



## ORIGINAL ARTICLE

# Study of the consistency of a system for digital preoperative planning in total arthroplasty of the hip<sup>☆</sup>

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### KEYWORDS

Preoperative templating;  
Total hip arthroplasty;  
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Agreement

### Abstract

**Objective:** To check the agreement of a preoperative digital templating, compared with the final result in the postoperative radiograph.

**Material and method:** The study was carried out in 55 total hip prosthesis cases. A templating-software Neteous<sup>®</sup> (Socinser<sup>®</sup>, Gijón, Spain) was used. Agreement was measured using the Kappa Index for the stem offset or Lin Index for others variables: stem size, cup size, femoral neck length, and the distance from the centre of rotation of the femoral head to the lesser trochanter. The percentage of accurate hits was also described.

**Results:** Stem size: the exact success or error of only one size was of 61.6%. Quantitatively the Lin Index was 0.64 (substantial). Horizontal offset: satisfactory agreement was obtained (Kappa Index of 0.75). In 6 cases (10.90%) was changed to lateralised during surgery, for more joint stability. Size of the cup: the agreement obtained was 0.67 (substantial) with a hit grade of 43.6%. Prosthetic neck length: the exact hit or error of only one size were found in 50.9%, moderate level of agreement. Distance from the centre of rotation to the lesser trochanter: was observed for almost perfect agreement with Lin Index of 0.95. The exact percentage of hits or gap error less than 5 mm was 74.5%.

**Discussion and conclusion:** In ours hands, the preoperative templating software analysed, has provided acceptable agreement rates, when compared with the postoperative result. But it takes more works verified by independent observers.

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**PALABRAS CLAVE**

Planificación preoperatoria; Prótesis total de cadera; Software; Concordancia

## Estudio de la concordancia de un sistema de planificación preoperatoria digital en artroplastia total de cadera

**Resumen**

**Objetivo:** Comprobar el grado de concordancia de un sistema informático de planificación preoperatoria, en comparación con el resultado final en la radiografía postoperatoria.

**Material y método:** Se analizaron 55 implantes de prótesis total de cadera. Se utilizó un programa informático de planificación comercializado Neteous® (Socincer®, Gijón, España). La valoración de la concordancia se realizó calculando el índice Kappa para el tipo de vástago o el índice de concordancia de Lin para el resto de medidas: talla de vástago y cotilo; cuello protésico; y distancia desde el centro de rotación a trocánter menor. También se describieron los porcentajes de aciertos.

**Resultados:** Tamaño de vástago: el acierto exacto o con error de solo una talla fue del 61,6%; cuantitativamente fue un Lin de 0,64 (sustancial). *Offset* horizontal: se obtuvo una concordancia satisfactoria (índice de Kappa de 0,75). En 6 casos (10,90%) se cambió a lateralizado durante la cirugía, para obtener mayor estabilidad articular. Tamaño del cotilo: la concordancia obtenida fue de 0,67 (sustancial) con un grado de aciertos del 43,6%. Longitud del cuello protésico: los aciertos exactos o con error de solo una talla se hallaron en un 50,9%, nivel de concordancia moderada. Distancia del centro de rotación a trocánter menor: se apreció una concordancia casi perfecta con un Lin de 0,95. El porcentaje de aciertos exactos o con discrepancia inferior a 5 mm fue del 74,5%.

**Discusión y conclusión:** En nuestras manos el sistema informático de planificación preoperatoria analizado ha proporcionado índices de concordancia aceptables al compararlo con el resultado postoperatorio. No obstante, hacen falta trabajos que sean verificados por observadores independientes.

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**Introduction**

Preoperative planning is an action that should be routinely carried out in the total hip arthroplasty process. It identifies biomechanical, anatomical and surgery technique factors that are of great use during surgery so as to increase the functionality and longevity of the arthroplasty. The success of hip arthroplasty primarily depends on proper positioning of the components to optimise surgery results.<sup>1</sup>

Furthermore, preoperative planning allows for proper selection of component size, reduces the risk of intraoperative periprosthetic fractures, helps to restore overall offset (femoral and acetabular) of the hip and makes it possible to reduce the probability of lower limb length discrepancy and of prosthetic dislocation. In addition, planning makes components more readily available for the surgeon, thus minimising inventory costs.<sup>2</sup>

Presently, the preoperative planning system about conventional radiography, using acetate templates provided by commercial establishments, has become obsolete. The great majority of these templates have 15–20% magnification (seen as “normal” in conventional X-rays), which brings with it a significant margin of error.<sup>3</sup> The inability to precisely determine the magnification of an X-ray is perhaps the biggest problem in preoperative planning, because conventional templates with pre-established magnifications make modifications or compensations impossible.<sup>4</sup> Conn et al.<sup>5</sup> found that classic preoperative planning coincided with component selection by only 69%.

In digital preoperative planning, the magnification measurements from both the templates and the digital X-rays

can be unified. This led us to the hypothesis that upon using digital planning whose protocol includes digital X-rays, we would obtain a higher final agreement. This combination has the potential to eliminate errors associated with the manual manipulation of templates and X-rays.<sup>6</sup>

The objective of this study was to retrospectively test the degree of concordance of a digital preoperative planning system that assessed component size, as well as the horizontal and vertical offset of a total hip arthroplasty.

**Methods and materials**

A retrospective study was performed with patients who underwent cementless total hip arthroplasty between 2005 and 2011. With these patients, Neteous® software (Socincer®, Gijón) Spain was used for the preoperative planning. Osteoarthritis of the hip was the main diagnosis that motivated total prosthetic implantation. Patients were not included if they showed necrosis effects in the femur head, rheumatoid arthritis, fractures or effects from infectious or neoplastic processes. The objective was to obtain a homogeneous group regarding the hip morphology.

All patients were operated on by a single senior surgeon at the hip unit in our hospital. Intervention was performed via lateral access modified by Hardinge.<sup>7</sup> All prosthetics were the cementless PROSIC® model (Socincer®, Gijón, Spain).

Planning was performed sequentially, following protocols according to a technique developed by a surgeon in our unit, after his inclusion in the Neteous® programme (Socincer®, Gijón, Spain). This planning is further detailed below.

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