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An anatomic study of the lateral patellofemoral ligament

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ABSTRACT

Objective: The lateral patellofemoral ligament (LPFL) is part of the lateral retinaculum cut during arthroscopic or open release. We investigated its anatomic and morphometric characteristics.
Materials and methods: We identified the LPFL insertion point on the condyle in vertical and sagittal planes in 32 adult cadaveric knees. We measured its length and width at the insertion point. We located the midpoint of this point and measured from it to the distal and posterior condylar ends. We measured anterior-posterior and proximal-distal lateral condylar lengths. We evaluated the insertion point shape on the lateral femoral condyle. Degree of relationship between variables was assessed using Pearson's correlation coefficient. $p < 0.05$ was considered statistically significant.
Results: The LPFL mean length was 23.2 mm, and mean width at the insertion point was 15.6 mm. Regarding its insertion into the lateral condyle, central insertions were more frequent (vertical plane: 53.1% central and sagittal plane: 75% central). A significant positive correlation was evident between the LPFL length and width at the insertion point ($p = 0.05$). Thus, the LPFL length was proportional to its width at the insertion point. A significant positive correlation was found between the anterior-posterior condylar length and width of the LPFL at the insertion point ($p = 0.017$). Therefore, greater anterior-posterior condylar length equates to a larger area of insertion on the condyle.
Conclusion: Greater width of the LPFL at the insertion point corresponds to greater LPFL and anterior-posterior lateral condylar lengths.

Introduction

An appreciation of the anatomy of the knee extensor mechanism, medial and lateral retinacular patellofemoral ligaments are necessary to understand patellofemoral joint stability.[1] Retinacular patellofemoral ligaments, particularly the medial patellofemoral ligament (MPFL), play an important role in stabilization of the patella.[2–6] The anatomic and biomechanical properties of the MPFL are described in detail in the literature.[7–10] However, the structural features and the margins of the lateral patellofemoral ligament (LPFL) remain poorly defined.[11]

The lateral retinaculum consists of the superficial oblique and deep transverse layers.[12] The LPFL and lateral patellotibial ligament in the deep transverse layer are the two main lateral retinacular structures that stabilize the patella.[13] Kaplan[14] first described the *lateral epicondiylopatellar ligament* as a palpable thickening of the joint capsule. Reider and colleagues[15] later renamed this structure as the LPFL in an anatomic study involving 21 fresh cadaveric knees. They observed that it is a palpable thickening of the joint capsule and connects the patella to the femoral epicondyle. They described its width as ranging from 3 to 10 mm. A correlation was also reported between morphometric properties of the LPFL and patella. Merician and colleagues[11] found that joint capsule was thickened laterally to form the lateral patellofemoral ligament. This capsular thickening was variable from knee to knee and the margins were difficult to define exactly. The lateral patellofemoral ligament was attached to the lateral patella at its widest part and anchored to the lateral femoral epicondyle. Vieira and colleagues[16] resected the LPFL in 10 fresh cadaveric knees. They observed that, after

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resection, the patella spontaneously luxated medially, demonstrating the role of this ligament in patellar stability.

Medial subluxation of the patella is a described complication after lateral retinacular and particularly LPFL release.[17,18] Of the 154 cases of medial patellar subluxation reported in the literature, 144 (94%) occurred in patients who had undergone a previous lateral retinacular release procedure[17–25] or a lateral release and tibial tubercle transfer.[26–28] Performing a limited lateral release avoids this complication.[11] However, when lateral release procedures are examined, it is clear that both layers of the retinaculum are cut.[29] Different techniques have been described for the repair or reconstruction of lateral patellar stabilizers.[17,30]

The purpose of this study was to elucidate the morphometric characteristics of the LPFL at its insertion in the femoral condyle and to evaluate the correlation between the LPFL and lateral femoral condyle measurements, which may be helpful in better describing the lateral release or reconstruction afterwards to decrease complications.

Materials and methods

We dissected 32 adult cadaveric knees fixed in formaldehyde at the Department of Anatomy, Dokuz Eylul University. The bilateral knees of eight female and eight male cadavers were examined. A longitudinal midline incision was made from 5 cm above the superior pole of the patella to the tibial tubercle. Then, the patella was turned down to a lateral position using the medial parapatellar approach. Subsequently, the LPFL was exposed by careful dissection (Fig. 1). We recorded measurements in two categories: measurements of the lateral condyle of the femur and LPFL. A caliper ruler with millimeter graduations was used to take these measurements.

