SOFT TISSUE RELEASES IN TOTAL KNEE ARTHROPLASTY

Relevance to Musculoskeletal Condition: Correction of a varus or valgus deformity of the knee by total knee arthroplasty (TKA) improves the alignment of the knee; however, the magnitude of soft tissue force needed to correct the joint deformity is unknown. This study aimed to quantify the angular correction and the resulting gap after various soft tissue releases, thereby restoring proper knee stability and alignment of the lower limb.

Introduction: It is common for knees with osteoarthritis or inflammatory arthritis to have a fixed deformity with associated soft tissue contractures. When performing TKA, the surgeon must release soft tissue contractures in order to restore proper alignment and function. To achieve this correction, the relative contribution of successive steps in the release procedures must be known.

Materials and Methods: Ten fresh-frozen cadaver knees were tested, 6 for the medial tissue releases and 4 for the lateral releases. All soft tissues were removed except the capsule, ligaments and tendinous insertions of muscles. The femur was clamped in a frame, and the tibia was allowed to freely move. TKA surgery was performed using the Genesis I implant and instrumentation (Smith & Nephew Richards, Memphis, TN). The distal femoral cartilage was made in 7° of valgus, and the proximal tibial cartilage was made 4 mm below the medial joint surface with a 3° posterior slope.

The tibiofemoral joint was measured with calipers in full extension and 90° flexion as the tibia was distracted from the fixed femur with a 53 N load. These measurements were repeatable to within 0.5%. Coronal angular change was measured with an optical encoder as 10 Nm varus and valgus moments were applied to the knee with a cable and spring scale. The encoder was located at the approximate center of the knee, and fixed to the femur and tibia by stainless steel rods. The internal angle between the 10 Nm varus and valgus moments was recorded. These angular measurements were repeatable to within 9%.

Stage intracapsular soft tissue releases were performed as an actual TKA. Subperiosteal or subligamentous sharp dissection was performed using a scalpel or Cobb elevator. The medial release was performed in the following successive steps: anterolateral capsule and iliotibial band release from the tibia 2 cm below the medial joint line, semimembranosus and posteromedial capsule release from tibia, continuation of the anteromedial fascia release 4, 6 and 8 cm below the medial joint line, medial collateral ligament (MCL) release from medial femoral condyle, release of one-half of posterior cruciate ligament (PCL), and finally, release of entire PCL. The lateral release was performed in the following successive steps: anterolateral capsule and iliotibial band release from tibia, posterolateral capsule release from tibia, popliteus tendon and lateral collateral ligament (LCL) release from femur, release of one-half of PCL, and release of entire PCL.

After each release step, medial and lateral tibiofemoral gaps and varus-valgus angular change were measured. A one-way analysis of variance was used to compare the angular correction and gap over the release steps.

Results: In the medial release sequence, a significant amount of angular change (Fig. 1) and an increase in the medial gap were obtained after the anteromedial fascia release from the tibia 8 cm below medial joint line (p<0.05). In the lateral release sequence, the release of the LCL and popliteus tendon from the femur led to a significant amount of angular change (Fig. 2) and an increase in the lateral gap (p<0.05). The additional release of the PCL led to a greater amount of angular change and increase in the gaps in both medial and lateral release procedures. The corrective angle and gap after the release of the PCL were greater in flexion than in extension in both medial and lateral release procedures.

Discussion: There are many studies about the order, needs, and clinical results of soft tissue release in TKA.2,3 However, there is a lack of information on the relationship between the extent of the soft tissue release and the resulting corrective angle or tibiofemoral gap. In the medial release sequence, the anterolateral fascia release from the tibia 8 cm below the medial joint line led to a significant corrective angle and increase in the medial gap. In the lateral release sequence, the LCL and popliteus tendon release from the femur led to a significant change. Further change could be obtained by the PCL release. Identification of the tibial insertion of the MCL and pes anserine is difficult intraoperatively. The results of this study may be useful because many surgeons quantify the extent of their releases by the distance from joint line.

Figure 1. Medial release angular change

Figure 2. Lateral release angular change

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References:

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