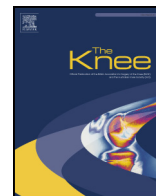




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The Knee



Alignment in total knee arthroplasty – A comparison of patient-specific implants with the conventional technique

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ABSTRACT

Background: Incorrect positioning and malalignment of total knee arthroplasty (TKA) components can result in implant loosening. Restoration of neutral alignment of the leg is an important factor affecting the long-term results of TKA. The aim of our retrospective study was to compare mechanical axis in patients with conventional and patient-specific TKAs.

Methods: 232 patients who underwent TKA between January 2013 and December 2014 were included to compare postoperative mechanical axis. 125 patients received a patient-specific TKA (iTotal CR®, Conformis) and 107 a conventional TKA (Triathlon®, Stryker). Standardized pre- and postoperative long-leg standing radiographs were retrospectively evaluated to compare the two patient cohorts.

Results: 113 (90%) radiographs of patient-specific TKA and 88 (82%) of conventional TKA were available for comparison. The preoperative deviation from neutral limb axis was 9.0° (0.1–27.3°) in the patient-specific TKA cohort and 8.2° (0.2–18.2°) in the conventional TKA group. Postoperatively the patient-specific TKA group showed 3.2° (0.1–8.4°) and the conventional TKA cohort 2.3° (0.1–12.5°) deviation. However, the rate of ±3° outliers from neutral limb axis was 16% in the patient-specific TKA cohort and 26% in the conventional TKA group.

Conclusions: Patient-specific TKA demonstrated fewer outliers from neutral leg alignment compared to conventional technique. Potential benefits in the long-term outcome and functional improvement require further investigation.

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1. Introduction

Total knee arthroplasty (TKA) is a reliable and highly successful treatment for osteoarthritis of the knee [1, 2]. Correct positioning of the TKA components with axial alignment of the limb and restoration of the mechanical axis are associated with a better outcome [3, 4]. Incorrect positioning and malalignment of the TKA components can result in implant loosening, loss of thickness of polyethylene tibial bearings, eccentric loading, and eventual early revision [5–9]. Previous studies could show that postoperative alignment within the range of 0° ± 3° of the mechanical axis is recommended [3, 4]. Despite various attempts to improve accuracy of conventional TKA positioning errors may occur due to variations in the bony anatomy, visual misjudgement by the surgeon or limitations of technique [10]. Computer-assisted surgery (CAS) can improve mechanical alignment over conventional

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instrumentation but did not result in better outcomes [11]. Customized cutting guides (CCGs) are a further modification of surgical technique in TKA. These are individually manufactured cutting blocks depending on preoperative three-dimensional imaging.

Patient-specific implants (PSI) aim to improve postoperative alignment and positioning using anatomical data obtained primarily from preoperative axial computed tomography (CT) or magnetic resonance imaging (MRI). Disposable cutting jigs and implants specific to a patient's unique anatomy are created. One such PSI system is the iTotal CR® (ConforMIS, Burlington, Massachusetts, USA) which was designed to restore a neutral postoperative mechanical axis, reducing bone resection and optimize component fit using a CT scan to obtain anatomical data to create individual cutting jigs and individual implant components.

The aim of our retrospective study was to compare the mechanical axis in patients with conventional and patient-specific TKAs.

2. Methods

We retrospectively compared 232 patients who underwent TKA in our hospital between January 2013 and December 2014. 125 patients received a patient-specific TKA (iTotal CR, Conformis) and 107 a conventional cruciate retaining TKA (conventional TKA) (Triathlon, Stryker) using a standard instrumentation. Indication for TKA was primary or posttraumatic osteoarthritis, no signs of a mediolateral instability or a massive varus/valgus deformity. All patients underwent a full-leg radiograph standing on both legs and lateral knee radiograph and patella tangential pre- and postoperatively. TKAs were performed by different surgeons. Axial alignment of the limb was evaluated on pre- and postoperative full-length weightbearing radiographs by an independent orthopedic surgeon (DA). For the mechanical axis of the leg and frontal alignment the following angles were measured: the hip–knee–ankle (HKA) angle defined as the angle between the mechanical axis of the femur and the mechanical axis of the

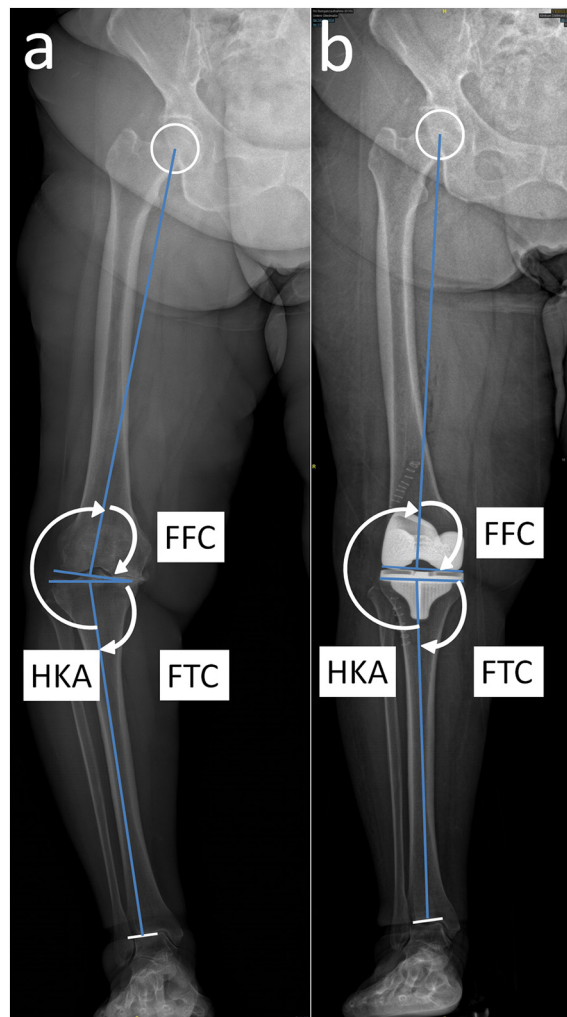


Figure 1. Radiological measurement showing the HKA mechanical axis of the leg, the FFC angles and FTC angles on a) preoperative and b) postoperative long leg radiographs.

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