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# Instability after total knee arthroplasty: Wobble and buckle

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ABSTRACT

Instability after total knee arthroplasty (TKA) is a common reason for component failure and revision surgery. These patients require a thorough workup at presentation in order to accurately diagnose instability as being the cause for the patient's symptoms and to identify the reason for the knee instability. Instability after TKA is classified as global versus isolated instability. The isolated instability can be further categorized as extension instability, flexion instability, or recurvatum. The goal of revision surgery for instability is largely to recreate equal flexion and extension gaps. Good results can be obtained after revision surgery for instability.



Total knee arthroplasty (TKA) is a successful operation that has helped many patients with debilitating knee pain from arthritis. With the long-term prosthesis survivorship reaching 90–95% at 10 years and with overall good to excellent clinical outcomes, this makes it one of the more reliable surgeries in orthopaedics [1]. However, failures do occur and there have been reports that approximately 20% of patients feel at least somewhat dissatisfied with their TKA [2]. Failures can occur for a number of different reasons including infection, aseptic loosening, periprosthetic fracture, polyethylene wear, and instability [3,4].

Instability after TKA has increasingly been recognized as a cause of failure after primary TKA. Recent studies have shown that instability after TKA is the reason for 7–22% of revisions [4–8]. Schroer et al. recently reported in a multicenter retrospective study that instability was overall the second most common reason for revision TKA surgery, second only to aseptic loosening. However, when looking at early vs late revisions, they found that instability was the number one reason for revision surgery within 2 years [4]. Other studies have shown this same finding with instability being the second most common reason for early TKA revision [9].

The diagnosis of TKA instability requires a thorough history and physical exam. Obtaining a complete history should include the presence of any previous deformity, the indication for the original surgery, complications after original surgery, previous knee procedures, the specific surgical techniques and prosthesis used in the primary surgery, and the overall recovery or rehabilitation the patient experienced. Additional information includes knowing the patient's pain location, timing of pain onset, activities or treatment modalities that either improve the symptoms or make it worse, presence of recurrent effusions, and a specific description of the current sense of instability the patient feels. The examiner should focus on the knee in addition to any possible extra-articular causes of instability. Varus–valgus testing of the knee in extension and then at 30 degrees and 90 degrees of flexion helps to test the knee stabilizers throughout range of motion. The anteroposterior laxity should be tested with both anterior and posterior drawer tests. The most useful physical exam technique to help identify instability in flexion

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is performed with the patient sitting in a chair with the knee flexed to 90° and the foot flat on the floor, then performing an anterior drawer test to assess to what extent the tibia is brought forward. A complete evaluation of the patient's radiographs including measuring the anatomic and mechanical axes is also necessary. This should all be performed in addition to a standard infection workup since the surgeon must exclude infection in all painful TKAs [7,10].

After a thorough evaluation, the type of instability after TKA can be identified. Instability after TKA can be classified as either a global laxity or an isolated laxity. Global laxity is defined as instability in all planes. It is generally from inadequate component thickness from the primary surgery itself or due to incompetent soft tissues such as that may occur with slow stretch overtime. Isolated laxity on the other hand is defined as instability in one plane. This can further be classified into extension instability, flexion instability, and recurvatum.

## 1. Global instability

Global instability is defined as instability in all planes. This can occur intraoperatively during a primary TKA if the tibial polyethylene component is significantly undersized, not filling the space adequately in any plane. The patients who develop symptoms from such instability would likely report symptoms early on the postoperative period. This is in contrast to those patients who had an adequate polyethylene component placed at the time of the primary surgery, but as time progressed, the soft tissues throughout the knee became incompetent as would occur late from slow stretch of globally incompetent tissues. These patients would likely report good pain relief and function initially after surgery, but slowly developed the instability symptoms overtime as the soft tissues stretch out. For those symptomatic enough to require revision surgery, polyethylene component exchange for a thicker component to adequately fill the space may occasionally be adequate, but often increased constraint is also needed to protect the deficient soft tissues structures from further attenuation and stretch overtime [6] (Fig. 1).

## 2. Extension instability

The first kind of isolated instability is instability in extension. This instability can be classified as either symmetric or asymmetric. Symmetric instability is the least common of the two forms and is caused when the extension space is not adequately filled by the components [5–7]. This is usually caused because of excess bone removal either from the distal femur or the proximal tibia. When the proximal tibia is deficient or has been over resected this will affect both the flexion and extension spaces equally creating global instability. If this is noted intraoperatively, then a thicker polyethylene component can be used to compensate. Excess bone loss or bone resection from the distal femur, will affect the extension space only. Simple insertion of a thicker polyethylene in this situation might balance the extension space but would cause an excessive tightening of the flexion space and cause elevation of the joint line. Tightening the flexion gap and raising the joint line can limit knee flexion and adversely affect patellar function. Instability and flexion–extension gap imbalance due to over resection of the distal femur should be treated with the addition of distal femoral augments which are available in most contemporary total knee systems [7,10].

Extension instability is most commonly asymmetric in the medial to lateral plane with one side relatively loose and the other side relatively tight. This is most often related to a long-standing varus or valgus deformity of the knee. It is important to balance the gaps in both planes in both flexion and extension and to it may be necessary to perform soft-tissue releases to reach a symmetric extension space in the medial–lateral plane that also equals the flexion space. Failure to achieve this goal causes residual instability and may ultimately result in poor clinical outcomes of the TKA [5,11].

### 2.1. *Valgus deformity*

In a valgus knee, the lateral side can be tight when compared to the sometimes attenuated and stretched medial collateral ligament (MCL). If left unbalanced and unprotected, the MCL will not tighten up overtime and the valgus deformity will return due to medial side joint space opening after TKA. Because valgus deformity is less common than the varus deformity, lateral soft-tissue releases are done less frequently than releases of the medial knee structures and therefore are generally considered more complex or challenging to perform, though the frequently used pie-crusting method is quite straight forward and reproducible once learned [12,13].

There are both bone and soft-tissue elements that are seen with a valgus deformity. The main bony feature of the valgus knee is usually the hypoplastic lateral femoral condyle, and often greater femoral side bone loss. When performing the bony cuts, it is important to take this deformity into account so that the optimal distal femoral angle and femoral rotation is achieved. If after the preliminary bony cuts the knee is well balanced in extension and flexion, then no further lateral releases are needed (Fig. 2). However, if there remains a residual imbalance, then the soft tissues must be addressed. It is generally preferred for both varus and valgus deformities to release the tight side structures, as opposed to attempting to tighten the loose side. The soft tissues on the lateral concave side in the valgus knee that have been sequentially released in the past, include the iliotibial band (ITB), popliteal tendon, lateral collateral ligament (LCL), posterolateral capsule, and lateral gastrocnemius [12–14]. A variety of different sequential releases have been proposed. Krackow et al. [15] proposed releasing the ITB and LCL first followed by the popliteal tendon and posterolateral capsule if needed. Favorito et al. [12] suggest that the LCL is most commonly the tightest structure and therefore should be released first in that situation, followed by the popliteal tendon, posterolateral capsule, lateral gastrocnemius and the ITB. Whiteside performed an anatomic study and recommended that lateral tightness in flexion and extension should be treated differently. He reported that lateral tightness in both flexion and extension is affected by the LCL and popliteal tendon while lateral tightness in extension only is due mainly to the ITB