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Original article

Does medial collateral ligament pie-crusting induce residual laxity in arthroscopic management of medial meniscus tears? A prospective study of 40 cases

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ABSTRACT

Introduction: Arthroscopic meniscectomy and medial meniscal repair are frequent procedures, liable to be complicated by iatrogenic cartilage lesions, especially in tight knee. Medial collateral ligament pie-crusting was developed to counter this, but, although the technique is employed, its impact on medial laxity has not been precisely determined. We therefore conducted a prospective observational study to compare radiographic laxity preoperatively versus 6 weeks following pie-crusting.

Hypothesis: Medial collateral ligament pie-crusting alters radiographic laxity at 6 weeks.

Material and methods: Between December 2015 and February 2017, 40 patients (33 male, 7 female) underwent surgery with pie-crusting for isolated medial meniscal lesion. Mean age was 39 years (range, 20–54 years). Meniscectomy was performed in 33 cases (82.5%) and repair in 7 (17.5%). Pie-crusting used an intramuscular needle under arthroscopic control, adjacent to the medial meniscus at the posterior two-thirds junction of the compartment, until opening was deemed satisfactory. Laxity was compared on preoperative versus 6 weeks stress valgus views (Telos™), by 2 independent observers, on 2 measurements: opening angle, and medial tibiofemoral joint space height. Each measurement was taken twice at a 2-week interval by each observer.

Results: Inter- and intra-observer concordance was excellent on both measurements: intraclass correlation coefficient was 0.82 (95% CI, 0.73–0.89) and 0.91 (95% CI, 0.86–0.94) pre- and post-operatively for opening angle, and 0.87 (95% CI, 0.79–0.92) and 0.88 (95% CI, 0.82–0.92) for joint space height. Tibiofemoral joint space opening was significantly greater at 6 weeks on both measurements: $0.9 \pm 1^\circ$ [range, -1° to 4°] ($p < 0.0001$) and 1.1 ± 1 mm [range, -0.6 to 3.2 mm] ($p < 0.0001$).

Discussion: Medial collateral ligament pie-crusting led to a moderate but significant increase in medial laxity at 6 weeks. A longer-term study is needed to assess progression.

Level of evidence: IV, prospective study without control group.

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1. Introduction

Treatment of medial meniscal lesions is one of the frequent indications for knee arthroscopy [1]. The posterior segment is the most frequent location, but with limited exposure [2], leading to possible misdiagnosis [3]. Medial meniscus resection or repair require good lesion visualization, to limit recurrence risk [3]. Limited medial tibiofemoral compartment opening can also result in

cartilage lesions when introducing the arthroscopic instruments and in medial collateral ligament tear under stress valgus [4–6].

A percutaneous medial tibiofemoral compartment opening technique was first described by Agneskirchner et al. in 2004 [7]: medial collateral ligament lengthening was achieved by “pie-crusting”, to induce intraoperative laxity. Several variants were subsequently described [8,9]. Cadaver studies confirmed that risk of saphenous vein and nerve injury was slight [10].

Claret et al. [11] demonstrated that pie-crusting did not jeopardize functional results, but their study did not assess postoperative laxity objectively.

To our knowledge, only two teams have studied radiographic medial laxity following pie-crusting in the medial meniscus [12,13].

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We therefore sought confirmation in a larger series, in a prospective observational study to compare radiographic laxity preoperatively and at 6 weeks. The study hypothesis was that medial collateral ligament pie-crusting alters radiographic laxity at 6 weeks.

2. Material and methods

2.1. Patients

The study was conducted between December 2015 and February 2017. For patients deemed eligible on preoperative consultation for pie-crusting in isolated medial meniscal surgery, stress valgus views were taken. Pie-crusting was performed according to intraoperative findings, on the senior surgeon's assessment, and the same stress valgus radiographs were repeated at 6 weeks. Patients thus did not undergo complementary pie-crusting systematically, but only if their medial tibiofemoral compartment was tight, which would increase the risk of iatrogenic lesion and recurrence without pie-crusting [3–6]. Varus/valgus morphotypes were not included in the series.

Review board approval was not sought, as pie-crusting was already common before the study was undertaken. Moreover, stress radiographs were taken long enough after surgery not to incur any risk of further iatrogenic ligament lesion [14]. Three surgeons took part in the study, out of the 10 regularly performing knee arthroscopy in our center.

Patients with history of surgery or complex trauma in the same knee were excluded, due to risk of preoperative laxity, as were non-isolated meniscal procedures (notably associated anterior cruciate ligament reconstruction) and patients not undergoing pie-crusting.

