



Original Article

Clinical and radiographic outcomes of hip resurfacing arthroplasty after eight years – a retrospective study[☆]



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ABSTRACT

Objective: To assess the clinical and radiographic outcomes of hip resurfacing arthroplasty for the treatment of hip osteoarthritis.

Methods: This study retrospectively assessed 30 patients with hip osteoarthritis who underwent hip resurfacing arthroplasty between 2005 and 2014. Patients of both genders suffering from advanced primary and secondary hip osteoarthritis were included in the study. Data were collected about postoperative complications and the need for revision of the arthroplasty. Antero-posterior pelvis and lateral hip x-rays were performed in order to classify osteolysis according to the Amstutz criteria; the Lequèsne index of severity for osteoarthritis of the hip and the UCLA activity level questionnaires were answered pre- and postoperatively.

Results: After a mean follow-up of eight years, a statistically significant improvement was observed between the mean of the outcomes of both scores, when compared pre- and postoperatively ($p < 0.001$). Nevertheless, there was a high incidence of arthroplasty revision (20%), related to the size of the femoral stem and errors in surgical technique.

Conclusion: Using the appropriate technique, hip resurfacing arthroplasty can present good results in well-selected patients.

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Avaliação do resultado clínico e radiográfico das próteses de recapeamento de quadril após oito anos – estudo retrospectivo

R E S U M O

Palavras-chave:

Osteoartrite
Prótese de quadril
Artroplastia de quadril
Falha de próteses

Objetivo: Avaliar o resultado clínico e radiográfico dos pacientes submetidos à prótese de recapeamento de quadril para o tratamento da osteoartrose de quadril.

Métodos: Foram avaliados retrospectivamente 30 pacientes com coxartrose tratados com prótese de recapeamento de quadril entre 2005 e 2014. Foram incluídos no estudo pacientes de ambos os sexos portadores de osteoartrose de quadril avançada, primária ou secundária. Foram coletados dados sobre complicações pós-operatórias e necessidade de revisão da prótese. Foram feitas radiografias AP de bacia e perfil de quadril para classificação da osteólise segundo os critérios de Amstutz; os questionários do escore funcional de Lequèsne e do nível de atividade física do escore UCLA foram aplicados nos períodos pré e pós-operatórios.

Resultados: Após um seguimento médio de oito anos, observou-se melhoria estatisticamente significativa entre as médias dos resultados pré e pós-operatórios de ambos os escores ($p < 0,001$). Entretanto, foi observada uma elevada taxa de revisão das próteses (20%), correlacionada ao tamanho do componente femoral usado e à falha na técnica cirúrgica.

Conclusão: A prótese de *resurfacing* de quadril pode proporcionar bons resultados, com a técnica adequada, em pacientes selecionados.

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Introduction

Long-term studies have demonstrated the excellent results of total hip arthroplasty (THA) in the treatment of hip osteoarthritis in patients of all ages. However, in young and active patients, especially athletes, THA does not meet the functional demands of these patients.¹ It was to meet such demands that, in the 1980s, the hip resurfacing prosthesis was developed, aimed at young and active patients, mainly due to the preservation of the femoral bone stock, as well as restoration of hip biomechanics, greater range of motion, lower dislocation index, possibility of return to sports activities, more physiological gait sensation, ease of revision, and lower rates of complications and postoperative mortality.^{1,2}

Despite these advantages, hip resurfacing is surrounded by controversy. The first generation of implants was discontinued due to a high rate of wear caused by a large metal head that articulated with conventional polyethylene. The second generation of implants was developed with a metal-on-metal tribological pair to reduce wear, but this interface presented complications such as adverse reactions to metal debris, which may cause the so-called pseudotumor, whose pathophysiology is not fully understood; aseptic reactions of lymphocyte-associated vasculitis and metallosis²; increased serum levels of chromium and cobalt ions; aseptic release; and femoral neck fracture.³

Due to these complications, many orthopedists have abandoned the use of hip resurfacing prostheses in the last decade,⁴ while a minority continues to use them due to the good short and medium-term outcomes in selected cases, such as those of male, young, and active patients with primary hip osteoarthritis.^{1,2,5,6}

The present study is aimed at retrospectively evaluating the clinical and radiographic results of patients who underwent hip resurfacing arthroplasty in this institute.

