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# Minimally invasive medial patellofemoral ligament reconstruction for patellar instability using an artificial ligament: A two year follow-up☆,☆☆

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ABSTRACT

*Background:* Recurrence of acute patellar dislocation affects approximately 30% of individuals, and up to 75% of those with grade IV instability. The medial patellofemoral ligament (MPFL) is considered to be critical for patellar stabilization. MPFL reconstruction with allografts has been proposed to reduce risk of recurrence, but there is limited evidence about the safety and effectiveness of techniques using synthetic allografts.
*Methods:* We present a retrospective case series of 29 individuals who underwent a MPFL reconstruction between 2009 and 2012, using an artificial ligament for patellar instability by a single surgeon. Clinical, radiological and functional outcomes were measured at a minimum of 24 months.
*Results:* 31 knees (29 individuals) were followed up for a median of 43 (range: 24–68) months. Using the Crosby and Insall grading system, 21 (68%) were graded as excellent, nine (29%) were good, one (3%) as fair and none as worse at 24 months. The mean improvement in Lysholm knee score for knee instability was 68 points (standard deviation 10). Ligamentous laxity was seen in 17 (55%) of individuals. In this subset, 12 were graded as excellent, four as good and one as fair. The mean improvement in patellar height was 11% at three months follow-up. All knees had a stable graft fixation with one re-dislocation following trauma.
*Conclusions:* We propose a minimally invasive technique to reconstruct the MPFL using an artificial ligament allowing early mobilization without bracing. This study indicates the procedure is safe, with a low risk of re-dislocation in all grades of instability.
*Level of Evidence:* Level IV Case Series



## 1. Introduction

Acute patellar dislocation frequently leads to recurrence. A systematic review of trials of reconstruction techniques versus conservative rehabilitation reported the rate of re-dislocation after a conservatively managed primary patellar dislocation ranged from 19–54% (5 trials, 339 patients) [1]. This risk is higher in patients with ligamentous laxity, with one retrospective single centre series of 104 individuals treated for patellar dislocation reporting an overall recurrence after an acute dislocation of 30%, and 75% in the subgroup (n = 66) who had ligamentous laxity and abnormal patella position [2].

Various surgical methods have been described in the literature to treat lateral patellar dislocation [3–8]. Surgical procedures used in Europe have been founded on strict radiographic guidelines, that is, "Le Menu A La Carte", where all the instability factors are individually corrected [9]. However, the importance of correcting each of these instability factors, alone or in combination is uncertain [9]. There is also uncertainty about the safety and effectiveness of current standard procedures. The above mentioned systematic review comparing surgical repair with conservative rehabilitation in a total of 339 patients with dislocation found no robust evidence of improved clinical (pain, range of motion) or functional (Kujala scores) outcomes in individuals managed with surgical repair [1]. Apart from recurrent dislocation, common post-operative complications reported in the literature are persistent patellofemoral instability, patellofemoral osteoarthritis, loss of flexion, medial subluxation, stiffness and chronic knee pain [1,3,7,8,10].

The importance of the medial patellofemoral ligament (MPFL) was first described in the late 1950s [11]. A cadaveric study on 25 specimens determined that, biomechanically the MPFL provides 53% of the lateral stabilizing force [12]. It is consequently the most important medial soft-tissue restraint and has been shown to be consistently injured

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after a patellar dislocation [4]. Brückner was the first to present a technique of transferring the medial part of the patellar ligament to the medial epicondyle to stabilize the patella [13]. But only recently with the evolution of shoulder surgery there has been an increased focus on reconstruction of the MPFL. Several techniques have been described to reduce the high incidence of recurrent dislocation with encouraging clinical results [8].

Numerous sources have been used to reconstruct the MPFL including semitendinosus, semimembranosus, gracilis, quadriceps, vastus medialis retinaculum, or artificial tendons [3,8,14–16]. In 1992, Ellera was the first to describe MPFL reconstruction with an artificial polyester ligament in 30 patients fixed by tunnel fixation on the patella and subfascially to the medial femoral condyle [17]. At a minimum of 24 month follow-up, 25 (83%) patients showed improvement with a Crosby and Insall grade of good-excellent [17]. The use of synthetic material is appealing to avoid the morbidity associated with other allograft choices [16]. However, there have been very few other articles describing techniques using synthetic allografts. Nomura et al. in 2000 have recently reported a five year follow-up study of 27 patients treated with MPFL reconstruction with an artificial polyester ligament with staple fixation at the femoral condyle, with 26 (96%) reporting good to excellent outcomes using the Crosby and Insall grading system [5]. But other cohort studies reporting on the use of the artificial ligament question its safety in view of late graft failure, risk of late infection, stiffness, inflammation and cost effectiveness subsequent to use of synthetic allografts [15,16].

The purpose of our study is:

1. To describe a minimally invasive arthroscopically assisted technique to reconstruct the MPFL using a synthetic allograft.
2. To describe our post-operative rehabilitation protocol.
3. To present data on safety and benefits of the surgical procedure in patellar instability especially in patients with predisposing factors.

