

Official Title: The effect of an adductor longus tenotomy on the bent knee fall out test

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INTRODUCTION

Adductor-related groin pain is the most common type of groin pain in athletes,[1,2] and pain at the proximal adductor longus insertion is a key finding in the diagnosis of longstanding groin pain.[3] “Tightness” or “shortening” of the adductor longus is considered both a cause and effect of pain,(ref) that can lead to increased tension at the proximal insertion, thus playing a role in the persistency of longstanding adductor-related pain. For patients who do not respond sufficiently to non-surgical procedures, an adductor longus tenotomy is a surgical option that is considered to reduce tension at the proximal adductor longus insertion assisting in reduction of pain and return to sport.

The bent knee fall out test (BKFO) is one of the most commonly used tests to test adductor flexibility.[4–6] This test involves a combined hip movement with hip flexion, abduction, and external rotation, and a high result is generally considered to be related to adductor muscle “tightness”, specifically that of the adductor longus.(refs) It is uncertain whether the BKFO test is actually measuring adductor muscle flexibility or hip joint range of motion, as the test results may also be affected by a femoral head cam morphology.[7] A slightly different test, called the Patrick FABER’s test, involves a similar movement and is mainly used as a hip joint pain provocation test.

By cutting the adductor longus tendon thereby removing the effect of potential adductor longus “tightness”, we will be able to show if and how much the flexibility of this muscle effects the test results, to assist in future considerations of what this test is actually testing.

Our aim was to investigate the immediate effect of an adductor longus tenotomy on the results of the bent knee fall out test.

METHODS

Participants

Athletes with groin pain are consecutively recruited from two clinics of a visceral surgeon specialized in groin pain in athletes. The clinics are located in Bordeaux and Paris, France, and patient population includes athletes from all over France. Inclusion criteria are: adult (>18 years old) athletes with adductor-related groin pain, subcategorized as adductor longus insertion pain, undergoing unilateral or bilateral adductor longus tenotomy by one visceral surgeon specialized in groin pain in athletes.

Adductor-related groin pain is clinically diagnosed as adductor tenderness and pain on resisted adduction testing as described in the Doha agreement on terminology and definitions of groin pain in athletes.[8] For this study, we further specified both palpation and resistance pain should be present at the proximal adductor longus insertion. No specific exclusion criteria were present other than refusal to participate in the study. As the vast majority of patients seen in the clinic are male athletes, we based our sample size calculation and primary analysis on male athletes only. The results from any female athletes included during the same period will be reported separately as a secondary analysis.

Ethics

Ethics approval was obtained by the ethics committee of Clinique du sport de Bordeaux-Merignac, France (#02-2020.2). Athletes will be included in this study after giving their informed consent according to the Declaration of Helsinki.

Patient demographics and injury information.

Demographic data (age, height, weight, type and level of sport) is recorded. Athletes are also asked about the duration of their groin pain (weeks), the onset of pain (sudden/gradual), whether the pain is unilateral or bilateral, highest pain during their last session of sports on a 0-10 numerical pain rating scale (NPRS, 0 being 'no pain' and 10 'worst pain imaginable'). They will also be asked if they have any pain in other locations than the groin.

Bent knee fall out test (BKFO)

The BKFO test is performed in either general anesthesia or spinal anesthesia, for patients operated in Bordeaux and Paris, respectively. This is standard procedure for the surgical procedures and also prevents any voluntary activation of the adductor muscles. The patient lies supine on the surgical table with approx. 90° knee flexion, 45° hip flexion, and the feet together and the hips in external rotation (also known as the frog-leg position). Standardization of position is achieved by flexing one leg first, so the medial malleolus is placed next to the medial knee joint line of the contralateral leg. The knee is then moved laterally, externally rotating the hip with the plantar surface placed towards the contralateral leg. The contralateral leg is then flexed, and the plantar surfaces of the feet are aligned. The distance between the most distal point on the head of the fibula and the surface of the surgical table is measured using a rigid tape measure and distance is recorded in cm to the nearest 0.5 cm (Figure 1) The BKFO test has excellent reproducibility with a standard error of the measurement of approx 1 cm or less.[4,11,12]

