Original Article

Preoperative planning of primary total hip arthroplasty using conventional radiographs

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ABSTRACT

Objective: the objective of this study was to present an analog method for preoperative planning of primary total hip arthroplasty procedures based on measuring the components by overlaying the transparencies of the prosthesis on the preoperative radiographs and checking the accuracy, both for predicting the size of the acetabular and femoral components used and for restoring the offset and correcting the dysmetria.

Methods: between March 2005 and July 2009, 56 primary total hip arthroplasty procedures performed on 56 patients at the Mario Covas State Hospital in Santo André were analyzed. The measurements on the femoral and acetabular components obtained through planning were compared with those that were used in the surgery. The offsets measured through the preoperative planning were compared with those measured on the postoperative radiographs. Dysmetria was evaluated before and after the operation.

Results: accuracy of 78.6% (p < 0.001) in predicting the size of the acetabular component and 82.2% (p < 0.001) in predicting the femoral nail was observed. The offsets measured through preoperative planning were statistically similar to the offsets measured on the postoperative radiographs. After the operation, we observed absolute equalization in 48.2% of the cases. In 87.5%, the dysmetria was less than or equal to 1 cm and in 69.6%, it was less than or equal to 0.5 cm.

Conclusions: the accuracy was 78.6% and 82.2%, respectively, for the acetabular and femoral components. The offsets that were planned preoperatively were statistically similar to those measured on postoperative radiographs. We found absolute equalization in 48.2% of the cases.

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Planejamento pré-operatório de artroplastias totais primárias de quadril com o uso de radiografias convencionais

**RESUMO**

**Objetivos:** apresentar um método analógico de planejamento pré-operatório de artroplastias totais primárias de quadril baseado na medida dos componentes pela sobreposição das transparências da prótese sobre a radiografia pré-operatória. E verificar a acurácia, tanto na previsão do tamanho do componente acetabular e do componente femoral usado como na restauração do offset e na correção das dismetrias.

**Métodos:** entre março de 2005 e julho de 2009 foram analisadas 56 artroplastias totais primárias de quadril feitas em 56 pacientes no Hospital Estadual Mário Covas. As medidas dos componentes femorais e acetabulares obtidas no planejamento foram comparadas com as que foram usadas na cirurgia. Os offset medidos no planejamento pré-operatório foram comparados com os medidos na radiografia pós-operatória. A dismetria foi avaliada nos momentos pré e pós-operatórios.

**Resultados:** foi observada uma acurácia de 78,6% (p<0,001) na previsão do tamanho do componente acetabular e de 82,2% (p<0,001) na previsão da haste femoral. Os offset medidos no planejamento pré-operatório foram estaticisticamente semelhantes aos offset medidos na radiografia pós-operatória. No pós-operatório observamos a equalização absoluta em 48,2% dos casos. Em 87,5% a dismetria foi igual a ou menor do que 1 cm e em 69,6% foi igual a ou menor do que 0,5 cm.

**Conclusões:** a acurácia foi de 78,6% e 82,2%, respectivamente, para os componentes acetabulares e femorais. Os offset planejados pré-operatório foram estaticisticamente semelhantes aos medidos na radiografia pós-operatória. Verificamos equalização absoluta em 48,2% dos casos.

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**Introduction**

Preoperative planning for hip arthroplasty procedures was initially poorly understood and used, since the designs and sizes of the prostheses were very limited. Today, the variety of designs and the number of sizes of the components have increased considerably, and total hip arthroplasty has been transformed into a more complex procedure.

Preoperative planning makes it possible to appropriately choose the sizes of the components, equalize the limbs and reduce the duration of the operation.

Charnley demonstrated the importance of preoperative radiographic studies for choosing the correct size of the prosthesis components, and also emphasized the importance of restoring the offset. The latter is directly related to the stability of the arthroplasty.

Dysmetria is a frequent complication of total hip arthroplasty. It causes lumbalgia, gait disorders and sciatic nerve injuries.

In this study, using conventional radiographs, we present a preoperative planning method for primary total hip arthroplasty based on measuring the components through overlaying transparencies of the prosthesis on the preoperative radiograph. The study had the following objectives: to assess the accuracy of predicting the sizes of the acetabular and femoral components; to analyze the restoration of the offset; and to correct the dysmetria.

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**Material and methods**

The project for this study was approved by the Ethics Committee of the ABC Medical School, under the number CEP 258/2007.

Between March 2005 and July 2009, 56 primary total hip arthroplasty procedures performed on 56 patients at Hospital Estadual Mário Covas were analyzed.

The mean age was 65 years. In all, 37 patients (66.1%) were female and 19 (33.9%) were male. All the patients had a diagnosis of arthrosis.

The inclusion criterion was the presence of unilateral hip arthrosis. The exclusion criteria were bilateral arthrosis; moderate or severe acetabular protrusion according to the Sotelo-Garza and Charnley classification; acetabular dysplasia greater than Crowe type I; femoral neck fracture; and alterations in other joints that caused dysmetria.

All the arthroplasty procedures were total and cemented, and were performed using a posterior approach.

Pelvic radiographs were performed in anteroposterior (AP) view, centered on the pubic symphysis, with the lower limbs rotated internally by 15° and a distance of 1 m between the bulb of the apparatus and the film; and in lateral view covering the proximal one-third of the femur.

The acetabular component was measured by overlaying the acetabular transparency on the AP radiograph of the normal hip, in order to choose the number that fitted the outline of the acetabulum best. The parameters used were the upper lateral border of the acetabulum, the teardrop and Köhler’s iliosciatic line (Fig. 1A and B). The size of the acetabular component was...