Material and methods

The research was duly approved by the Research Ethics Committee of the institution and all patients signed an Informed Consent Form.

Between 2005 and 2014, 33 patients (38 hips) underwent hip resurfacing arthroplasty by the Hip Group of this Institute.

The study included all patients who underwent hip resurfacing arthroplasty for the treatment of primary or secondary coxarthrosis, such as femoral head osteonecrosis, slipped capital femoral epiphysis, and sequelae from traumatic hip dislocation, among others, with at least one year of follow-up. Patients who did not respond to the contact for an interview and radiographic update were excluded from the study.

The functional scores of Lequèsne et al.,⁷ validated for Brazilian Portuguese,⁸ and the UCLA physical activity score⁹ were retrospectively applied in order to assess preoperative conditions, as well as current symptoms; anteroposterior and lateral radiographs of the operated hip were also made. The radiographs were evaluated to identify osteolysis around the acetabular and femoral components, following the criteria of Amstutz et al.,¹⁰ described in Table 1; the positioning of each of the components was also analyzed. The femoral component was defined as in valgus when it presented a stem-diaphyseal angle 5° greater than the original cervico-diaphyseal angle and defined as positioned in varus when it presented a stem-diaphyseal angle 5° smaller than the cervico-diaphyseal angle.¹⁰

Table 1 – Classification of osteolysis around the femoral and acetabular components in accordance with the criteria of Amstutz et al.¹⁰

	Femoral component	Acetabular component
0	Not radiolucent	Not radiolucent
1	Radiolucent in zone 1 (superior)	Radiolucent in zone I
2	Radiolucent in zone 2	Radiolucent in zone II
3	Radiolucent in zone 3	Radiolucent in zone III
4	Radiolucent in zones 1 and 2	Radiolucent in zones I and II
5	Radiolucent in zones 2 and 3	Radiolucent in zones I and III
6	Radiolucent in zones 1 and 3	Radiolucent in zones II and III
7	Radiolucent in zones 1-3 (incomplete)	Radiolucent in zones I-III (incomplete)
8	Radiolucent in zones 1-3 (complete)	Radiolucent in zones I-III (complete)
9	Component migration	Component migration

The pre and postoperative results of the Lequesne and UCLA scores were compared using the paired Student's t-test. Moreover, the clinical results were correlated with the radiographic findings of each patient. A 5% significance level was adopted.

In addition to these data, information on postoperative complications such as infection, thromboembolic events, neurological injury, and early death was collected from the medical records, as well as complications that required prosthesis revision.

Results

Of the 33 patients (38 hips) operated in the period, seven (eight hips) were excluded, as the authors were unable to contact these patients for questionnaires and radiographic update. Therefore, 26 patients (30 hips) were included in the study.

The Kolmogorov-Smirnov normality test was applied to assess whether the scales presented normal distribution, and this assumption was accepted for all scales and all moments of evaluation.

The analysis of the demographic data indicated that the mean age of the patients was 44.2 years (± 9.4 years); 17 (65.4%) were male, and surgery was performed on 18 (60%) right and 12 (40%) left hips. The mean follow-up time was 8.1 years (± 2.63 years).

Statistical analysis demonstrated that the mean score of the Lequesne index, in which a lower value indicates a better functional outcome, decreased statistically from the preoperative period (16.2 ± 3.8) to the current time (8.9 ± 7 ; $p < 0.001$), and the mean score of the UCLA questionnaire for physical activity level, in which the lowest value (0) indicates a severe limitation of physical activity and the highest value (10) indicates a regular participation in impact activities, was statistically significantly higher in the preoperative period (3.1 ± 1) when compared with the current time (5 ± 1.9 ;

Table 2 – Description of the assessed scales over time, and results of comparative tests.

Variable	Preoperative period (n = 24)	Postoperative period (n = 24)	p
Lequesne			<0.001
Mean \pm SD	16.2 ± 3.8	8.9 ± 7	
Median (min; max)	17 (10; 22)	9 (0; 22)	
UCLA			<0.001
Mean \pm SD	3.1 ± 1	5 ± 1.9	
Median (min; max)	3 (1; 5)	5 (1; 8)	

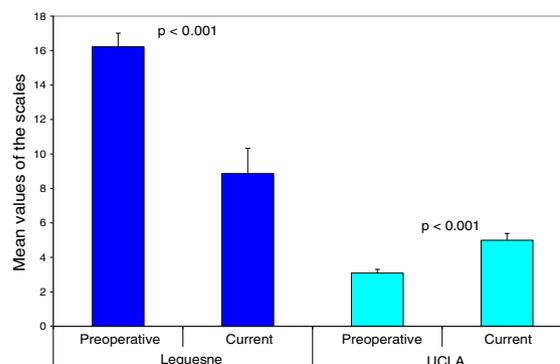


Fig. 1 – Mean values and respective standard errors of the scales evaluated over time, and results of the comparative tests.