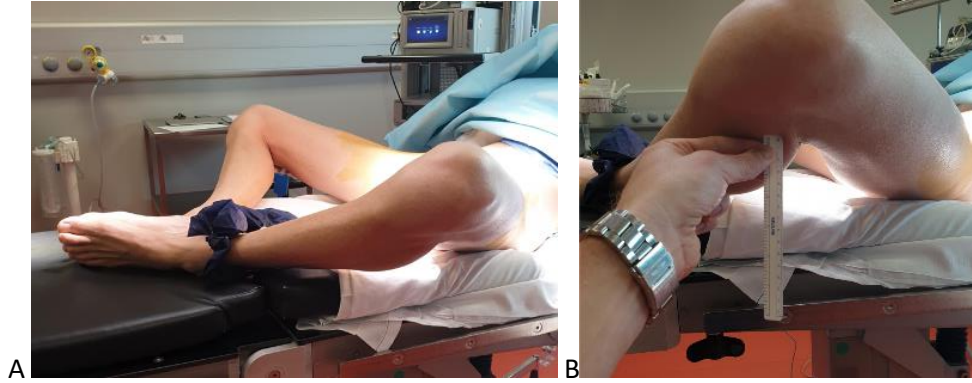


Figure 1 A: Position of the patient's legs prior to the surgical procedure, B: Measurement from the head of the fibula to the surgical table

Surgical procedure

The proximal adductor longus tendon is identified through palpation, and a longitudinal incision of approximately 4cm is made in the line of the tendon. The fascia of the adductor longus is divided to identify the tendon (figure 2), and a transverse incision is made as close to the insertion as possible (approximately 0.5cm) resulting in a full release of both the adductor longus tendon and muscle, as present on the posterior side of the tendon. A minor removal of approximately 0.5 cm of the released tendon is made, and the adductor longus is placed approximately 5 cm from the pubic bone (figure 2). The wound is closed in layers after careful hemostasis. The tenotomy is either performed unilateral or bilateral.

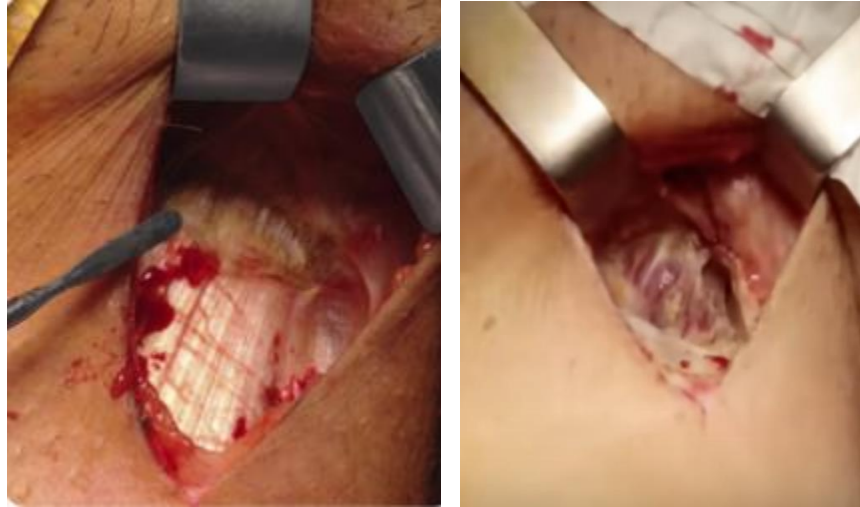


Figure 2 Adductor longus tendon before and after the tenotomy.

Statistical analysis

Data are presented as means with standard deviation (SD), unless indicated otherwise, and non-normally distributed data are expressed as medians with the 25th–75th interquartile range (IQR₂₅, IQR₇₅). A paired T-test is used to compare the BKFO results pre- and post- tenotomy. Additionally, correlation between baseline values and change in BKFO will be analyzed to investigate whether patients with higher baseline test results also have a larger change. Analyses are carried out in Statistical Package for Social Sciences (SPSS; version 21, IBM). Effect sizes were calculated using Cohen's d and assessed as; small ($d = 0.2$), moderate ($d = 0.5$), and large ($d = 0.8$).[13]

Sample size

We calculated our sample size using G*power software (v. 3.1, Heinrich-Heine-Universität, Düsseldorf, Germany). We used BKFO values from non-injured football players; mean 13.1 cm, standard deviation (SD) 4.4cm.[4] We performed pilot measurements pre- and post-tenotomy on five patients. These had a

mean of 2.1 cm reduction, which we used for the sample size calculation. We set the required power at 95%, used an α -error probability of 5%, and a correlation between measurements of 0.5. This resulted in a total sample size requirement of 60 participants.

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