2.2. Surgical technique

All procedures were performed as outpatient surgery. Patients were positioned supine, with a knee-holder and tourniquet inflated to 300 mmHg. An arthropump was used systematically. Pie-crusting used an intramuscular needle, submeniscally, adjacent to the medial meniscus, at the posterior two-thirds junction of the compartment. The needle was moved to-and-fro, with valgus pressure on the knee in 20° flexion. The surgeon heard creaking whenever the medial compartment was seen to open on arthroscopy (Fig. 1). The degree of opening was at the surgeon's discretion, for sufficient exposure to allow the meniscal procedure to be executed without iatrogenic risk. Meniscectomy used a shaver and basket punch. The arthroscopic criterion was meniscectomy of unstable white/white zone lesions. In case of repair, after tear freshening, repair used FasT-Fix 360™ anchors (Smith & Nephew, Andover, MA, USA) and PDS suture for the anterior segment. A maximum 4 sutures were used per meniscus, to achieve a stable meniscus at end of procedure.

Postoperatively, immediate weight-bearing was authorized, with 2 crutches for pain relief during the first days. Flexion was limited to 90° for 6 weeks in case of repair.

2.3. Assessment methods

Pre- and post-operative stress valgus views were taken using a Telos™ GAIII/E stress device (ARD 1-Medizinprodukte GmbH, Hungen, Germany) at 110 Newtons [12,15]. Subjective instability and clinical laxity were screened for preoperatively and at 6 weeks' check-up. A simple neurologic examination (epicritical sensation) screened for hypoesthesia in the saphenous nerve territory.

The main endpoint was residual medial ligament plane laxity, assessed radiographically by two observers and on 2 techniques. Tibiofemoral compartment opening height was measured as the length of a vertical line between the center of the medial tibial plateau and the medial condyle (Fig. 2), on preoperative and 6

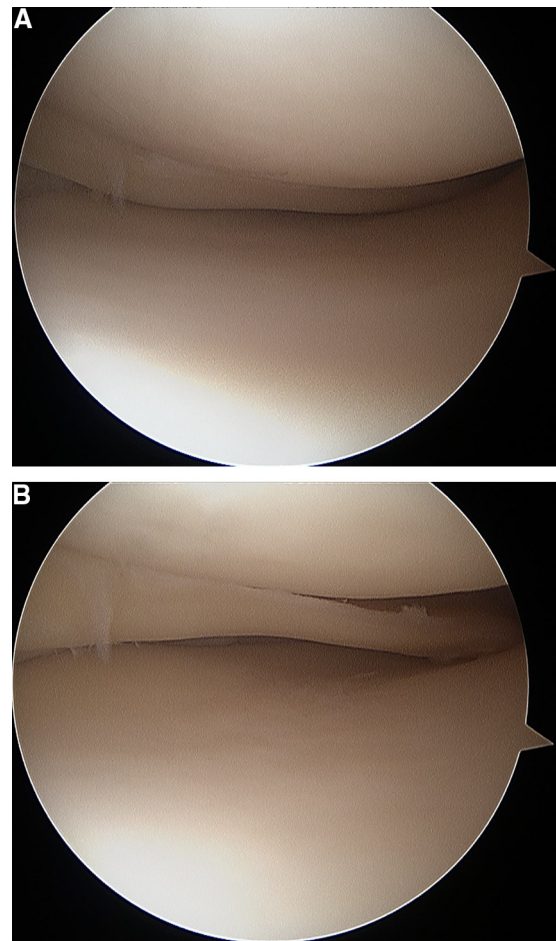


Fig. 1. Assessment of laxity induced by medial collateral ligament pie-crusting under arthroscopic control. A. Medial tibiofemoral compartment before medial collateral ligament release. B. Medial tibiofemoral compartment after medial collateral ligament release.

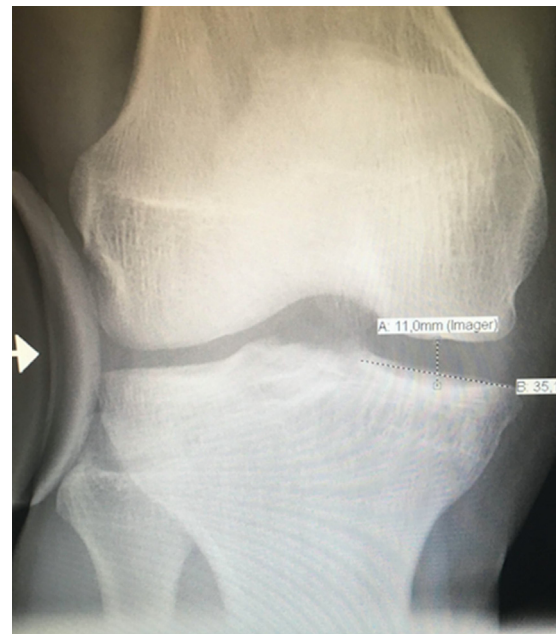


Fig. 2. Radiologic measurement (mm) of medial tibiofemoral compartment opening height.

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