Abstract  Background: Lengthening of the iliotibial band by various methods such as distal detachment, Z-plasty, or multiple puncture are common procedures for balancing the contracted valgus knee in total knee arthroplasty. This study was performed to measure the lengthening effect of multiple puncture and release of the distal femoral attachment of the iliotibial tract.  Methods: In a cadaver study on 14 knees, we studied the possible elongation of the iliotibial band by distal femoral detachment (release of Kaplan’s fibers) and multiple puncture of the distal half of the tract. Maximum elongation was measured under a constant tension of 60 N.  Results: The average gain in length of the combination of both procedures was 16.3 mm (range 12–23 mm) with a tension force of 60 N applied.  Conclusion: The results show that a sufficient release of the iliotibial band can be achieved with the techniques except for severe cases of valgus deformation, where more effective methods to release the iliotibial band such as Z-plasty or complete dissection should be performed.

Keywords  Iliotibial band · Valgus knee · Ligament balancing · Kaplan’s fibers

Introduction

The role of the iliotibial band (ITB) in the normal knee is that of a dynamic stabilizer of the lateral structures. Moreover, its distal fibers originating from the lateral femoral epicondyle and inserting on the tibia at Gerdy’s tubercle act as a passive lateral restraint called the lig. femorotibiale laterale anterius [9].

In the valgus knee, normally there is a substantial contracture of the lateral structures at various degrees. For the surgeon performing a total knee implantation in these types of knees, it is of major importance to release all tight structures on the lateral side and to preserve the normal joint line in order to establish a well balanced knee for implantation of a condylar type of implant. According to the different degrees of the deformity, the lateral release is performed by resection of all osteophytes, lateral capsular release including the posterolateral corner, the arcuateum complex, ITB release, popliteus tendon release, and in severe cases proximal elevation of the lateral collateral ligament and the desinseration of the gastrocnemius muscle.

The contracture of the ITB is of great significance in cases of a flexion contracture in a valgus knee. A variety of different techniques to achieve a lengthening effect on this structure are reported in the literature. One of the key points is the approach used for a lateral deformed knee. Authors using the standard medial approach perform ITB releases by z-lengthening [7], desinseration at the level of the proximal tibia, or multiple puncture at the joint level [8]. Using a lateral approach to the valgus knee, authors also report techniques like Z- or V-Y-plasty and multiple puncture on the more proximal, superficial layer [5].

One of the most important points is to gradually release the ITB instead of complete transection because this structure is a major restraint to anterolateral instability.

The purpose of this study was to measure the possible gain in length of the ITB at the level of the knee by two different techniques:

- The dissection of the tract from the intermuscular septum on the distal femur down to the lateral epicondyle (Kaplan’s fibers)
- The multiple puncture of the tract in the distal third of the thigh.
Materials and methods

We performed this investigation on 14 knees from seven fresh cadaver specimens. The specimens showed no signs of injury or deformity of the lower extremities. A skin incision of 40 cm was made on the lateral side of the leg, and the ITB was visualized from the midthigh to the proximal tibia by subcutaneous preparation. To allow for the different sizes of the cadavers, the length of the ITB was measured from the anterior iliac spine to the tubercle of Gerdy (TG).

The TG was then elevated with a bone block of approximately 1×1×1 cm. The anterior and posterior borders of the tract were sectioned proximally to the lateral femoral epicondyle so that only the distal femorotibial part of the ITB was mobilized. A metal clamp was attached to the bone block and connected to a spring balance (Fig. 1).

Then a tension of 60 N was applied in the longitudinal direction, and the elongation of the distal part of the iliotibial tract was recorded by measuring the distal movement of Gerdy’s tubercle with the knee held in extension.

Three measurements were taken in turn. First, we measured the distalisation of the tubercle by the releasing effect of the preparation and by the stretching of the structures.

Then all of Kaplan’s fibers and the attachment of the ITB to the intermuscular septum were cut, and a further distalisation of the TG recorded while maintaining a tension of 60 N (Fig. 2).

In a third step, the distal half of the fascia lata was punctured with a no. 11 blade using standard operative techniques (Fig. 3). Multiple punctures were done extensively while further displacement of the TG was recorded. The total recorded distalisation of the tubercle was the sum of the tensioning effect, the initial release effect of the preparation, the dissection of all attachments of the tract to the femur, and the elongation by multiple punctures. The order of the techniques was chosen according to the sequence of releases during the performance of a total knee replacement in valgus knees using a lateral approach.

Results

The average length of the ITB was 50.4 mm, varying from 47 to 53 mm.

After the preparation of the ITB by incising the lateral capsule of the knee, we first applied a tension of 60 N to the tibial tubercle in order to stretch the distal portion of the tract without any release, and this led to a gain in length of 4.7 mm (range 3–7 mm). Cutting all fibers from the distal third of the femur and releasing all attachments to the lateral femoral epicondyle and the surrounding femur (Kaplan release) produced an additional gain in length of 4.9 mm (range 3–7 mm).

Multiple puncture of the distal third of the tract led to an elongation of another 6.7 mm (range 4–10 mm).

The total amount of lengthening was 11.6 mm (range 8–16 mm) without tension and 16.3 mm (range 12–23 mm) under tension of 60 N (Table 1).

Discussion

Lengthening or release of the ITB has become a standard procedure in total knee arthroplasty for the severely valgus knee.

If the deformity does not exceed 25 deg and no flexion contracture is present, a minor release up to 2 cm will be