Seminars in Arthroplasty 26 (2015) 246–250

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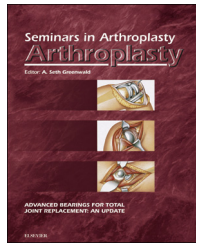

Instabilty in total knee replacement: Causes and management

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ARTICLE INFO

Keywords:
total knee replacement instability
complication
revision knee

ABSTRACT

Instability after total knee replacement can be a common cause for revision surgery, causing pain, swelling, and lack of function in patients. Symptoms of instability can be subtle, so it is important to have a high suspicion when patients complain of persistent or functional limitations after TKR. Causes of knee instability include implant loosening or malposition, polyethylene wear, ligament rupture, or failure to balance the soft tissues at the time of the original procedure. Extension instability usually requires release of the tight soft tissues and placement of a thicker insert, in order to tension the lax soft tissue structures. Flexion instability is addressed by revising the femoral implant to a larger size. A hinged-knee replacement may be necessary in situations of ligament incompetence.

1. Introduction

Stability and constraint in a non-linked total knee replacement (TKR) is provided by contact forces and friction between the bearing surfaces, conformity of the femoral implant to the polyethylene insert, ligamentous support, and muscle forces about the knee. By definition, an unstable TKR is one in which one or more of these factors have failed, leading to the loss of ability to perform functional activities.

Instability of a total knee replacement (TKR) is commonly cited as a cause for early revision [1–6]. Sharkey et al. [3] found that instability was the reason in 21.2% of cases, revised within 2 years of the index procedure, and 22.2% afterwards. A follow-up paper to this revealed that instability remains a common cause of revision, representing the third most common cause of early revision (7.5%) [7]. This is also borne out in registry studies, with the Swedish arthroplasty register citing instability as one of the top 5 most common reasons for TKR revision.

The fact that instability commonly requires *early* revision suggests that it was present from the time of the index procedure, making it likely that there was a technical error at the time of surgery. Malposition of the implants, excessive release of ligamentous structures, incorrect femoral sizing, and failure to balance the soft tissues all can contribute to TKR instability, and thus, must be avoided.

2. Clinical presentation

The presentation of an unstable knee can range from difficulty stair climbing in situations of flexion instability to frank dislocation in cases of global instability. In most cases, patients will complain of pain around the knee and/or swelling. Pain can be a result of inflammation because of chronic, excessive stresses placed on the soft tissues or overuse of the muscles attempting to stabilize the knee. Joint swelling is common because excessive joint motion can irritate the joint lining and create a reactive effusion. Patients may complain of the knee “giving way” with certain activities, and the sensation that the knee does not support them.

No funding was received for this work.

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http://dx.doi.org/10.1053/j.sart.2016.06.012
1045-4527/

3. Classification of TKR instability

It is helpful to think of instability in terms of whether it occurs in extension, flexion, or both. With extension instability, the soft tissue sleeve is inadequately supporting the knee with weight-bearing activity, and thus a thrust may be present upon ambulation. Flexion instability occurs when the knee is bent and results in the lack of support with activities such as stair ascent or descent. Global instability is when the knee is unstable in both flexion and extension and may even dislocate.

4. Diagnosis

The diagnosis of instability can be difficult because of the subtleness of symptoms in certain cases, but must be suspected in patients with pain, swelling, and/or diminished function. The problem, of course, is that during the recovery from the index TKR, these symptoms are expected up to a certain duration. The key point is that the patient must have given adequate time and rehabilitation prior to making a decision to revise a patient for instability.

The clinical examination of the unstable knee is essential in making the diagnosis. Inspection and palpation of the knee may reveal a joint effusion; tenderness around the pes anserinus tendons is common with flexion instability, as this muscle group attempts to stabilize the knee by pulling the tibia posteriorly.

