Accuracy of an MRI based patient matched cutting jigs technology in TKA: evaluation with navigation

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Introduction: In recent years, patient-specific instrumentation (PSI) has been introduced with the aim to reduce the overall costs of the implants, minimizing the size and number of instruments required, and also reducing surgery time. However these systems should also be precise enough to eventually result in a good alignment.

The aim of this study is to investigate the accuracy and reliability of a MRI based Patient Match Technology system (VISIONAIRE, Smith & Nephew, Inc, Memphis, Tenn) by intraoperative use of VectorVision knee navigation System from BrainLAB (Redwood City, Calif).

Methods: Between February 2011 and May 2011, 15 patients with primary gonarthrosis were selected for unilateral TKR. The first three patients were excluded from this study, as they were considered as a warm up to set up the procedure. Therefore 12 patients entered the study. Preoperatively all patient underwent a full-length weight-bearing radiograph in A-P and a MRI of the knee according to the protocol suggested and approved by the manufacturer in order to set up the custom made cutting guides. All patients were operated with cemented posterior stabilized prosthesis cruciate ligament sacrificing (Journey BCS, Smith & Nephew, Inc, Memphis, Tenn) by the same surgeon using the VISIONAIRE patient matched cutting jigs.

During surgery, once the guides were placed and fixed according to the surgical technique, the actual orientation was checked by the navigator (see FIG 1a, 1b, 1c). The following parameters were evaluated: size of the implant, alignment in coronal and sagittal plane of both tibial and femoral components.

An unsatisfactory result was considered an error ≥ 2° in both plane for each component as a possible error of 4° could result in aggregate.

Results: On the coronal plane the mean deviation of the tibial guide from the ideal alignment was 1.2°±1.5 (range 0-5°) with 2 cases > 2°, while in the sagittal plane it was 3.8°±2.4 (range 0-7.5°) with 7 cases exceeding 2°. On the coronal plane the mean deviation of the femoral guide from the ideal alignment was 1.2°±0.6 with 1 case > 2°, while in the sagittal it was 3.7°±2.0 with 3 cases exceeding 2°. The sizes of the custom cutting blocks were correct in all the patients.

Discussion and Conclusions: The results of this preliminary study documented a only fair accuracy of the method with a consistent risk of error of more than 2°, especially in the sagittal plane.

We could speculate that the great error found in the tibial slope and femoral flexion is due to the lack of a preoperative radiological study of the overall lower limb in lateral view as only a MRI imaging extending 8 cm below joint line is acquired preoperatively.

On the basis of this preliminary experience, the PSI system based only on data acquisition with A-P radiograms and RMN cannot be defined as accurate. In case of use of custom-made cutting jigs, we recommend an accurate control of the alignment in any step of the procedure.