$p < 0.001$), when applied in patients who did not require prosthesis revision of the prosthesis, as shown in Table 2 and Fig. 1.

Of the 30 hips operated in this series of cases, six (20%) required revision, four (66.7%) due to aseptic loosening of the femoral component and two (33.3%) due to femoral neck fracture.

Among the surgical complications that did not require arthroplasty revision, there was one case of a complete lesion of the fibular nerve (3.3%), which evolved with complete recovery after one year of surgery; there were no cases of postoperative infection, DVT/PTE, heterotopic ossification, dislocation, lower limb dysmetria, or adverse reactions to metallic debris, and no deaths related to the surgical procedure were observed.

The radiographic evaluation of the patients revealed that the mean size of the acetabular components was 52.8 mm (± 3.8 mm) and of the femoral components, 46.6 mm (± 3.6 mm). The mean difference between the femoral cervicodiaphyseal angle and the stem-diaphyseal angle of the prosthesis was 2.82° ($\pm 6.8^\circ$); the valgus positioning was defined as a positive value and the varus positioning, negative. In patients who did not require prosthesis revision, in accordance to the classification of Amstutz et al.,¹⁰ the mean osteolysis around the femoral components was 2.3 (± 2) and around the acetabular components, 2.7 (± 2).

When assessing the patients who underwent revision due to femoral component loosening, it was observed that the two female patients had small femoral components (40 and 42 mm). One patient had two cysts larger than 2 cm each in

the femoral head, preoperatively, in addition to a femoral component that measured 44 mm; and one patient had a 44 mm femoral component placed at 10° of varus in relation to its original cervicodiaphyseal angle. On radiographic evaluation of the two patients who underwent revision due to femoral neck fracture, it was observed that in one, the upper cortical of the cervix was damaged during milling and in the other, the acetabular component was exceedingly horizontal, at an angle of 21°, probably causing impact of the ridge of the acetabular component on the femoral neck during hip flexion and abduction.

Correlating the clinical and radiographic results of patients who remained with the resurfacing prosthesis, it was observed that, of the five patients who presented poor clinical results (worsened or unimproved Lequèsne and UCLA scores), four had their femoral components placed in valgus or excessive varus (at least 10° difference between the cervicodiaphyseal and stem-diaphyseal angles), and one presented acetabular component release. Of the 19 patients who presented good clinical results, two had grade 7 osteolysis around the acetabular component, one patient had two guidewires broken during the surgical procedure that were left *in situ*, and the remainder did not present noteworthy alterations.

Discussion

In the past decade, the hip resurfacing prosthesis was reconsidered as a useful option in the treatment of young patients with hip osteoarthritis who aimed at maintaining a physically active life. However, its use is currently questioned, since the arguments used to support this procedure have not been proven by scientific evidence.⁴

The promise of a longer durability of the resurfacing prosthesis, due to the metal-on-metal interface, was not achieved. Literature reports indicate a mean period of three years until revision for this procedure, vs. 7.8 years for THA.¹¹ In the present study, the mean time to revision was four years. More optimistic reports show a 90% durability rate in 29 years of follow-up with the more modern THA implants,¹² while Daniel et al.,⁵ in their prospective study of 1000 patients, showed an overall 10-year survival rate of 97.4% and 15-year survival rate of 95.8% with the resurfacing prosthesis. In the present study, a revision rate of 20% was observed at eight years of follow-up. However, this difference can be explained by several factors; the implant used in the present study was the Cormet (Corin), which had a high rate of complications and is no longer used,^{2,13} while in the study by Daniel et al.⁵ the Birmingham Hip Resurfacing System (BHR – Smith & Nephew), the implant that has presented the best results to date, was used.^{2,5,11,14,15} The study by Daniel et al.⁵ prospectively evaluated 1000 hips operated by the same surgeon, who had previously operated on another 500 prior to the study, while the present study was performed with 30 operated hips (in addition to eight not included in the evaluation); it is widely described in the literature that the first cases operated are those that present the worst results, due to the steep learning curve caused by the technical difficulty of this procedure.^{2,5,16}