All measurements were made with the knee at 30° of flexion. First, the anterior–posterior (A–B) and proximal–distal (C–D) lengths of the lateral condyle were measured. Then, the midpoint of the insertion point of the LPFL on the condyle (E) was identified, and we measured from this point to the distal (E–D) and posterior (E–B) ends of the condyle (Fig. 2). Next, we measured the length and width (at the insertion point on condyle) of the LPFL (Fig. 3). In addition, the lateral condyle of the femur was divided into three equal parts (superior–middle–inferior) in the vertical plane and into three equal parts (anterior–middle–posterior) in the sagittal plane. Subsequently, the areas of the insertion points of the LPFL on the condyle were identified in the sagittal and vertical planes (Fig. 4).

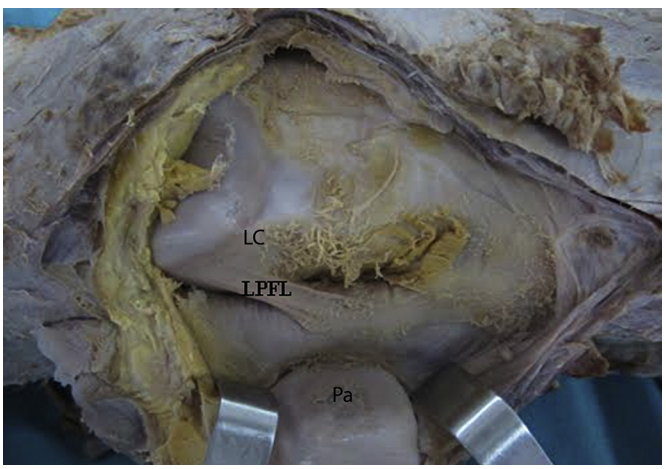

Fig. 1. Photograph of the anterolateral aspect of the left knee (LPFL: lateral patellofemoral ligament, Pa: patella, LC: lateral condyle of the femur).

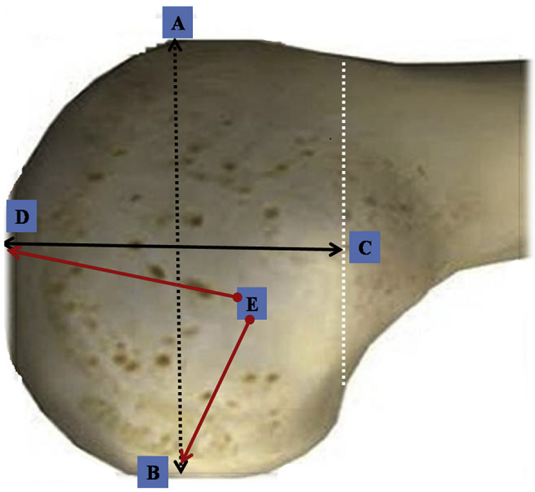

Fig. 2. Schematic representation of the measurements of the lateral condyle (A–B: anterior–posterior length of the condyle; C–D: proximal–distal length of the condyle; E–B: distance between the midpoint of the LPFL insertion point on the condyle and the posterior end of the condyle; and E–D: distance between the midpoint of the LPFL insertion point on the condyle and the distal end of the condyle).

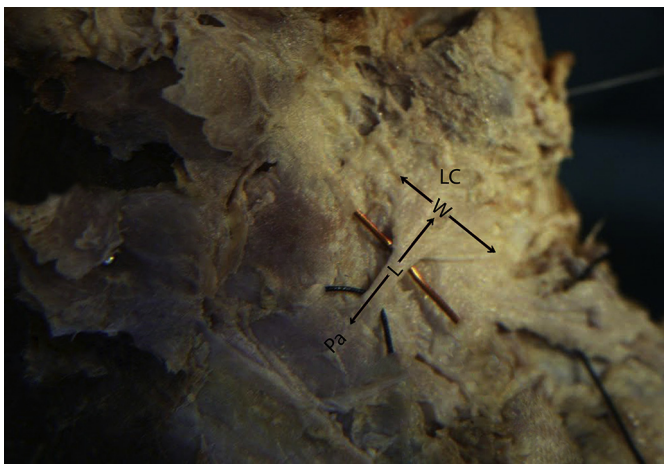

Fig. 3. Photographof the measurement of the LPFL (L: length, W: width, Pa: patella, LC: lateral condyle of the femur).

Statistical analysis

All statistical analyses were performed using SPSS 18.0 (version 18.0; SPSS Inc., Chicago, IL, USA). The degree of relationship between variables was assessed using Pearson's correlation coefficient. Statistical significance was defined as $p < 0.05$.

Results

In all knees, we observed that the LPFL was located in the deep retinacular layer and underwent insertion into both the patella and femur with fan-like expansions. No scar over the skin indicating an operation or no degenerative changes was observed in patella. The lateral femoral condyle and LPFL measurements are presented in Table 1.

The relationship between the width (LPFL_W) and length (LPFL_L) of the LPFL was analyzed, and the relationship between the LPFL_W and measurements of the lateral condyle (LCAP_L, LCPD_L) was evaluated using Pearson's correlation coefficient. The relationship between the width (at the insertion point on the

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