthop Traumatol 2007;8:202-6.
2. Ganapathi M, Vendittoli PA, Lavigne M, Günther KP. Femoral component positioning in hip resurfacing with and without navigation. Clin Orthop Relat Res 2009;467:1341-7.
3. Beaulé PE, Harvey N, Zaragoza E, Le Duff MJ, Dorey FJ. The femoral head/neck offset and hip resurfacing. J Bone Joint Surg Br 2007;89:9-15.
4. Beaulé PE, Lee JL, LeDuff M, Amstutz HC, Ebramzadeh E. Orientation of the femoral component in surface arthroplasty of the hip. A biomechanical and clinical analysis. J Bone Joint Surg Am 2004;86-A:2015-21.
5. Shimmin AJ, Back D. Femoral neck fractures following Birmingham hip resurfacing: a national review of 50 cases. J Bone Joint Surg Br 2005;87:463-4.
6. Amstutz HC. The THARIES hip resurfacing technique. Orthop Clin North Am 1982;13:813-32.
7. Falez F, Favetti F, Casella F, Panegrossi G. Hip resurfacing: why does it fail? Early results and critical analysis of our first 60 cases. Int Orthop 2008;32:209-16.
8. Radcliffe IA, Taylor M. Investigation into the effect of varus-valgus orientation on load transfer in the resurfaced femoral head: a multi-femur finite element analysis. Clin Biomech 2007;22:780-6.
9. Silva M, Lee KH, Heisel C, Dela Rosa MA, Schmalzried TP. The biomechanical results of total hip resurfacing arthroplasty. J Bone Joint Surg Am 2004;86-A:40-6.
10. Morlock MM, Bishop N, Zustin J, Hahn M, Rüther W, Amling M. Modes of implant failure after hip resurfacing: morphological and wear analysis of 267 retrieval specimens. J Bone Joint Surg Am 2008;90 Suppl 3:89-95.
11. Girard J, Lavigne M, Vendittoli PA, Roy AG. Biomechanical reconstruction of the hip: a randomised study comparing total hip resurfacing and total hip arthroplasty. J Bone Joint Surg Br 2006;88:721-6.
12. Kim PR, Beaulé PE, Laflamme GY, Dunbar M. Causes of early failure in a multicenter clinical trial of hip resurfacing. J Arthroplasty 2008;23(6 Suppl 1):44-9.