Another factor that probably had an important role in the high revision rate of the present series was the size

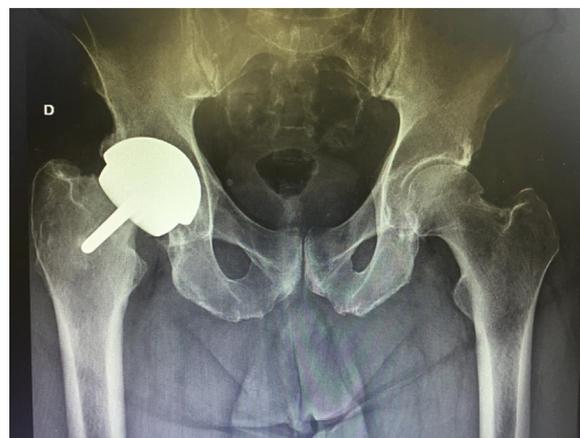


Fig. 2 – Femoral neck fracture resulting from lateral cortex lesion during the surgical procedure.

of the implants, with an overall mean of 46.6 mm of the femoral components, and of 43.6 mm (± 2.9 mm) in revised hips. Femoral components smaller than 48 mm have been shown to be an important risk factor for aseptic loosening; therefore, several authors have mentioned a small femoral head (in the patient's original hip) as a contraindication for the hip resurfacing prosthesis.^{10,17,18} In the present study, a femoral component smaller than 48 mm presented an odds ratio of 2.8 for the occurrence of aseptic loosening when compared with a component larger than or equal to 48 mm.

Of the six hips that required revision surgery, four were due to loosening of the femoral component and two due to femoral neck fracture. Of the four patients with component loosening, three presented a femoral component smaller than 48 mm and one had osteonecrosis of the femoral head with two cysts greater than 2 cm each, another condition widely accepted as a risk factor for the femoral component and as a contraindication for the procedure.^{5,10,13}

A femoral neck fracture is another complication described only with this type of prosthesis. Marker et al. prospectively evaluated the incidence of femoral neck fracture and found that the surgeon's experience is the main risk factor; 89% of cases occurred in the first 69 operated hips, probably due to injury to the lateral cortex of the femoral neck during milling.¹⁶ The study by Shimmin and Back¹⁹ confirms this statement and adds that components placed in varus are also a risk factor for femoral neck fracture. Corroborating these statements, one of the patients in the present study who presented femoral neck fracture had a lateral cortex lesion (Fig. 2), and another had a femoral component placed at 12° varus in relation to the patient's original cervicodiaphyseal angle.

Despite the fact that the present study presented a high rate of revision (20%) in the follow-up period, a large proportion of the patients presented a significant improvement in pain and function of the operated hips when evaluated by Lequèsne algofunctional questionnaire ($p < 0.001$). This finding is similar to that of several other studies, which showed good results of hip resurfacing arthroplasty in selected patients, the main characteristics being men aged less than 50 years, absence of deformity in the femoral head or acetabulum, use of femoral components greater than 48 mm, and

absence of cysts >1cm in the femoral head, in addition to the surgeon's experience and familiarity with the surgical technique, and use of the Birmingham Hip Resurfacing prosthesis.^{3,5,13}

The limitations of the present study include the small number of patients operated on, its retrospective design and subsequent assessment of the patients' preoperative conditions, and absence of a control group, which can lead to biases. New, prospective, randomized, and controlled studies should be conducted to clarify the possible benefits of hip resurfacing arthroplasty when compared with THA, considering the increasing use of metaphyseal stems in young patients, the use of larger femoral heads, that decrease the dislocation rate, and the advent of more modern polyethylene inserts, which are expected to provide greater durability to the new generation of THA prosthesis.

Conclusion

The hip resurfacing prosthesis, despite providing good results in selected patients, mainly young and active men with primary hip osteoarthritis, presents a high rate of complications and should not be routinely used.

Conflicts of interest

The authors declare to have no conflicts of interest.

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