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The twin peg Oxford knee — Medium term survivorship and surgical principles

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ABSTRACT

Background: A multicentre study of single peg Oxford knees reported failure associated with osteoarthritis progression, femoral component loosening, unexplained pain and meniscal bearing dislocation. Suboptimally positioned femoral components and intraoperative MCL damage could explain these problems. We hypothesised that modifying implantation technique to optimise femoral component positioning and MCL preservation, and introducing the twin peg Oxford knee would address these problems and improve longer term survival. Moreover, its better congruency in high flexion could reduce wear. This study aims to investigate this hypothesis by asking 1) Is the 98% survivorship up to nine years found in an earlier study sustained at longer term (up to 13 years)? 2) What are the remaining causes of failure?

Methods: We described our modified implantation technique. A cohort of all patients treated by the senior author using this modified technique and the Oxford twin peg cemented knee replacement between September 2003 and August 2013 was investigated. A survival analysis was performed and the causes of failure were analysed.

Results: The cohort consisted of 468 patients with 554 medial cemented implants. In all, 16 implants were revised and the 12-year survivorship was 95%. Patients with extended indications had a lower survivorship than those with anteromedial osteoarthritis (10-year survival rate 78% vs 97%, $p < 0.001$). There were no failures due to femoral loosening.

Conclusions: Using our surgical principles the cemented twin peg Oxford knee can result in good medium to long-term implant survival, comparable to those obtained by the originating centre for the single peg Oxford knee.

1. Introduction

The most commonly used design of unicompartmental knee replacement (UKR) is the Oxford knee, which has two cemented (single peg and twin peg) and one cementless (twin peg) version of the femoral component. The cemented Oxford twin peg design evolved from the Oxford phase III single peg design. Besides incorporating an extra femoral peg, it also has an increased arc which allows the component to be inserted in greater flexion, thereby adding more contact and avoid edge contact in deep flexion, reducing the risk of wear. In a multicentre study to which we contributed, the four commonest indications for revision of the single peg Oxford design were progression of osteoarthritis to the lateral compartment, femoral loosening, dislocation of the bearing and unexplained pain [1]. Although the femoral loosening problem might be addressed by using the potentially more stable twin peg design, inadequate surgical technique could also explain these failure modes. Medial collateral ligament damage during insertion could lead to subluxation or dislocation of the meniscal bearing and to valgus malalignment [1,2]. Valgus malalignment

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would overload the outer compartment and predispose to progression of osteoarthritis to the lateral compartment. Malposition of the components could also explain these failure modes [2]. For example, overhanging of components could lead to soft tissue irritation [3], and impingement could lead to pain, wear and loosening [4–6]. Our multicentre study was published more than 10 years ago but the National Joint Registry for England, Wales, Northern Ireland and the Isle of Man (NJR) still shows a high failure rate of 12% at 10 years for the Oxford knee [7] although the same implant has been used both inside and outside Oxford with excellent results [8,9].

In an attempt to address the four commonest causes of failure we encountered [1] we decided to adapt our surgical technique to reduce the risk of medial collateral ligament damage and malpositioning, the most likely causes of osteoarthritis progression, dislocation and pain. We also decided to use a more securely fixed version of the Oxford implant to reduce the risk of femoral loosening. With the approval of our New Procedure Committee and our patients' informed consent, we decided to discontinue the phase III single peg Oxford partial knee in 2003 in favour of the twin peg version. Our first 100 patients showed satisfactory clinical outcomes and radiological appearance when measured at two years [10] and our survivorship of a larger cohort of 249 patients with 288 implants showed a satisfactory cumulative implant survival of 98% at nine years with no cases of femoral loosening [11].

We hypothesised that the good survivorship obtained with the twin peg femoral component that we reported earlier would be maintained up to and beyond 10 years. We also hypothesised that using the twin peg femoral component combined with the adapted technique would reduce the frequency of revision attributable to the four commonest causes found in our multicentre study. The purpose of this paper was to report this longer-term survivorship of the Oxford twin peg knee and to describe the surgical principles which we have used in this group of patients.

2. Patients and methods

The study comprised all patients operated on between September 2003 and August 2013 by the senior author or under his direct supervision using the cemented twin peg Oxford partial knee system (Zimmer Biomet UK Limited, Bridgend, UK). They were treated in two centres. The Information Department of each centre provided up-to-date lists of all operations according to codes which were checked against the surgeon's records. Patients were registered with the UK National Joint Registry during this period. Patients were selected for treatment if they had medial compartment osteoarthritis, which in most cases meant anteromedial osteoarthritis (AMOA) [12]. We also included patients who had extended indications, in particular AMOA patients with more extensive erosion of the lateral femoral condyle or with limited anterior cruciate ligament damage which still preserved some function. In addition, we considered patients with previous localised trauma, such as tibial plateau fracture, or tibial or femoral shaft fractures. We also considered patients with avascular necrosis regardless of aetiology. All these extended indications were recorded at the time of surgery.

2.1. Surgical technique

The manufacturer's published surgical technique [13] contains some but not all of the steps we have taken to reduce the risk of progression of arthritis, unexplained pain, dislocation of the bearing and femoral loosening. Our extra steps were based on our experience and course faculty discussions. The published technique has 11 steps, and we refer to these steps while highlighting where our technique extends beyond the published one. We emphasise the vulnerability of the medial collateral ligament (MCL) during capsular release, meniscectomy and especially the need to avoid accidental section by the saw.

2.1.1. Preservation of the medial collateral ligament

Preserving the medial collateral ligament will reduce the risk of progression of osteoarthritis and dislocation of the bearing. There are four moments during the operation when the MCL is at risk of being damaged, not all of which are emphasised in the published technique.

1. *At the start of the operation (before Step 1)*. If a standard periosteal elevator is used to free the capsule from the tibial plateau the MCL will be damaged. This pitfall can be avoided through the use of a narrow elevator to release the capsule, thus avoiding release of the posteromedial fibres of the MCL, which are attached within one centimetre of the joint line.
2. *When removing posteromedial osteophytes from the medial femoral condyle (Step 1)*. We believe that, unlike the published technique, these osteophytes should only be removed once the tibial plateau has been excised because only then is there sufficient slackness of the MCL to allow its safe retraction.
3. *During the horizontal tibial saw cut (Step 2)*. As the published technique emphasises, this risk can be reduced by protecting the MCL during the saw cut by a suitable metal retractor.
4. *During excision of the remnants of the medial meniscus (Step 4)*. As the meniscus is pulled anteriorly and laterally and a scalpel is used, it is easy to accidentally cut a V-shaped gap in the posteromedial fibres of the MCL, which are attached to the meniscus. The risk of this pitfall can be reduced by gently pushing the knee into valgus, which tenses the ligament and allows the meniscus to be safely excised.

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