## 2. Patient & methods

### 2.1. Study design & setting

We retrospectively reviewed all individuals who underwent a MPFL reconstruction using an artificial ligament (LARS Ligament, CORIN Ltd, Mersilene Tape MT, or AchilloCord$^{PLUS}$ Ligament, Neoligaments Ltd) for patellar instability by a single surgeon between 2009 and 2012 who had completed 24-month follow-up. Each case was treated at a specialized orthopaedic knee clinic run by the investigators. The University Human Research Ethics Committee and hospitals where the study was conducted approved the study.

All individuals underwent a screening interview and examination to determine their eligibility using the criteria listed in Table 1. Preoperative assessment included a thorough history, physical examination and radiological evaluation. Patients were assessed for passive patellar hypermobility, mal-tracking, apprehension, knee range of motion and a Clarke test as a part of the physical examination [18]. Generalized ligamentous laxity was scored using the Wynn Davies criteria [19] and classified using the method established by Runow et al. [2]. The Lysholm knee scoring scale was administered to assess the functional impairment due to clinical instability and evaluate the outcomes of knee ligament surgery [20,21]. Plain radiographs (antero-posterior, lateral and skyline view) examinations and Magnetic Resonant Imaging (MRI) scans were performed to assess the integrity of the MPFL, chondral damage, internal derangement and the position of the tibial tuberosity. The procedure was recommended for individuals with a torn/attenuated MPFL who had symptoms such as giving way, instability, & mal-tracking that did not ameliorate after three months of conservative therapy including quadriceps muscle strengthening (Table 1).

**Table 1**
Inclusion/exclusion criteria.

| Inclusion criteria | Exclusion criteria |
|---|---|
| Torn/attenuated medial patello-femoral ligament | Intact medial patello-femoral ligament |
| Recurrent patellar dislocation refractory to conservative treatment > three months | Instability in presence of moderate-severe patello-femoral arthritis |
| Pathological ligamentous laxity | History of previous surgery |

### 2.2. Outcome measures

Clinical outcomes included pain level, knee range of motion, passive patellar hypermobility, mal-tracking & apprehension at follow up [3]. Plain radiographs were used to measure the sulcus angles & the patellar height (Insall–Salvati index) at baseline and three-month follow up [3]. Radiographs were also performed at six, 12 months and yearly follow-up to assess the integrity of the fixation (alignment, positioning) and other complications (arthritis, fracture). Adverse events including re-dislocation, prominence of the graft, and knee stiffness were monitored. All outcomes were measured by a single investigator and confirmed by a senior surgeon.

Functional outcomes were assessed using the Lysholm knee scoring scale to measure symptoms in the knee at baseline and yearly follow-up [20]. The Crosby and Insall grading system was used to assess outcomes following ligament reconstruction. Using this system, outcomes were classified into four categories (Excellent, Good, Fair to Poor & Worse) [22].

### 2.3. Surgical technique

A two-step surgical procedure was performed including a knee arthroscopy followed by reconstruction of the MPFL using an artificial ligament. Patients underwent general anaesthesia. Prophylactic intravenous antibiotics using one gram of Cephazolin was administered. Positioning and draping was similar to a standard knee arthroscopy. The knee was first examined & the tightness of the lateral structures was assessed. Following this a knee arthroscopy was performed using standard antero-medial & antero-lateral portals to visualize the knee, remove any loose bodies and deal with any other intra-articular pathology (e.g. chondroplasty for chondral wear). The lateral retinaculum was released arthroscopically using thermal ablation in all patients.

The Through Tunnel Technique was used to achieve fixation for the artificial ligament [23]. A 2–3 cm vertical skin incision was made over the lateral upper half of the patella. Under image intensifier a 3.2 mm tunnel was drilled over a guide wire through the junction of the upper third and the lower two thirds of the patella (Fig. 1). A wire was then passed through the patellar drill hole. A 1 cm incision was made over the medial condyle at the natural attachment of the MPFL through which the wire was pulled medially using long forceps in the middle layer of the soft tissues, just superficial to the capsule. Through the same incision, a second 3.2 mm tunnel was made at the isometric insertion site of the MPFL (1 mm anterior to the extension line of the posterior cortex and just proximal and behind the attachment of the superficial part of the medial collateral ligament), along the epicondylar axis of the femur [3,24]. For skeletally immature patients, the tunnel was accurately positioned in the epiphysis to avoid injury to the growth plate [3].

The artificial ligament was then prepared by folding it over itself and passing an endobutton at one end to secure the fixation at the lateral border of the patella. A wire passer was utilized to thread the ligament through the patella and the femur. The ligament was now tensioned with the leg in full extension. Subsequently, the knee was positioned in full flexion, without engaging the ligament at the lateral femoral cortex. Femoral fixation was then achieved using a 7 mm interference peek screw, which was inserted through the lateral incision (Figs. 2, 3). This avoided over loosening or over tightening of the artificial ligament. The knee was then taken through a range of motion to check tracking and patellar stability.