To examine the knee in an office setting, the patient must be cooperative and not guarding. Muscular activation can create rigidity and therefore hide instability. The TKR is examined through a range of motion, applying varus and valgus stress, to assess the balance of the medial and lateral collateral ligaments. Obviously there is a range of laxity for different patients, so this examination must be taken in context with the patient's complaints.

With the knee at 30° of flexion the stability provided by the posterior capsule will be eliminated, allowing one to assess the collateral ligaments. Through a range of motion to 90°, varus and valgus stress will allow one to assess the medial and lateral laxity. At 90° of flexion, the flexion gap can be assessed for anterior/posterior stability. An anterior and posterior drawer can be applied to ascertain the translation of the tibia upon the femur.

Plain radiographs are of course necessary for the evaluation of implant position, fixation, and polyethylene wear. An MRI is helpful at assessing the competence of the ligamentous structures (Fig. 1), and the rotational alignment (Fig. 2). In particular, rotational malalignment of the femoral component can lead to a flexion space that is unequal medially and laterally.

Examination under anesthesia can be revealing in cases where the patient's muscular activation prevents evaluation. When instability is suspected, a trial of hinged-knee bracing is helpful to confirm the diagnosis. If a patient's symptoms abate with the brace, then instability of the TKR is confirmed.

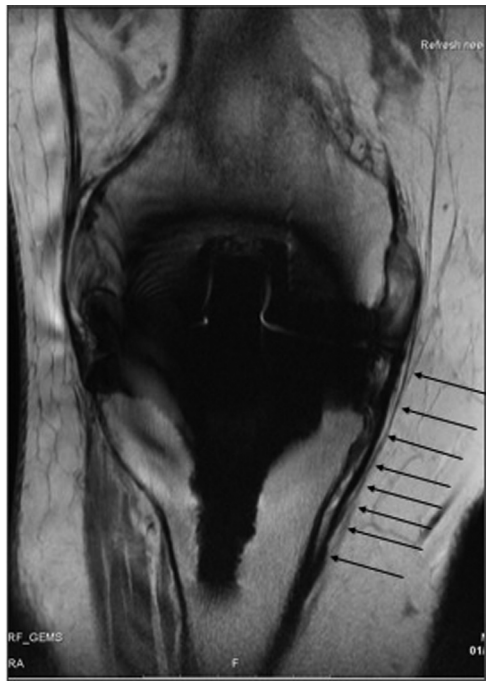

Figure 1 – MRI of a total knee replacement, demonstrating an intact medial collateral ligament (arrows).

5. Causes

Implant malposition in the coronal plane can cause instability. For example, a femoral component placed in varus, leading to overall limb alignment with medial mechanical axis deviation, can cause a lateral thrust (Fig. 3). Loosening of the implant can produce "pseudolaxity," with the implant moving with stressing. Similarly, polyethylene wear can create asymmetric joint spaces, leading to pseudolaxity.

Ligament rupture due to trauma or attrition can also occur. Rupture of the posterior cruciate ligament in a cruciate-retaining TKR can lead to flexion instability.

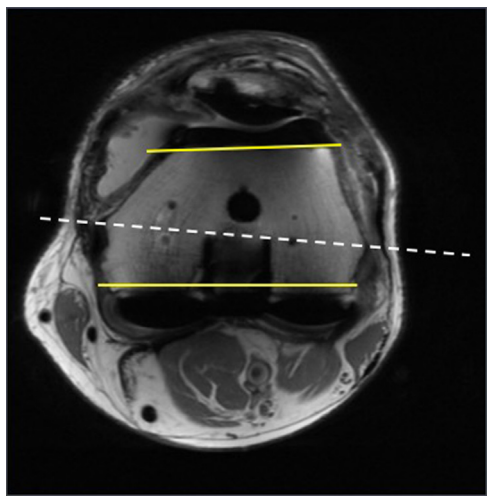

Figure 2 – Axial MRI of a femoral component (solid lines show anterior and posterior flanges), demonstrating internal rotation relative to the epicondylar axis (dotted line).