

Three-Dimensional, CT-Assisted Planning Aid In Primary Hip Arthroplasty

Orthopaedics / Pelvis, Hip & Femur / Joint Replacement - Primary

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Background

The endoprosthetic replacement of the hip joint represents a considerable intervention in the biomechanics of the human body. For this reason, such interventions require detailed preoperative planning, aimed not only at reconstructing the natural centre of rotation as accurately as possible, but also at making as precise as possible a forecast concerning the size and position of the prosthesis, leg length, and any special intraoperative features that might be encountered, in order to avoid complications. At present, preoperative planning is done using conventional x-rays, whereby exact planning is hampered by factors such as different enlargements, the projection angle not always being accurate, as well as imaging of the entire volume.

Objectives

The objective of our study was to test the feasibility and practicability of a 3D planning system.

Study Design & Methods

In 586 patients (average age 71.6 (31-95) years) with diseases of the hip requiring endoprosthetic treatment, a CT was performed preoperatively for 3D planning. For this purpose, a continuous spiral from the iliac crest to 20 cm distally of the acetabulum was prepared, with a slice thickness of 2 mm and a reconstruction interval of 2.5 mm. In addition, 6 single slices with a slice thickness of 2 mm were prepared in the area of the knee joint to determine the bicondylar plane. The data were further processed in DICOM format on an external workstation for 3D planning, with the aid of special software (SYMBIOS® 3D-Hip Plan), whereby an exact presentation of the acetabulum and femur was possible in all three planes. After establishing the pelvic axis and determining the original centre of rotation, first the acetabular cup was positioned and then the stem.

Results

In 545/586 patients (93%), the acetabular cup was successfully implanted as planned. In the area of the stem, in 26/586 patients (4.5%) an individual stem was implanted, as adequate treatment could not have been achieved here, even if the modular stem had been used. In the remaining 560 patients, the planning was implemented exactly in 532/560 patients (95%).

Conclusions

3D hip planning enables a preoperative simulation of implant positioning, which makes it possible to optimally determine and reconstruct the centre of hip rotation. Potential

difficulties that might arise intraoperatively can already be identified preoperatively. Patients who require an custom made stem can be reliably identified.